March

CAN YOU FIND EVIDENCES OF "TERRIBLE OUTRAGES"?

A fair sample of the scene at any dock on the arrival of any liner. U. S. customs officers inspecting baggage.

"Making the Tourist Honest."—p. 36

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RAISE WAGES AND CUT COSTS

By

BAILEY MILLARD

"GIVE an American a few tons of dynamite and a mountain to bore through in a month and he is happy," said an efficiency engineer to me the other day. "Americans love to do big things in a great hurry. They despise small things. A structural shop orders the supplies from a rolling mill. The big beams are promptly shipped. The angles and smaller pieces do not come for weeks or months. The superintendent of the structural shop pleads for permission to begin work immediately on material not deliverable for three months. If permitted to do the work ahead of time he clamors for permission to ship it. He is always ahead on big work, always behind on small work, and this means a great waste of time and energy."

But we are coming to the day when the smaller things will be recognized as of as much importance in the problem of production as the larger, the day when the man beside the machine and his capacity for work and wage will be more closely considered. In fact, in certain centers where the big activities hold sway there is already a mighty and successful effort toward right planning, right execution and right reward for the toiler. In these places such marvels of economy are being wrought by bright master minds as to stagger the imagination of the men of the old school of wasters whose motto was "Get there," and who recked not of the cost.

Yes, the science of business and industrial efficiency, scoffed at by the headlong egoists who thought they were doing big things in the best way, but often were only misdoing and wasting, has been tried out and may be definitely and demonstrably declared to have won.

The science of efficiency! Here is a new, big, vital and tremendously important subject that is engaging the best minds in some of the great industrial plants of the country, and has been taken up by some of the railroads which are emulating the luminous example of the Santa Fé, a railroad company that has done wonders in conserving its own forces, saving millions of money and organizing its workmen on a system that is nothing short of altruistic.

Who conceived this principle of efficiency, the thing that is now so intensively engaging the master minds of industry? Well, of course the idea of economy in production has always been insisted upon by the heads of great plants, but time has shown that it has not always been intelligent and successful economy, and as for humane dealings with employees, they rarely have been considered in the scale. But think of

AN ENTHUSIASTIC ADVOCATE OF EFFICIENCY.
The celebrated lawyer, Louis D. Brandeis, who told the railways how to save a million a day.

an economy both intelligent and successful and in which the idea of the fair deal is always uppermost; for without the fair deal there can be no economy and no efficiency. Let us give credit where credit is due. After a careful study of the genesis of this great movement I find that to Frederick W. Taylor, formerly chief engineer of the Midvale Steel Works, belongs the honor of introducing scientific efficiency in this country. Some of the men who are doing things in his line call him "the Father of Efficiency," and he deserves the title.

Scientific labor management had its first successful demonstration at the Midvale Works in the latter eighties, but it is only of recent years that it has received its great impetus. Taylor introduced a differential rate system for the employees by which those that could do a certain amount of work in a day received a certain amount for each piece, while those that were not capable of reaching the standard were given a smaller rate. Under the old piece work plan, a man that had been turning out five pieces a day received $2.50. Under the new system when they turn out ten they receive $3.50. Thus the total cost of a piece was reduced from $1.17 to 69 cents while the daily pay of the man was $1 more.

Then Taylor introduced into the same plant a method of dividing the work of tire-turning into a number of short operations, fixing a certain time and pay for each. This new system increased the output from the tire department fully thirty-three per cent.

So successful was Taylor at Midvale with his new ideas of industrial economy that other manufacturers employed him to improve conditions in their shops and factories. He worked quietly and nearly always made marked improvements. Meantime he devoted himself to the study of efficiency, both for the benefit of employer and employee. Other men, followers of his, have gone farther in this line and made more famous successes, but such distinguished students of efficiency as Louis D. Brandeis, Frank B. Gilbreth, Harrington Emerson, and H. L. Gantt acknowledge themselves as disciples of Frederick W. Taylor.

It has taken a good many years to get the idea of scientific efficiency into the minds of our captains of industry. A large proportion of them still adhere to the old methods and are not willing to let the "theorists" run their shops. But where those "theorists" have been given full sway, as they have in some places during the past few years they have confounded the scoffers. For one thing they have obliterated from the toiler's list of maxims the first and most obnoxious one from the master's point of view—"The least service for the most pay." If the theorists had done nothing more than that they would be entitled to wear wreaths and halos. But they have done much more.

Take as a luminous example, the work of Harrington Emerson in bettering conditions on the Santa Fé system. There had been a disastrous strike in the shops, and when Mr. Emerson was set to work to straighten out conditions most of the employees were very hostile to the management. No one could have gone to work to carry out the principles of scientific efficiency under more unfavorable, or, indeed, demoralizing conditions than those that confronted Mr. Emerson when he faced the situation. It was a man's game and it was played by men. Here were twenty shops, large and small, scattered along nine thousand miles of railroad in twelve different States, with twelve thousand disgruntled mechanical employees to deal with and fifteen hundred locomotives and fifty thousand cars to care for and keep running.

President Ripley, a man of clear vision, who had come to have full confidence in Emerson and his theories, after several interviews with him, made him consulting engineer to study conditions and advise betterments, and Vice-President Kendrick rolled up his sleeves and went to work with him.

The crying need was to get the equipment in shape. Emerson did not begin to megaphone orders to everybody. He went quietly into the main shop at Topeka and began to study mechanical conditions. The first thing he found out was that something was wrong with the belts that carried the power to the machines. Now belting is an insignificant item in railroad operation, but much turns upon it, literally as well as figuratively. In the Santa Fé shops belting was nobody's care. The only official who showed any interest in it was the claim agent who on one occasion had induced the shop men to take a lot of singed and water-soaked belts from a wreck after they had been refused by a consignee. The belts were constantly breaking and every break entailed a loss of time to machine and mechanic, and what was more important, held locomotives in the shops, preventing the movement of trains and decreased revenue. Under the old system a premium—overtime—had been offered on breakdowns. New belts of the best quality were put in and the cost for belt repairs was reduced in one year from $12,000 to $630, while the saving in time and increase in revenue from that source alone was many times the original sum.

But the belt demonstration was only the razor edge of the entering wedge. The system was extended to the maintenance of all shop machinery and tools. In the year 1903-4, which included only a month or so of the Emerson efficiency

E. P. Ripley, President of the Santa Fé.
He is fully alive to needed improvements in railroad management.

work, what is known as the unit cost of the maintenance was $10.31. By June, 1907, this cost was reduced to $4.89 and in 1909-10 it dropped to $3.24. With a 60 per cent. increase of work, maintenance costs dropped 51.4 per cent.

Meantime improvements were going on in other directions all along the line—the revision of grades, new designs for locomotives and cars, water purification, welfare work that decreased and finally eliminated the hostility of the workman to the company, and most humane of all, a pension system for wornout employees.

Like all men of broad vision, Emerson has faith in men. He believes in their heart-in-heart goodness and he knows that the main cause of their hostility to their employers is mismanagement. It was his belief in the men of the Santa Fé, from top to bottom, that more than anything, has resulted in his great victory over bad conditions on that system. Ten thousand pamphlets conveying the principles of standard practice instruction were distributed among the employees of the road. The mottoes were: "Fairness, not favoritism; efficiency not drudgery; individuality, not subserviency." The generous attitude of the company is set forth in the following opening sentences of this booklet:

"The employee wants as high wages as he can get. The employer wants his output to be as cheap as that of his competitors. Both desires are reasonable and the problem is to reconcile them without injustice to either party.

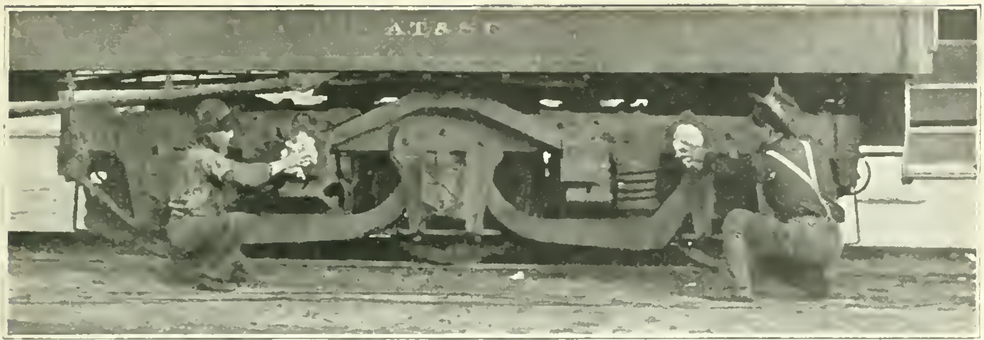
"An absolutely clear understanding of the problem by both parties is necessary.

"The worker cannot be expected to work for one employer for less pay than is paid under similar conditions for the same work by another employer. The wage payer will not pay higher wages than the current rate or than the business conditions permit. There may be, however, quite a gap between the wages paid by competitors and the higher wages the employer would be willing to pay if it can be proved to him that it is to his advantage to do this. Wages above current rate should result from individual effort."

In Laying Bricks Apprentices Should be Taught to Use Both Hands at One Time.

The men liked the ring of these words and all the competent ones were pleased by the individual appeal that was afterward made to them. For example, instead of "pooling" locomotives the Santa Fé assigned each engine to a regular and competent crew. By this system the engineer was made to feel an individual interest in his machine and an individual responsibility and anxiety for its condition and repair. Engine "failures" were thus reduced from 11,880 in 1907 to 6,952 in 1908. On the Santa Fé an engine failure means any trouble with a locomotive that causes a delay of five minutes or more to a train, and every failure is followed by an investigation. Twenty-five per cent. of the power was formerly out of service, but this percentage was reduced to thirteen.

Not alone to individual responsibility, but more to efficiency reward does the Santa Fé owe the great success of its experiment. Each man is employed at a definite and equitable hourly rate of wage, paid to him without regard to his efficiency. Definite time unit equivalents are stated in advance for each operation assigned, by which the man must give a fair hour's work for a fair hour's pay. This fair hour's work for a fair hour's pay is called 100 per cent. efficiency, and if he attains this efficiency the worker is paid a bonus of 20 per cent. As efficiency diminishes the bonus diminishes. At 90 per cent. efficiency the bonus paid

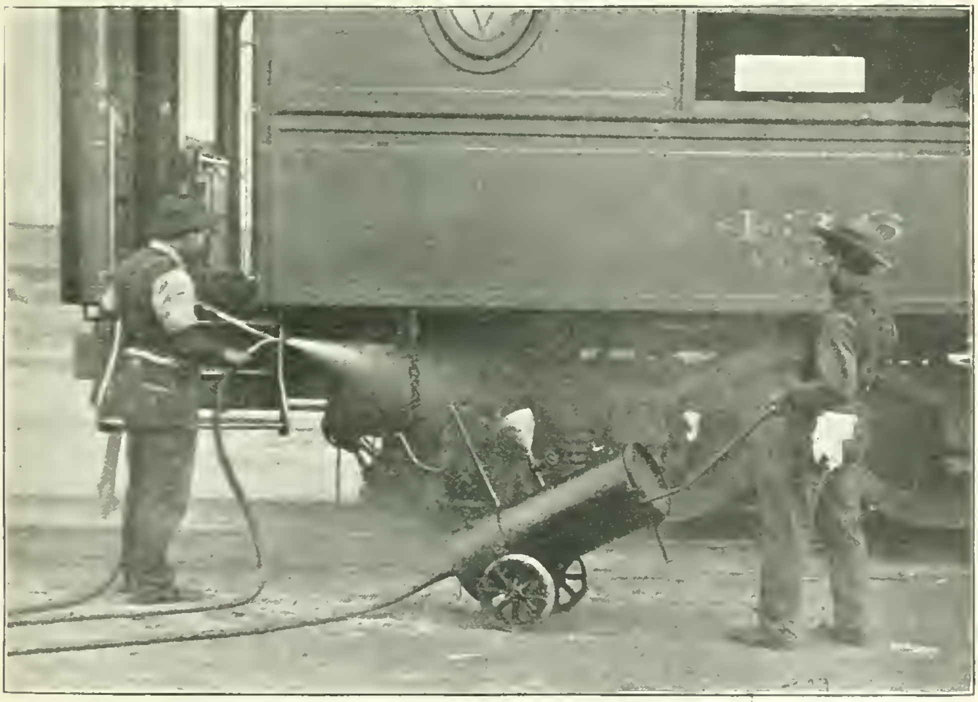


OLD METHOD OF OILING TRUCKS, WHICH REQUIRED TWO MEN HALF AN HOUR PER CAR.
Santa Fé railway yards, Los Angeles.

is 10 per cent., while at 67 per cent. efficiency the bonus stops. Foremen are paid a bonus on the basis of the average efficiency of their men, and superintendents are similarly rewarded on the basis of the foremen's efficiency.

The results of this bonus plan were at once seen in the increased interest of the men and the greater amount of work they turned out. Last year the Santa Fé employees received the sum of $1,250,000 in these premiums on their labor.

Has it paid to expend this large amount in this unusual way? Yes, it has paid and it has paid well. For not only have there been no strikes on the Santa Fé since its introduction—and strikes cost money—but the net cost of locomotive repairs for a year has been reduced from five and one-half millions to four and one-half. In a period of three years, during which from $200,000 to over a



NEW METHOD OF OILING TRUCKS ON THE SANTA FÉ RAILWAY, LOS ANGELES.
Time required: five minutes per car for two men.

THE WRONG WAY OF LAYING OUT THE BRICK FOR THE WORKMEN'S USE.

million was paid out in bonuses, the entire system made net savings of over $5,000,000, or nearly $2,000,000 a year.

Under the old method one man at $3.50 a day finished one pair of tank wheels on the machine lathe a day. Under the new method one man handles two pairs of tank wheels and a pair of trailers in a day.

Besides increased pay the men are provided with reading and recreation rooms all along the line, and there is a model hospital system to care for them when they are ill or injured. On retirement at the age of sixty-five pensions of $20 to $75 a month are granted them, according to their former wage and length of service. Altogether the men of the Santa Fé feel they are having a fair deal, and they are satisfied with their treatment. A strike on that system is now considered impossible.

THE RIGHT WAY—IMPROVED METHOD OF HAVING THE BRICKS ON PACKETS AND THE BOXES PROPERLY SPACED FOR THE GREATEST SPEED WHEN THE WALL IS AT THIS LEVEL.

When on March 20, 1905, efficiency work was begun in the matter of locomotive repairs an enumeration was made of all locomotives and the sum of their detentions in the Topeka shop, a total of 1,735 days for fifty-six locomotives. A year later, by applying rigid rules of efficiency the sum of detentions had sunk to 254 days and a larger number of locomotives had been repaired.

In some instances greater economies were effected than were attempted. When Mr. Kendrick called Mr. Emerson's attention to the high average of locomotive repair cost it was seen that in 1904-5 it amounted to $4,165 for each engine. Mr. Kendrick wanted the cost reduced to $3,165 for each engine. Mr. Emerson cut it down to $3,037. The miles run between locomotive failures on a difficult division was increased from 4,377 in 1902 to 20,000 in 1909.

THE FATHER OF EFFICIENCY IN BUSINESS AFFAIRS.
Frederick W. Taylor.

In the matter of car repairs the introduction of efficiency principles has worked wonders of economy. Simpler processes for doing things have been devised. For example, the oiling of trucks has been simplified by the use of a compressed air machine. By the old hand method it took a man an hour to oil the trucks of a car; now it takes two men only five minutes.

Such men as Louis D. Brandeis, H. L. Gantt, and Charles B. Going, who have closely observed the methods pursued by Mr. Emerson in his efficiency work on the Santa Fé, are enthusiastic in its praise. It was the study of this work that led Mr. Brandeis to make the offer to the railroads that were threatening rate advances that he would save them a million a day and charge nothing for the service. Mr. Brandeis' intention was to employ Mr. Emerson as the head of a general school of efficiency that would save the roads the sum mentioned every day of the year. Some of the companies are willing that the plan should be tried, but others demur, sticking to old methods, though they are only staving off the inevitable.

On a lesser scale than that of the Santa Fé, efficiency work has been tried on the Southern and Union Pacific, and has shown excellent results. It will not be long before all the lines of the great Harriman system will introduce these methods, but the objections of wise old master mechanics will first have to be overcome.

Under its progressive president, Mr. L. F. Lowe, the Delaware and Hudson system has made marked improvements by the introduction of efficiency methods. The Erie system, which had been much run down, has also tried the plan, particularly in the matter of coal consumption. On a certain watched locomotive it was found possible to cut down the fuel bill over sixty per cent. An effort is being made to standardize this performance, and though it may not be successful a big saving is bound to result.

The advanced mechanical practices of the Union Pacific have resulted in considerable savings, and so have those of the Northern Pacific, the New York Central, the New York, New Haven and Hartford and the Boston and Maine. But Mr. Brandeis, the most enthusiastic of all the disciples of Taylor, the "Father of Efficiency," will never rest content until he has induced all the railroads of the country to try the improved methods. Brandeis is not doing this so much for the railroads as he is for the people, for whom he has made many a good fight. He believes with H. L. Gantt that with increased freight rates come increased prices, that with increased prices come higher cost of living; with higher cost of living comes a demand for

Secured Efficiency in a Hostile Shop.
Harrington Emerson, whose ability was promptly recognized by President Ripley of the Santa Fé.

higher wages and with higher wages comes higher cost of production, involving another increase of prices, and the cycle thus repeats itself.

This same Gantt, whose economic philosophy I have boiled down into the foregoing language, is in himself a walking cyclopedia of efficiency methods. Not long ago he was engaged by the president of a cotton mill company to solve the problem of making its labor more efficient. He put in trained observers with stop watches to stand by the most skillful weavers and study all their motions in detail, a practice recommended by Taylor. The observer learned just how the skilled weaver started and stopped his loom, how he removed the empty bobbin from the shuttle and put in a new one and how he tied the knot. This study resulted in fixing as a standard task the number of picks a loom should throw, eliminating all unnecessary delays. A substantial bonus was offered for the accomplishment of this number on each loom. This stimulated individual activity. Those weavers who could not make a good showing were taught by the best operators, and in a short time there was an average increase of output from the looms of eighty per cent! The average wages were increased forty per cent., while the actual wage cost for each piece of cloth produced was only sixty per cent. of the former wage cost.

In a pillow case factory where Gantt introduced his methods of efficiency and his bonus plan, similar results were obtained and, better still, it was found that in twenty-eight cases of goods furnished before efficiency work was begun the average number of imperfections to each case was 47½. In eleven cases after the efficiency work was started the average number of imperfections found in each case was less than one! This great improvement was made in a few weeks after Gantt went into the factory.

Like results were obtained by this master of efficiency in a packing-box factory, in a bleachery and in other industrial plants.

Going back to Taylor and his steel work, let me quote a few paragraphs from a report of Assistant Superintendent R. J. Snyder of the Bethlehem Steel Company:

"One of the best results has been the moral effect upon the men. They have had it placed in their power to earn a very substantial increase in wages by a corresponding increase in their production capacity, and this has given them the feeling that the company is quite willing to reward the increased effort. They display a willingness to work right up to their capacity, with the knowledge that they are not given impossibilities to perform.

"The percentage of errors in machinery has been very materially reduced, which is unquestionably due to the fact that in order to earn his bonus a man must utilize his brains and faculties to the fullest extent. He has thus no time for dreaming, which was no doubt, the cause of many errors.

"Breakdowns are less frequent. The men work up to their capacity and now obtain from the machines the product they are capable of turning out."

In the matter of yard labor Mr. Taylor saved the Bethlehem Company fifty per cent. of the cost of the removal of material and made many other savings.

Frank B. Gilbreth is now considered one of New York's foremost efficiency experts. He takes contracts for the construction of bridges and other structures and produces marvelous results from his methods of labor management, based on what he calls his "motion studies," made in his own actual experience in various trades he has learned and also from accurate observations of the work of others. Mr. Gilbreth uses stereoscopic views of various operations showing the men how the work should be done. Beside these he has books of details for them to study.

A Man Who Does Not Believe in Wasting Human Energy.
L. F. Lowe, President of the Delaware and Hudson Railway.

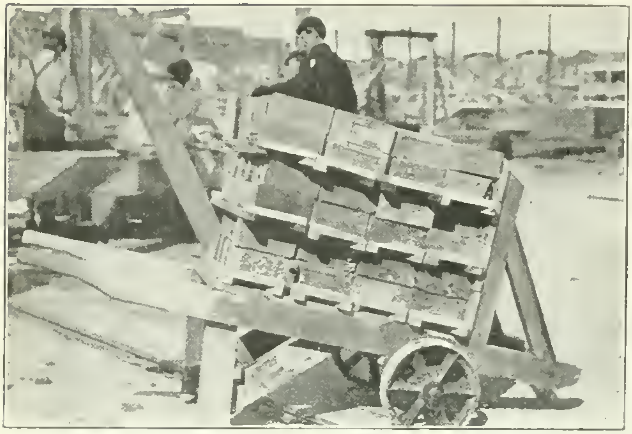
"On one occasion," he says, "I had to drive a lot of piles in quicksand. I wanted to get the work done as rapidly as possible. I raised the pay of all the men 25 cents a day, from $1.75 to $2, with the understanding that in return they were to do the work in the manner I described to them. Then I employed a boy at $11 a week to stand on the bank with a stop watch and a pencil to keep a record of the work done by each gang. Where the work had previously required 4.28 minutes for each trip of the bucket out of the hole, after I had standardized the method in this manner, it required only 2.21 minutes, or a reduction of almost one-half.

"The study which has been given to scientific efficiency has demonstrated many things. For instance, it has been found that in one kind of labor in order to be most efficient a man must have 27 units of rest for every 100 that he works. I tell my men when there is nothing for them to do, to sit down and rest. It has been found that the most efficient load for a shovel is 21½ pounds, and that in carrying weights, 92 pounds is the proper amount. This was the weight which I set for brick carriers to handle and had "packets" designed to carry this weight.

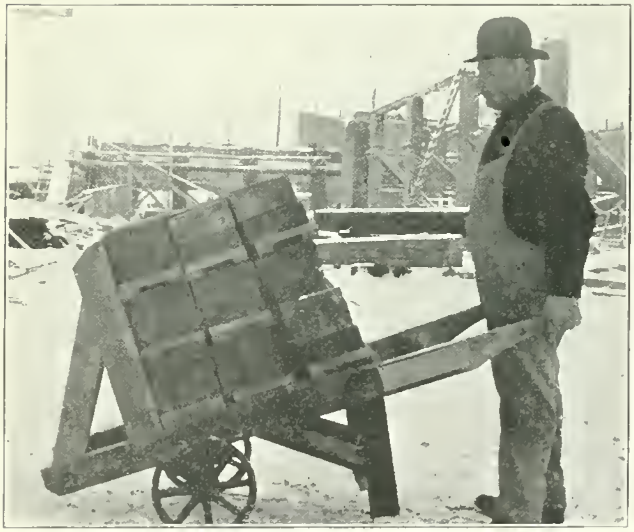
"In wall work I use what I call non-stooping scaffolds for the bricklayers. I find that a man will do better and quicker work where he is not compelled to stoop over to lay brick. Also I have my brick "packet" placed in a handy position by a cheap man, so that the bricklayer need waste no time. I have taught men how to pick up brick and mortar with both hands at the same time instead of using one at a time as most of them formerly did.

"The care of the health of men has been one of my studies. I don't believe in the old driving and sweating system. I believe in the new non-perspiring way, advocated by Taylor, of whom I am a close disciple. The drive or military system is going out. Instead of that we are introducing the more humane, the more practical and the more economical method of rewarding a man for good work and not making a shirking, cringing time-server of him. Yes, men must be well-fed and well-rested. I find it cheaper to feed them free rather than to let them eat at boarding-houses."

Mr. Gilbreth stimulates the ambition of his men in various ways. Once he had a lot of Swedes, Russians, Irish and



The Best Method, Up to Date, for Handling Brick.
This barrow holds 216 bricks as against the usual 60.



The Improved Barrow Is Easily Pushed, Too

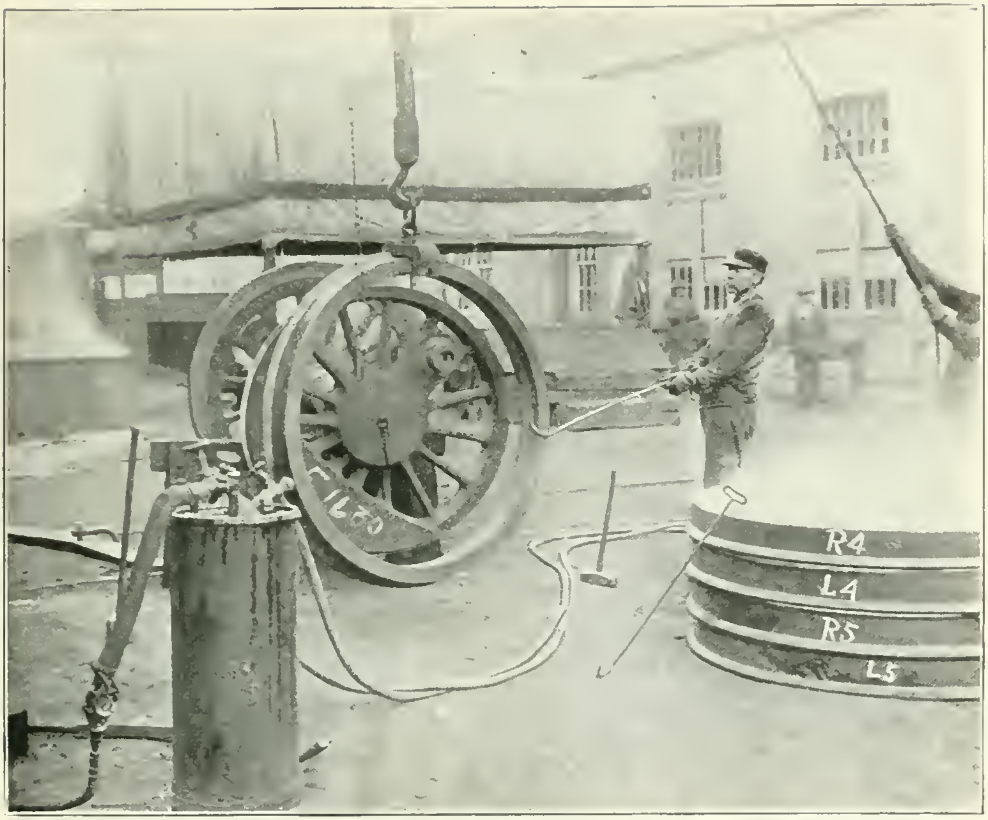
others working on a big bridge. The work was going slowly, so he told the foreman that the flag of the nationality making the best record would be floated from the highest part of the structure. The Swedes put forth their best efforts and soon their pride of country was gratified by the flying of the Swedish flag above the workers. The Russians then bent to the work and soon their flag displaced that of the Swedes. For some time the record of the Irishmen was low, but, with dogged determination, they set to work to raise it and finally did so; and when their big green banner, with its harp emblem, floated high above the bridge their foreman swelled out his chest and broke forth in this piece of Irish sunburstry:

"Ah, me b'ys! There's the flag of Erin. Keep up yer licks and don't let onny domned Protestant pull it down!"

And they didn't.

Mr. Gilbreth uses the flag system in gang work on houses. Where several houses are being built at once a flag is raised on one to show that the gang on that house made the best record on the previous day. He offers prizes to his men for suggestions as to the best manner of doing a given job.

Efficiency experts declare that in their scheme of standardizing and subdividing the work after carefully planning it out the responsibility does not rest merely upon the man in charge, but in the same ratio down to the poorest paid worker. They say that the planning should be done by the highest intelligence, and that the workmen should not only be provided with every facility for actual production, but that he should be made to think, too. They keep a sharp lookout all the while to see that the man fits the job in each case. In a textile plant where efficiency methods were being introduced the expert found that the output of the room in which repairs were made to faulty bolts of cloth was altogether too small. He discovered that a trucker named O'Brien was paid $1.10 a day for gathering up the bolts needing such repairs and taking them to the repair room. O'Brien was in the habit of tumbling these bolts upon the floor in a heap, after which he would go day-dreaming about the place. When a girl



METHOD OF HEATING COMPLETE SET OF TIRES AT ONE TIME WITH CRUDE OIL BURNER.
This is the new method. Formerly a piece of red-hot gas pipe was placed around the tire to expand it. It was a slower process.

ran out of work she had to go to the pile and pull over the bolts until she found one of the kind upon which she was operating. All the girls did this and it wasted their time.

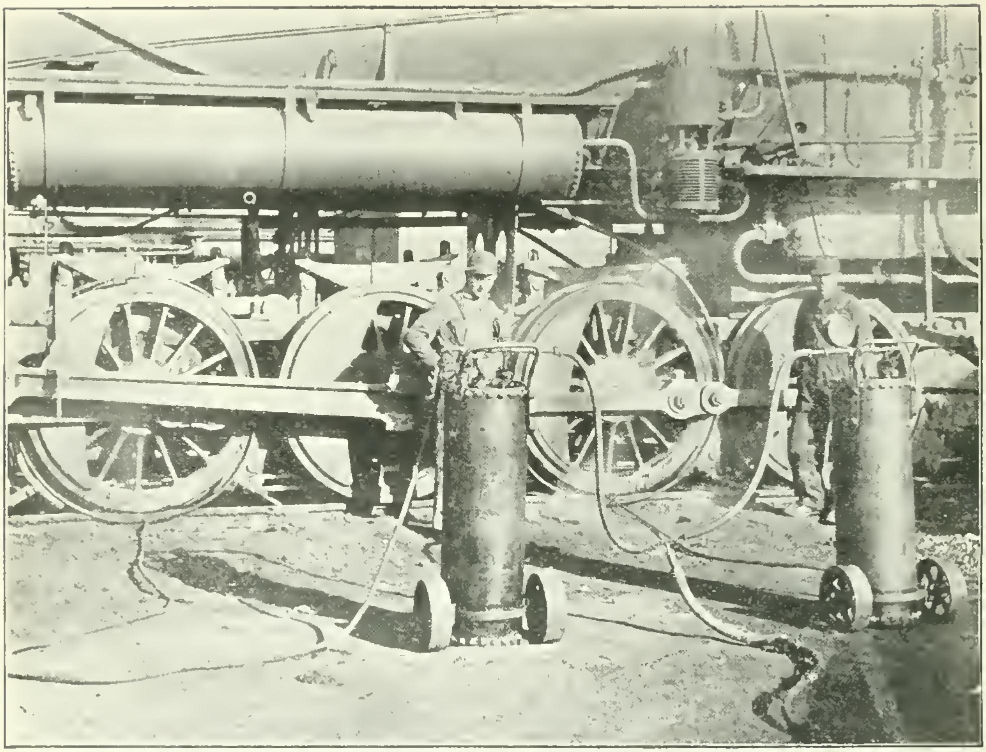
"I want a five-dollar man to take the place of Trucker O'Brien," said the efficiency man to the superintendent.

"What!" cried that official, aghast at the request. "A five dollar man to do trucking?"

"That's exactly what I want," said the expert, in a matter-of-fact way. "The intelligence of everybody in the room is subjected to the O'Brien intelligence. We need a five-dollar intelligence that can sort out the bolts and deliver them quickly and properly to the girls."

The five-dollar man was put in the place and the change resulted in a great saving to the factory.

PITTING THE FOREIGNERS AGAINST ONE ANOTHER.
The gang that has the highest score or lowest unit of cost in bricklaying flies its country's flag.

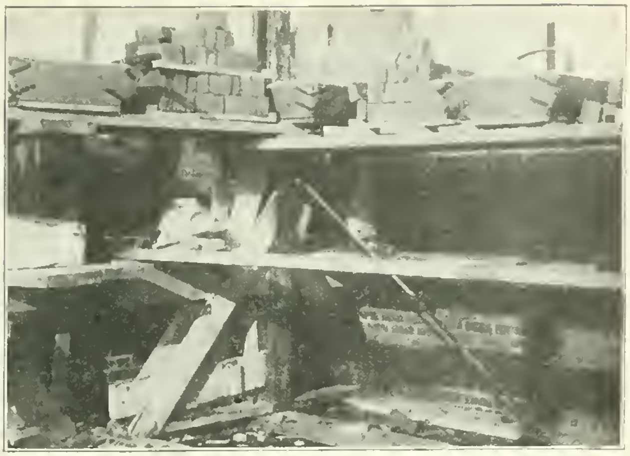


IMPROVED APPARATUS, FOR REMOVING AND REPLACING LOCOMOTIVE TIRES, SET UP FOR USE.

"I think I have found the reason for the very great inefficiency that exists in American plants," said Harrington Emerson, who since leaving the Santa Fé has been working to reduce cost and improve labor conditions in several industrial concerns. "It is the cumulative effect of small inefficiencies on an end result. For instance, you have a printing press and a poor operator on it on black work turning out 800 good sheets out of a possible thousand and the other 200 are spoiled. Now if you had a poor press capable of turning out only 800 sheets and that man was working on it, the combination of poor man and poor machine would run the result down to 600 good sheets. Then if you should invite in a scientific manager he would say: 'You have to improve your press and train that man so that he will know how to operate it, and get 900 good sheets out of his thousand.' After you have done this, say that you put your press on color work and have to print each sheet four times to get four colors. You get 90 per cent. good sheets out of each impression and the

MASONS FINISHING A WALL ON A NON-STOOPING SCAFFOLD.

end result is that you have only 640 sheets out of the thousand. So that while the individual element for each impression represented by that ninety per cent. is very high the end would be only sixty-four per cent."



NON-STOOPING SCAFFOLD WITH BRICKS SYSTEMATICALLY SET UP IN A CORNER.

Mr. Emerson's point was that in this case the efficiency of the man and the machine should be still further increased.

Prejudice against innovation, the fixed habit and desire of master minds to do the same thing in the same old way, is the greatest obstacle to the introduction of efficiency. Charles B. Going, who gave such valuable testimony before the Interstate Commerce Commission at its rate hearing, pointed this out when he referred to the testimony of Joseph Ramsey, Jr., justifying the extremely low average made by freight cars in the United States—twenty-one and a half miles a day. To "prove" his point Mr. Ramsey quoted as a typical case the coal shipments passing through St. Louis, in which it regularly took thirteen days to move a car seventy-five miles—proof, one would think, of appallingly wasteful methods.

APPARATUS USING CRUDE OIL IN PLACING AND REMOVING TIRES.
Note how the hot flame is directly applied to the tire.

The Non-Stooping Scaffold.
The low-priced man lifts the bricks two feet, so that the high-priced man does not have to waste time in bending to pick them up.

"Mr Ramsey's argument," said Mr. Going," was, that as it took this time this time was necessary. The argument of the efficiency engineer would be if it took this time something must be wrong." And of course something was wrong. But railroad men of settled views are hard to convince and so are the heads of many industrial plants. They see nothing in the new system but "theory" and are against it because of that and because it does not provide a means for driving men. And the old-timer who thinks he is sufficiently successful is nearly always a man-driver.

But these hard heads are being won over and every day adds to the list of big activities in which the new science of business and industrial efficiency is being introduced.

When In Disgrace

When in disgrace with fortune and men's eyes,
I all alone beweep my outcast state,
And trouble deaf heaven with my bootless cries,
And look upon myself and curse my fate,
Wishing me like to one more rich in hope,
Featur'd like him, like him with friends possess'd,
Desiring this man's art and that man's scope,
With what I most enjoy contented least;
Yet in these thoughts myself almost despising,
Haply I think on thee and then my state,
Like to the lark at break of day arising,
From sullen earth, sings hymns at heaven's gate;
For thy sweet love remember'd such wealth brings
That then I scorn to change my state with kings.

—Shakespeare.

Who Am I?

by F. C. Walsh, M.D.

Are you always sure of your own identity? What is one's self, anyway? Everybody has two personalities,—a first and second in command, so to speak. In our waking hours, the first is on watch; the second appears only in our dreams, or, in abnormal states, the result of disease or injury. There are individuals who, even in their waking hours, are influenced by this "second personality," which, in reality, has become the first in command. The instances here shown are dramatic pictures of this elusive condition. Johns Hopkins Medical School, of Baltimore, has recently established a department for the study and treatment of such cases.

INQUIRY failed to throw any light on his history. Nobody seemed to care whether he had one. Yet he seemed to fill in with the ebb and flow of the daily shifting life of the tidewater city of Seattle. It was not very long after the first rush of the gold-seekers to the Klondyke, and he was looked upon by the old-timers of the city as a strange atom in the flotsam and jetsam which the back-flow had left stranded on the lonely shore of failure. To the new-comer, his story carried the conviction of reality; and even the experienced did not doubt that he had at least been to the North in that mad rush for the metal which represents the world's standard. The one element of justifiable doubt was his own admission that he couldn't remember the exact location of his discovery, the richness of which, if his story could be believed, would place the possessor beyond the wildest dreams of avarice, at a time and place when dreams, especially golden ones, required something very substantial to satisfy. With his Irish humor and dashing spirit of narrative, he would hold his auditors spell-bound. It was only after questioning him that they imagined they had been victimized to the extent of the price of a drink. Finally, like all oft-repeated tales, this one became so boresome that all who met him set him down in their minds as a monomaniac, whose reason had become unbalanced as the result of hardship and the stupendous stories of gold-discovery which made the sole topic of conversation. There was an uncanny glint of mystery in his eyes, an elusive something in his own inability to place his name and identity, which caused many to shudder at his approach. Who was he? The question, one of idle curiosity to most, was soon to find a curious answer.

He was talking excitedly one night in a certain hotel-lobby, to a group of Eastern men fascinated with the glowing accounts of the new country. One of the party, who happened to be a surgeon, became especially interested, and after some moments' thought, asked permission to feel of the other's head; then passing his fingers over the unknown's skull, like a phrenologist feeling for bumps, the doctor turned to the others with a jubilant smile, and told them he had discovered something. The group was interested; a talk was held amongst them, with the result that they agreed then and there to do what they could to help him. As a consequence, the unknown was taken to an adjoining town, placed in a hospital, and operated on for an old fracture of the skull, due, in all probability, to some unknown injury. When he recovered consciousness, he seemed to be an entirely different personality. His memory returned sound and clear; and he was able, for the first

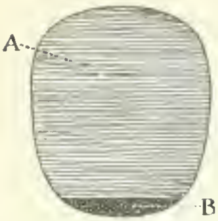


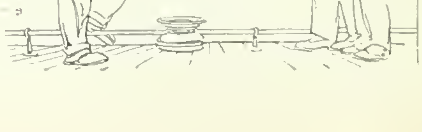
FIG 1: LOOKING THROUGH BRAIN FROM THE REAR.
A. Normal identity of a normal man. B: "Second self" — unconscious—in a normal man.

time, to say just who he was. Then he told his story, straightforward and connected. He was an Irishman, it seems, who had come to this country with a little money in his possession, shortly before the Klondyke discoveries. Having nothing in particular to do but seek his fortune, he had left for the Alaska country on hearing of the wonderful opportunities there. Like others, he had suffered hardships, but continued on with the determination of finding gold, if any was to be found. Alone, he had wandered in his quest from the main trail, with its scattered horde of seekers; and alone he had come upon fortune and misfortune together. In swinging his pick, while prospecting, into some loose rock beneath an overhanging ledge, he had struck a lucky find at a moment when least expected, at the same time loosening a small boulder above him just enough to bring it bounding down upon him. It had struck his head, laying him unconscious with wealth within his grasp, and fracturing his skull, as was later discovered. The wonderful part of his story is, that after the operation he succeeded in making his way back to the very spot of his discovery, found things just as they were at first, filed his claim, and afterwards sold out for many thousands of dollars. He is living today, and enjoying in comfort the fruits of his terrible, but curious and interesting experience.

This illustration from real life shows only one of the many interesting phases of lost-identity. This condition, which may come suddenly into the life of any one, often presents characteristics more pronounced, but seldom, if ever, more dramatic. Double personality, that peculiar state of mind during which Smith may think he is Brown, or some entirely unheard of individual, and in which role he enacts most naturally and logically the newly assumed personality, forgetting that he ever was Smith, is now and then present as an after-effect of brain-injury, or as the result of disease. The manifestation of changed identity, in most instances, shows itself not so much as a deterioration of intellect, as of character and morals. A person who, previous to such a misfortune, may have been a model of virtue in his community, often becomes the most quarrelsome of mortals, a disgrace to himself and to all near and dear to him. Many are known to have changed their beliefs on the most vital subjects, developing criminal traits, and turning to thievery or worse, only to end in jail or in serving a long imprisonment.

Up in Alberta, that wide domain but recently subdued to the plow, lived an old Scotchman, widely known by his given name of Alec, who kept a general store, and had a reputation for honesty and shrewdness over a wide range of territory. He was the last man in the world to be suspected of doing the least thing contrary to the accepted standard of a desirable citizen. He had prospered in business, had no enemies, and was respected and happy. One day he started out alone on horse-back, to be gone some days on a hunting-trip. The following day the horse returned alone, riderless. Evidently something serious had happened. A searching party was gotten together at once, and began to scour the country for miles around. That same

FIG. 2: THE GOLD SEEKER'S CASE.
Light and dark portions now equal. An alternating personality, first A then B predominating. An abnormal condition.



DIAGRAMMATIC REPRESENTATIONS OF NORMAL BRAIN AND SKULL
Figure 1—Shaded line represents seat of higher faculties. Figure 2 Injury at A causes loss of memory; at B, of speech; at C, of identity. Figure 3 A represents "seat" of the "personality" in interior of the brain; B, "second-self," existing in all brains—note relative size of the two personalities. When A is injured or "submerged," B assumes command, showing a different "identity."

night Alec turned up at his home, apparently sound and well, and spoke of the incident as nothing more than a sort of joke, with himself as victim. He had been riding down a steep and narrow bridle-path, he said, whistling and unconcerned, when a bear from an adjoining thicket suddenly bounded into the path ahead, frightening his horse before its rider had time to realize the reason. He was thrown suddenly from the saddle, alighting on his head some fifteen feet below the side of the path. He felt all right; he looked all right, and there the story ended. But before a week had passed, those who knew him best began to note a strange change in his manner toward them. He became irritable and quarrelsome without the slightest provocation. Just about the time these changes in his disposition were becoming a topic of common conversation, Alec mysteriously disappeared. So far as could be learned, he had taken absolutely nothing with him; everything in his store, and in the living-rooms above, was in perfect order. Weeks went by, and no word or knowledge came. Search was made in all conceivable quarters, but with no success nor slightest trace of him. He had disappeared as completely as if swallowed by some terrible cataclysm. All hope of ever seeing him again was at last sadly abandoned. Some months later, news spread like wild-fire over the regions of western Montana and northern Idaho, of the appearance there of one of the most daring bandits that wild country had ever known. He would appear and demand food at some ranch one day, and then suddenly show up, on the same quest, at another ranch some thirty miles distant the day following. Such wide leaps seemed impossible for a man on foot, but the various descriptions of him tallied exactly. These strange raids continued day after day, and though he was said to be heavily armed, no one had been hurt in any way, nor had any one the courage to resist him. Hardened frontiersmen seemed awed by his presence, and wholly incapable of coping with his subtle tactics. He would calmly walk up to a group of campers, demand food or ammunition, or whatever else he needed, keeping his finger on the rifle-trigger all the while, and then solemnly warn them to discourage from following him the numerous posses which were in hot pursuit, saying he was prepared to fight to the death. There was something in his look which always caused a shiver when he told them this. Men who had joined in man-hunting before, as gladly as if they were running a fox to earth, one by one dropped from the pursuit. There was a something in his elusiveness which bordered on the uncanny. Who he was none could guess. He became the mysterious terror of a vast wilderness. But he had harmed nobody. About the time the hunt was given up, there happened to be a hunting party from across the Canadian border encamped in western Montana. They were seated around the fire one morning, enjoying their breakfast bacon, when they became suddenly aware of the presence of a stranger who had stepped from the shadow of the surrounding pines. Emaciated, unkempt, in rags, he presented a pitiful sight. Startled to their feet by his ghastly appearance, and with thoughts of the terrorizing bandit uppermost in mind, they began a wild scurry for their fire-arms, when who should one of the party recognize in the unexpected visitor, but the long-lost Alec. The members of the party discovered very quickly that something was wrong with him mentally, for even in his weakened condition, he was cross and very irritable, muttering revenge on all civilization, with no recollection of the principal events of his past and home. They broke camp at once, and started with him across the border. In the course of a few days he was taken to a well known hospital in eastern Canada, where it was discovered that he had suffered from a fracture of the skull. He was operated on without delay, and successfully. His story had a happy ending, for before he left the hospital, his mind had recovered its own proper personality, and Alec became himself again, as shrewd as before, and as honest. Thus, by the surgeon's hand, two interesting mysteries were solved, and a desirable citizen saved for days of further usefulness.

Fine questions of law and right shade into one another with a nicety difficult to unravel, in certain phases of double-personality. Smith, say, was considered a perfectly sane man up to a year ago. He deserts a wife, and all trace of him is lost until ten years later. An old friend discovers him in a remote part of the country, married again, with a family. He is prosperous and respected in his new environment, and is as sane as any man in the community. He has changed little in the ten years in physical appearance, but absolutely fails to recognize his old friend, or any incident in his own former life as Smith, for his name is now Brown, and he is just as much another sane individuality, as if he had literally been born again. What is his standing legally? Would it be right to punish the present Brown, when it was the former Smith who was guilty of wife desertion? Is Brown guilty of bigamy? Should Brown be compelled to go back to the former wife, Mrs. Smith, a woman who would be as strange to him under his second personality, just as much as to any stranger? Who is Brown, anyway,—in law, in justice, and in fact? Outwardly he is certainly Smith, but in his heart has never, in all truth, heard of him. Such a problem actually came up before a California court some years ago. The case was of a kind to make any thinking person ask himself "Who, indeed, am I," and leave the question unanswered. A person is accustomed to believe that if anything exists in this universe, it is surely himself. Perhaps a recital of the instance just referred to, may give that person room for doubt.

John Anderson was a fairly prosperous farmer, who rented some eighty acres in one of the corn-belt states. He had a wife and family, with whom he lived in perfect accord, as well as with his neighbors. He was hard-working, prudent and saving, and as sound in intellect as you or I. Owing to the delicate health of one of the children, and for reasons of ambition, he conceived the idea of going to southern California to buy an orange grove, to have a home of his own, and live in peace and quiet with his family for the rest of his days. His frugal habits and continuous toil had provided enough for this purpose, so he went on alone, with the intention of sending for his family as soon as he could find the kind of place he wanted. For some time letters were received at frequent intervals; everything seemed to be progressing favorably with him, and then no more letters came, and all trace of him was lost. Months of waiting went by, and years. The mother and children were verging on poverty, and had long given up the father as dead. One day surprising news was brought by a neighbor, who had just returned from the West, and had known Anderson in former days. He had met Anderson face to face in California; had found him living in most prosperous circumstances with a new wife and family. But he had failed to recognize the old friend, who had grown up with him from boyhood, and seemed so changed in thought, actions, and everything but his external appearance, that the old neighbor was beginning to wonder whether or not he himself was losing his own proper identity. This news of Anderson resulted in a purse being made up for the long-abandoned woman, and the neighbor and Mrs. Anderson went to California to take legal steps to enforce her rights and bring her husband back, if possible. The meeting between the two was pitiful. All who witnessed it were impressed with the man's innocence, and actually took sides against the woman for bringing trouble and notoriety to such a solid member of the community. But the wife held her ground. His eyes, hair, gait, manner of speech, all were the same she had known so long. As she recited these various facts, and the many little familiar incidents known only to themselves, of their many years together, Anderson appeared sincerely dumfounded, and first with tears in his eyes, and then in anger, flatly told her she was mistaken; that he had never heard of the man Anderson, and that his name was Arnold,—George Arnold. The matter got into court. All were convinced that the man was Arnold. But on hearing the other side, became equally convinced that he must be Anderson. No shadow of doubt was thrown on the man's sanity. The court was at a loss. Then Anderson, or Arnold, was taken ill with pneumonia, and in the course of a week was dead, solving the problem so far as he was concerned. Then all parties agreed that the case was one of double-personality. What the court's decision would have been had the man lived, is of course unknown.

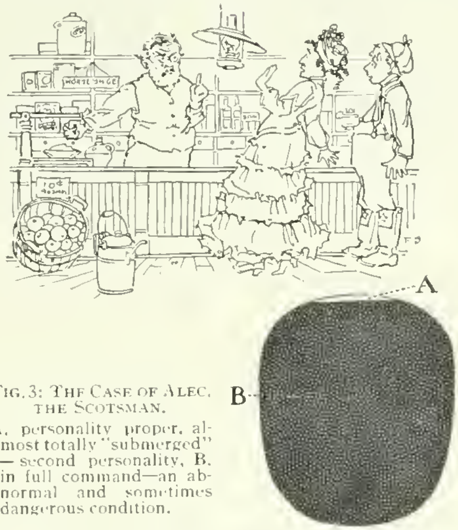


FIG. 3: THE CASE OF ALEC, THE SCOTSMAN.
A, personality proper, almost totally "submerged" — second personality, B, in full command—an abnormal and sometimes dangerous condition.

It is not always an easy matter to trace the cause of these cases of lost-identity. Many occur without any sign or history of brain-injury. The cases in which we are unable to assign a physical cause are most baffling, leading to speculation into unknown regions of the psychic world. Undoubtedly further research will throw much light on this very interesting subject. A few years ago, a man in high professional standing, residing in one of the Wisconsin towns on Lake Michigan, disappeared without any reasonable cause whatsoever. A wide search was instituted for hundreds of miles around, but in vain. At the end of some weeks all hope was abandoned, at least of ever finding him alive. Then rumors from various farmers just beyond the Mississippi began to come in. One farmer had hired a vagrant farm-hand for a couple of days, who, after putting in several days of hard labor, suddenly disappeared without pay. Another farmer had, he thought, employed the same man under the same circumstances. Then another report, and another, of similar import, came flashing over the wires. All the descriptions fitted exactly that of the missing lawyer. Devoted friends hurried to that part of the country from which the rumors came, with the hope of finding the wanderer. They were able to trace him from farm to farm, and then from one village to another. In a certain town on the river was a factory for the manufacture of buttons. Some one said that a man answering the description of their friend was employed there. They hurried on, and there, in the garb of the commonest of workmen, was their cultured, learned friend, engaged in the useful, but lowly occupation of making pearl-buttons from clam-shells. He was happy, and seemed to enjoy his work immensely, and couldn't understand why they should want him to go back to home and friends, now totally forgotten. He was another identity entirely, who had returned to the simple life with a vengeance. In the course of a few days, he was restored to home and his former personality, and said in explanation that a compelling craving for a simple life had caused the trouble. It would seem from this instance, that mental labor alone is not sufficient for the needs of many brain-workers, and that if those who employ their mentality only, would resort daily to some simple manual work, Nature would not make such violent demands when these needs are ignored. Manual work is the essence of the simple life, and the brain-worker, of any, can least afford to overlook this fact.

The incidents or accidents leading up to double-personality, cause the manifestation by "letting loose" the second-ego, or "other self," which lies sleeping in all of us. To all intents and purposes, this second personality is as sane and healthy as the first, but—it is entirely different. Intellectually, this second-personality is often keener; morally, it is on a lower plane.

Within the past year, the son of a merchant was thrown from a wagon, owing to the horses running away. He was only sixteen years old, a handsome and manly young fellow, as promising a son in every way as any one could wish. He lay at home for weeks, hovering between life and death, as a result of his injuries. In the course of some months he had apparently fully recovered, and was physically as robust as ever. Mentally he was exceedingly brilliant, and astonished his parents and friends with his scintillations of wit and depth of philosophical thought. His parents, particularly, felt a strangeness while in his presence they had never felt before. And then strange stories reached their ears of petty thefts committed by him; of carousals beyond their comprehension; of waywardness and delinquencies which seemed wholly foreign to his former character and habits. Finally a daring burglary was committed, and the youth apprehended as the offender. It was the final blow to the sorrowing parents. Extenuating circumstances were set forth, and the case never came to trial. Instead, the son was taken to a hospital, an opening was made in the skull, and a piece of bone, which had been causing pressure on the brain, removed. He was soon out again, and up to his newly-acquired offenses. The operation had proved a failure. Not long after, in the midst of a drunken revel, he put an end to himself with a common poison. This pitiful tragedy of a young life was due to an injury of the head, an injury not considered, as to its bearing on the future, at the time it occurred.

Today, through a better understanding of these unfortunates, and other victims of delinquency, many of them are cared for in psychic institutions, where they properly belong; and, thanks to Victor Horsley, of London, who made the first experiments in brain surgery on monkeys, many of these saddest of cases in the annals of the curiosities of lost-identity, can be completely cured by operative interference as practiced by the skilful hands of skilful surgeons.

AN OBJECT LESSON OF THE UNITED STATES OFFICE OF PUBLIC ROADS, AT MONROE, LA.
The old highway to the left, and the new.

$250,000,000 HIGHWAY ROBBERY

By

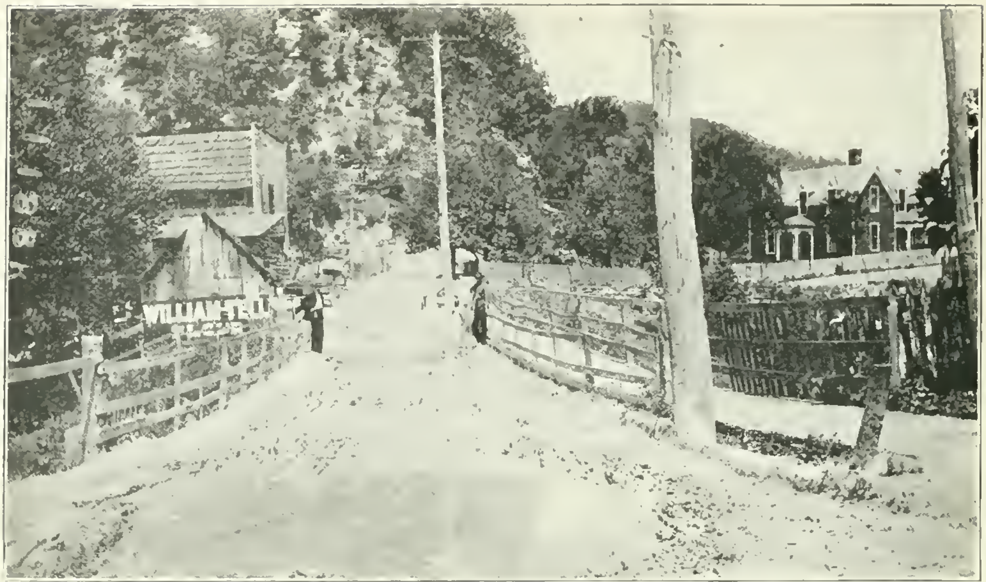
CHARLES FREDERICK CARTER

FORTY million dollars were wasted on the public roads of the United States through ignorance, incompetence, and indifference in 1904. As the same amount was wasted in the same way in 1910, the American people would seem to be holding their own nobly.

But these statistics present only half a truth which, like other half truths, is misleading. In 1904 the expenditures on public highways aggregated $79,000,-000, while in 1910 they had increased to $100,000,000. That is to say, instead of wasting half the hard earned money devoted to road improvement we have become so enlightened that we only waste forty cents out of every dollar. Truly, we may plume ourselves on such a record.

Still, this is but the preface to that great National joke, the public road: for the direct waste which may be charged to the lack of suitable highways, according to Logan Waller Page, Director of the United States Office of Public Roads, foots up the neat little sum of $290,000,-000. The way Mr. Page figures it out, the annual loss due to incorrect and inadequate methods in the construction, maintenance, and administration of public roads may be set down at $40,000,000, while the burden imposed through excessive cost of transportation from the farm to the railroad station reaches the impressive sum of $250,000,000.

The latter item is based upon statistics gathered by the Government, which show that the aggregate weight of crops hauled to market annually is more than two hundred and fifty million tons. The average haul is 9.4 miles, and the average cost 23 cents per ton per mile. This makes the total cost amount to $540,-500,000. In Europe, where good roads are the rule rather than the exception, the cost of hauling is much less than half what it is here. Hauling on the famous highways of France, for example, costs but 10 cents per ton per mile; in England, the same; while Belgium reduces this low rate half a cent, and Germany



AS IT WAS.

caps the climax with an average rate of 8.5 cents per ton per mile for transportation on her fine highways. It seems reasonable to assume, therefore, that with the same class of highways here the cost of hauling the crops to market might well be reduced one-half, at least.

This $290,000,000 wasted outright through the lack of suitable roads is equivalent to five per cent interest on $5,800,000,000, which would pay for the construction of 1,160,000 miles of modern highways at $5,000 a mile. As excellent roads are built in some localities for half that sum, or even less, and since the total of unimproved roads does not much exceed two million miles, it is probable that this sum would come

AS IT IS.
Road at Paintsville, Ky.

pretty near to supplying the whole nation with adequate roads.

It would be a most profitable undertaking to borrow the money on bonds for building highways, for the whole indictment against bad roads has not yet been recited.

Still another way in which American roads waste money is in the unnecessary amount of ground they occupy. The average highway here is four rods, or sixty-six feet wide. In the middle Western States much of the ground given up to highways is worth a hundred dollars an acre. Only a small part of this space is actually needed for a roadway, the rest being devoted to weed culture. These weeds furnish an inexhaustible supply of seeds with which adjacent farms are stocked without effort on the part of their owners, causing either a heavy outlay for labor to keep the weeds down or a still greater loss from damaged crops. In Europe they think too much of their land to waste it so foolishly. They find there that a roadway from twenty to thirty feet wide is ample for traffic a hundred fold heavier than traverses the lonely highways of the prairie States. Robert J. Thompson, U. S. Consul at Hanover, who has been investigating the subject, estimates that in thirteen of the agricultural States of the middle West there are seven hundred thousand miles of country roads. By reducing their width from sixty-six to thirty-six feet, 2,500,000 acres of generally tillable land would be restored to cultivation, which, valued at $100 an acre, would foot up the staggering total of $250,000,000. When so many thrifty farmers are giving up their homes in these States to seek lands in Canada, it does seem as if a form of waste equivalent to furnishing 15,625 of them with a quarter section each might be worth a little earnest consideration.

A Small Two by Two Concrete Culvert Would Obviate This Very Common Disgrace.

Even this is not all the story, by any means. Back of it all are the still greater losses of the farmers who are unable on account of bad roads to haul their crops to market when prices are highest. In a paper read before the American Road Builders Association at Indianapolis last December, Mr. Page bruised the pocket nerves of every farmer in Indiana by reminding them that in 1909 prices of wheat in Chicago ranged from 90½ cents to $1.60 per bushel, the lowest price being reached in August when the roads were at their best, while the top prices were attained when the roads were practically impassable; that the State's wheat crop that year being 33,124,000 bushels, every advance of one cent per bushel meant a gain in the value of the crop of $331,240, while an advance of one cent a bushel on the corn crop aggregated $1,965,200. Thus they could see what they lost by not having roads upon which they could haul a load to market at any time.

Indeed, if all the indirect losses were counted in, it is not unlikely that the grand total properly chargeable to a lack of suitable roads would be somewhere near a half billion dollars a year. Nor is this all. Aside from any question of money is the *isolation* imposed by bad roads. Churches, entertainments, and agreeable neighbors count for naught if one is separated from them by a mile or two of impassable mudholes. Good roads mean more to the children than to the grown members of the farmer's family, for they may spell the difference between an education and the lack of one. It has been found that in communities provided with good roads the average school attendance the year

A SCHOOL BUILDING AND A COUNTRY ROAD THAT ANY COMMUNITY SHOULD BE ASHAMED OF.

round is over eighty per cent, while with bad roads the attendance rarely exceeds seventy per cent, while it may be as low as thirty per cent. The best schools are always situated on good roads, the worst schools on bad roads.

But better things are now in sight. Energetic efforts are everywhere being made to still further increase the annual expenditure for roads, and more especially to reduce the percentage of waste.

As an earnest that the first purpose will be accomplished there are now thirty-two States which have adopted some form of State aid or supervision for road construction and maintenance. New York led the van with an expenditure from State funds in 1910 of $2,500,000, while Pennsylvania was second with an outlay of $1,000,000. Massachusetts spent $750,000 of State money on her roads, Maryland, $350,000, New Hampshire, New Jersey, and Rhode Island $300,000 each, Washington $375,000, Vermont $175,000, Virginia $250,000, West Virginia $120,000, and other States various amounts. California, which at the last election ratified a proposal to issue bonds for $18,000,000 to construct a trunk highway system, will soon rank next to New York in the extent of her useful roads. In the South they are not spending so much in cash but they are getting good roads by employing convicts to build them. Of the fifteen thousand miles of highways built in the twelve southeastern States between 1904 and 1910 the greater part was accomplished by the use of convict labor. Georgia keeps 4,500 convicts at work on her public roads the year around.

Indeed, no fewer than thirty-three States have laws favorable to the employment of convicts in road building. Unfortunately, though, the laws in many cases are vague, and in still others narrow; so that the plan is actually followed in but eighteen States, though in several others convicts are employed in quarrying, cutting, and crushing stone for use in road building. It has been found that a convict will do practically as much work in a day as a free laborer and that the cost of guarding and maintenance on the highways is actually less than the cost of maintenance and guarding in jail.

GOOD SCHOOLS AND GOOD ROADS USUALLY GO TOGETHER.

Besides the outdoor work is better for the prisoners.

The highly important task of reducing the waste of money actually raised for highway construction is being accomplished through various agencies in addition to the State highway departments already referred to. Foremost of these outside agencies is the United States Office of Public Roads. Organized in 1893 with an appropriation of $14,000 with offices in two attic rooms, this bureau has increased in usefulness until now it occupies a four-story building of its own, which includes within its walls physical, chemical, petrographic, and photographic laboratories, and a machine shop, and has at its disposal an appropriation of $116,000. A staff of twenty-four engineers and superintendents of road construction are employed to teach the art of road building to any community that will take the trouble to ask for their services and provide the material and labor. A favorite feature of the bureau is the "Object Lesson Road Project." This consists in assigning an engineer to supervise the construction of a short section of road to demonstrate proper methods and instruct local builders. Up to July 1, 1909, 264 object lesson roads had been built in thirty-five States, demonstrating the proper methods of using crushed stone, gravel, sand-clay, shell, earth, bituminous materials and brick. Besides this, the engineers of the bureau give special advice, deliver technical lectures, introduce model systems of construction, maintenance, and administration in counties and study and report on practical methods for a series of years.

Beside the Government bureau there are several national organizations, such as the American Highway League, which held a convention at Chicago last May. Membership in this League is limited to representatives of State highway departments. Its purposes are to provide a means of effective co-operation between States and to study methods of construction and maintenance.

An organization which is expected to accomplish a good deal is the American Association for Highway Improvement, organized at Washington last November.

A Fine State Road in Massachusetts.
This is the sort of highway that delights automobilist and farmer alike. Other sections could well follow New England's example.

Its Board of Directors includes James McCrea, President of the Pennsylvania Railroad; W. C. Brown, President of the New York Central; Louis Hill, President of the Great Northern; W. W. Finley, President of the Southern Railway; B. F. Yoakum, Chairman of the Frisco Lines; Alfred Noble, Past President of the American Society of Civil Engineers; Dr. E. J. James, President of the University of Illinois; Lee McClung, Treasurer of the United States; John Goodell, Editor of the Engineering Record; Robert P. Hooper, President of the American Automobile Association; U. S. Senator Lafayette Young, and L. W. Page, Director U. S. Office of Public Roads. The objects of this association are to correlate and harmonize the efforts of all organizations working for road improvement; to stimulate sentiment for road improvement; to work for equitable and uniform road legislation in all States; to promote efficient road administration in the States and the correlation of all road construction so that the important roads of each county shall connect with those of adjoining counties and the important roads of each State with those of adjoining States. The founders hope to make the association a sort of clearing

AN UNDRAINED "HIGHWAY" IN TENNESSEE.
Compare with illustration opposite.

house through which all road improvement organizations may give to each other the benefit of their experience, their ability, and all the facilities at their command.

When to all these influences are added the efforts of the railroad industrial departments, practically all of which do what they can to further the movement for improved highways, and some of which even run "good roads trains" for the enlightenment of their patrons, and the propaganda carried on by such organizations as the American Automobile Association, the Touring Club of America, and the Association of Automobile Manufacturers, it may be seen that the outlook for better roads is distinctly brighter. It would be brighter yet if there were many such public spirited citizens as Sam Hill, of the State of Washington.

Mr. Hill went to Governor Hay and offered to give a year of his time wholly to further the movement for better roads. Finding his offer so heartily appreciated he not only spent the year but several thousand dollars of his good money in the cause. One of the things he did was to pay the expenses of one of the best highway engineers in England to go to Seattle to deliver an address on the subject of roads. Another thing was to pay the expenses of the city engineer of Seattle and of a professor from the University of Washington on a three months' trip to England to study road construction. His efforts are already beginning to bear fruit; for while there were seventeen appropriations for the improvement of State roads in 1909, none of which were connected and therefore were of comparatively limited use, there is now a project under consideration, backed by Governor Hay, for a State trunk line 1,100 miles long, running from Bellingham on Puget Sound down through Seattle and the southern part of the State to Spokane and back by a more northern route to Seattle, which would accommodate three-fourths of the people in the State.

The present unpardonable waste of forty per cent of the money actually raised for road construction is simply due to the fact that many people do not know what a road is, and, furthermore, they would not know how to build one even if they did know what it should look like. Witness Iowa, which now spends $5,000,000 a year on roads, yet scarcely has a road to her name. Indiana is a close second with an equal expenditure, but a trifle more to show for it. In the latter State waste is made easy by dividing responsibility for road

Miles of this Type of Drain Ought to Be Built Along Our Highways.
Laying side drains at Westfield, Mass.

AUTOMOBILES TEAR TO PIECES ROADS LIKE THIS.
A macadam road in Georgia.

work among local authorities in a hopeless sort of maze so that no one has any power or money to do anything effectively. Maryland, up to 1909, extended the same absurdity to State supervision by dividing authority for construction between the State Geological Survey and the State Highway Commission.

By way of contrast Wisconsin, having adopted the war cry, "A dollar's worth of road for every dollar of tax," is showing how to make money work miracles. In 1907 as much as $10,000 was appropriated for the use of the State Geological Survey in experimental road building and in advising local road authorities. As there are fifteen hundred of these local road bodies, the contract was rather a large one. But the Survey engineers did the best they could by addressing public meetings and distributing pamphlets, and by establishing a correspondence school for road builders. In order to make every dollar count they managed to induce some localities to build roads graded to a width of twenty-four feet with a stone surface only nine feet wide. Everybody knew that such a narrow roadway would not answer at all, but after they had tried them they wanted no other kind. These nine-foot roadways answer the purposes of light traffic and they cost but $1,800 to $3,500 per mile, while the 14-foot stone surface, which allows two teams to pass and which is used for heavier traffic, costs from $3,000 to $5,000 per mile.

Every community which reaches the point of determining to have real roads and raises the money to pay for them does not get what it wants. Some counties in California paid for good roads, or thought they did, but the work was so badly done that the good roads movement received a setback. On the other hand there was Pike County, Alabama, which raised money to pay for gravel and macadam roads, but wisely sent to the U. S. Office of Public Roads for an engineer to build them. He found sand-clay roads, costing one-fifth of what macadam would cost, better suited to the locality. In Kansas sand-clay roads cost from $707 to $1,183 per mile, which seems to bring them well within the limit required to interest the average farmer in highway improvement, according to the opinion of the Good Roads Convention which met at Cleveland in 1909.

This does not prove that sand-clay roads should be built everywhere under all conditions. The true moral to be drawn from the experience of Pike County is always and under all circumstances to employ a highway engineer to direct operations. Road building is an art that calls for something more than good intentions.

An interesting feature of the highway situation is the passing of macadam construction, for many years regarded as the highest type of road. But the advent of the automobile has utterly destroyed the reputation of the macadam road. It has been found by costly experience that no ordinary water bound macadam is capable of withstanding for any length of time the action of excessive automobile traffic, and in Massachusetts actual count shows that automobiles make up forty-two per cent. of the traffic on the highways of the State. The speeding rubber tires whirl away the rock dust, thus destroying the bond of the wearing surface, then ravel out the larger fragments of stone. Some sort of binder that will hold material, both fine and coarse, together is absolutely necessary. The question is so important that the American society of Civil Engineers has appointed a special committee to investigate. Various combinations of tar, asphalt, and crude petroleum have been tried in various localities with different degrees of success. It is already evident that a bituminous binder that will work well under one set of conditions will not answer at all under other conditions. The difficulty is to suit the binder to the requirements of the traffic and the climate.

Some other points which should be possessed by a good road according to the concensus of opinion of the world's foremost highway engineers, as formulated in the conclusions of the First International Road Congress, held at Paris in October, 1908, and of the second Congress held at Brussels in August, 1910, are as follows:

The minimum width of roadway should be 19 feet 8 inches.

The camber should be the least that will allow the proper run-off of rain water.

Grades should be moderate, with as little difference as possible between minimum and maximum.

Curves should have as great a radius as possible, but not less than 164 feet. Curves should be connected with tangents by parabolic curves. Curves should be slightly raised at the outside, but not enough to interfere with ordinary vehicles. The view at curves should not be obstructed.

Road crossings should be visible and well opened out. Railroad and tramway crossings at grade should be avoided if it is possible to do so; otherwise they should be signalled night and day.

Wherever possible tracks should be provided for bicyclists and paths for horsemen.

The sides of roads should be defined by trees wherever possible.

Binding material should be used in the construction of metalled (broken stone) roadways, special attention being given to determining the character of the binder best suited to local conditions.

Superficial tarring may be considered as definitely accepted in practice.

Emulsions of tar, oil, or hydroscopic salts have a real but not a lasting efficiency. Therefore, their use should be limited to special cases such as race courses.

Cross and longitudinal sections of roads and gutters should facilitate the flow of trickling water and prevent infiltration.

That maintenance is quite as important as construction is well understood in Europe where fourteen nations spend $160,000,000 annually for the maintenance of 994,000 miles of road which cost $5,000,000,000 to build. In the United States, unfortunately, the importance of constant care has not been realized as clearly as it should have been. But in this particular, too, marked improvement is noticeable. New York, which leads the Nation in the magnitude and comprehensiveness of its highway improvement programme, has copied the patrol system that has made the roads of France so famous. The road patrolmen in New York furnish their own horse, cart, and tools and keep the highways in first-class condition at a cost of $75 per mile per year for labor and $25 per mile for material. Oil is successfully used to lay the dust, the plague due chiefly to the automobiles, at a cost of $422 per mile of sixteen-foot roadway per year.

To sum up the situation in a sentence, there are so many hopeful signs of improvement everywhere that it seems safe to predict that within ten years the administration of the public roads will be established upon a satisfactory basis.

MANY TALK ON ONE WIRE

By

RENÉ BACHE

"HELLO! Is this New York?"

"Yes."

"This is Honolulu, in the Hawaiian Islands. Give me the Flatiron Building."

That is the sort of long-distance telephoning we shall soon be able to do. Indeed, there is every prospect that within a short time people will talk from Chicago to London over a wire. We may even send a whisper direct from Boston to Peking, China, or actually transmit a spoken message around the world!

All of this as the result of an invention just patented by Major George O. Squier, of the Signal Corps, United States Army. He has made a free gift of it, however, to the American people, and anybody is at liberty to use it without paying a cent for the privilege.

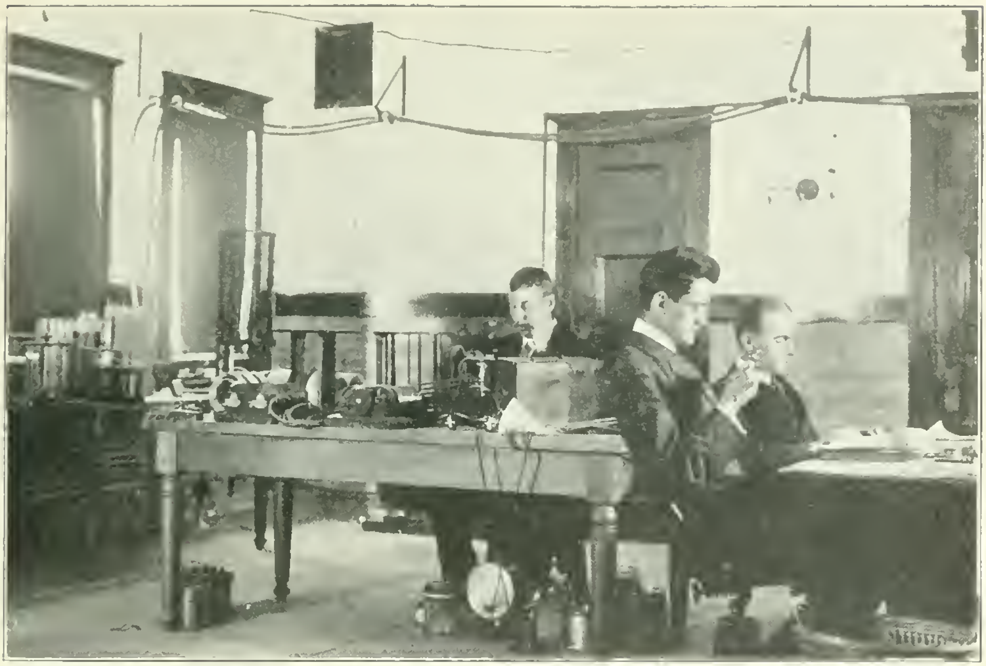
THE MAN WHOSE DISCOVERY ENABLES MANY TO TALK ON ONE WIRE.
Major George O. Squier, U. S. Army.

The invention does not merely promise to provide a means whereby one may telephone for a distance almost indefinite. It also makes practicable the employment of a single wire for the simultaneous sending of a number of messages, whether by the voice or by the telegraph.

Briefly described, the method adopted is one whereby wireless messages are sent over a wire—a sort of "wire wireless," as Major Squier calls it. A paradox, one might say. But the matter will be better understood when it is explained that the messages travel not through the wire itself, but through a thin layer of ether surrounding the wire. All that the wire does is to act as a guide.

Everybody is familiar with the enormously tall poles erected for wireless telegraphy. Such an "antenna," as it is called, sends out electro-magnetic vibrations which expand like the circles made by a stone which a small boy throws into a pond. It follows, of course, that their effect at any particular distant place is relatively infinitesimal. But, if all of these vibrations were bunched together and sent in a single direction, it is obvious that they could be rendered a million times more efficient, so far as the carrying of vibrations to a given point is concerned.

Now, this is exactly what is accomplished by the invention here described which, by the way, does not require the use of any new apparatus whatever. The ordinary telephonic outfit, as it exists today, may be used, without the addition of a single instrument. What Major Squier has patented is merely a new



WHERE THE EXPERIMENTS WITH THE MULTIPLEX TELEPHONE WERE CONDUCTED.
Signal Office Research Laboratory at the Bureau of Standards, Washington.

method, by which it is practicable to send extra conversations by the wire.

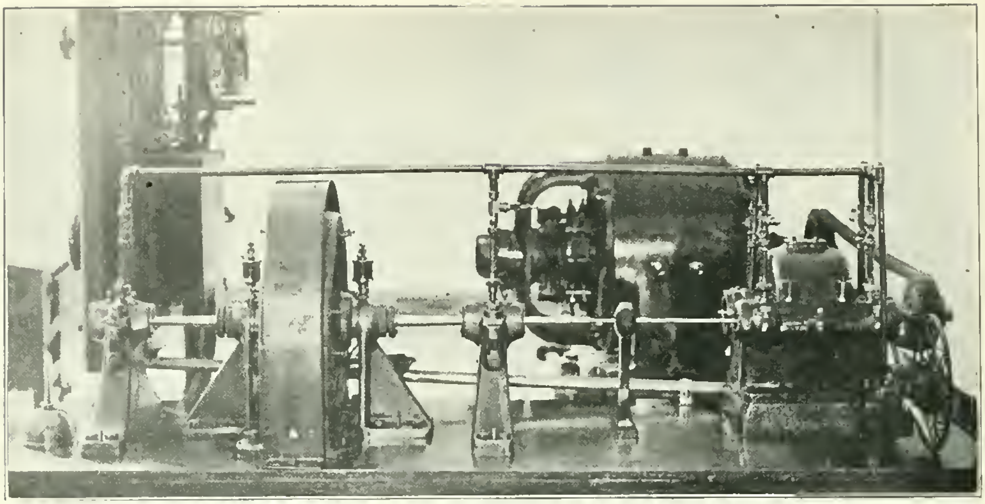
At the bottom of the idea upon which the invention is based lies the fact that the electro-magnetic rays which pass over a telephone wire are audible only within definite limits of frequency. If the vibrations are fewer than sixteen to the second, they transmit no impression to the human ear. On the other hand, if they number more than 20,000 to the second, the human auditory apparatus is unable to respond to them, and so perceives nothing. In other words, our ears are deaf to vibrations above 20,000 per second, and below sixteen vibrations.

To carry his messages, Major Squier employs high-frequency waves, far above the limit of human hearing. Obtaining them from a dynamo, he tunes them to various pitches, so that each conversation carried on over the wire is based upon a separate and particular number of vibrations per second. Inasmuch as the talks are on different electrical tunes, they do not interfere with one another in the least.

It will be understood, then, that high-frequency waves, suitably tuned, are traveling along the telephone wires—not in the wire itself, but in a layer of ether surrounding it. They cannot be called sound waves, because they are too rapid to produce an impression upon the human ear. Major Squier calls them "ultra-sound vibrations." Nevertheless, each voice that speaks into the transmitter affects these waves differently, and every spoken word is faithfully carried by them. When, therefore, at the other end of the line, they are retranslated back into sound waves, the message becomes audible to the listener.

Instead of an ordinary direct current through the wire itself, impulses are sent along it in the shape of high-frequency waves which, as the inventor says, "don't get into the wire at all." If it be asked how many "extra conversations" can be put on the conductor, the only possible answer is "several," because the number must depend upon the diameter of the wire and other conditions.

As the frequency of the electro-magnetic waves increases, their energy appears to have a steady growing tendency



ONE HUNDRED THOUSAND-CYCLE GENERATOR FOR ELECTRIC WAVES USED BY MAJOR SQUIER IN HIS EXPERIMENTS.

to get out of the wire itself. The ordinary battery telephonic current is largely a conduction current through metal, and the ohmic resistance of the wire is one of the principal obstacles to long-distance telephoning. On the other hand, in wireless telegraphy, frequencies from 100,000 up to several millions per second are used, and the energy is chiefly radiated into the ether of space.

There is, however, an intermediate range, in which the vibrations are from 20,000 to 100,000 per second, and wherein the electro-magnetic energy is still sufficiently linked to the wire to prevent excessive radiation into the ether. The wire, while carrying but a small part of the energy, nevertheless acts as an efficient guide for the high-frequency waves. Accordingly, use is made of these *steered* ether waves as a vehicle to carry telephonic or telegraphic messages.

It will thus be seen that the new invention combines the principles of wireless telegraphy and telephony with those of telegraphy and telephony by wire. Major Squier, in other words, has taken the apparatus and methods now used in wireless communication, and has applied them to the transmission of electro-magnetic waves along metal conductors, thus accomplishing an enormous improvement in efficiency over the plan of employing antennæ at transmitting and receiving stations, which is the ordinary custom.

The circuits are ordinary telephonic circuits, such as are now utilized in wire telephony and telegraphy. "In fact," says the inventor, "the regular twisted-pair paper-insulated lead-covered telephone cable serves the purpose very well, the energy being conveyed principally in the minute layer of ether separating the two metallic conductors. By this means a most efficient system of high-frequency telephony or telegraphy is maintained, and, at the same time, any interferences between neighboring circuits operated by the system are eliminated, so that many such circuits may be brought to the same switchboard without interfering effects."

The inventor further says: "Since a plurality of high-frequency waves of different frequencies may be impressed on the same line, and since these may be selectively separated from each other by suitably tuned circuits, it is obvious that multiplex telephony is practicable. Also, it has been found that these high-frequency waves may exist on the same line with ordinary battery telephonic currents without in any way affecting them; and thus the system may be applied to the usual telephonic circuit without 'cross talk' or other disturbances."

Major Squier calls attention to the

fact that it is almost impossible to make an ordinary telephonic system work satisfactorily over any circuit that is connected with the ground. Lines with such circuits are subject to serious difficulties, chief among which are the strange noises heard in the receiving instruments. The cause of these noises, by the way, is not very well understood. But the new plan makes it practicable to connect a telephone circuit with the earth at both ends without inviting the slightest suggestion of such disturbances—a very important feature of the invention, in Major Squier's own opinion.

The high-frequency telephonic messages and the local battery messages may exist on the line simultaneously without a trace of any "cross-talk" or disturbing noises from other external sources. Earth or ground connections form a part of the tuned circuit, and no noises from the earth are permitted to pass, because all such ground connections are tuned to frequencies far above the human auditory limit.

Very essential is the fact that the condensers used are of a capacity so small as to be measured in terms of thousandths of a microfarad, and they block all currents of such low frequencies as the ordinary telephonic currents, or those which bring disturbing noises from external sources.

The whole range of electro-magnetic vibrations is viewed by Major Squier as a spectrum extending from the ultraviolet, which is a region of high frequencies, to the exceedingly slow oscillations of the infra-red, such as are used on long-distance submarine cables. One might say that these are terms of light; and so, indeed, they are. But, as the inventor explains, light and electricity are the same thing. Vibrations within certain limits of frequency, as already stated, can be heard over a wire. Above 20,000 a second they become inaudible to the human ear. When they have got up to 700,000,000,000,000 to the second, they become visible to the eye. We could actually see telegraphic messages, instead of hearing them, if our eyes were suitably constructed.

The waves used by Major Squier belong to the great unexplored region which lies above the limit of audibility and below the limit of visibility. They can be neither heard nor seen; yet they are utilized for purposes of wireless telegraphy, and those of them which are relatively low down in the scale of frequency can be employed to carry messages.

All the vibrations being bunched together and guided by the wire in a single direction, they can be sent to an enormously greater distance. Hence, the likelihood that long-distance telephones operated on the new principle will be able to carry messages across the ocean and even, if desired, around the world.

Such, briefly described, is the novel idea which seems destined to revolutionize telegraphy as well as telephony; for it is as applicable to the former as to the latter. It ought greatly to cheapen both. But Major Squier seems to think that one of the most important advantages of his discovery lies in the fact that it can be utilized and applied with the apparatus already in common employment. Its application does not demand a single instrument that cannot be purchased for a moderate price in the open market—for which reason it is at the service not merely of the telephone and telephone companies, but of any private citizen. It is the property of the people.

All of the experiments with the multiplex telephone up to date have been conducted over a single circuit, which connects the research laboratory of the Signal Corps—at the Bureau of Standards—with the construction laboratory of the Signal Corps, on Pennsylvania Avenue, close by the War Department, in Washington. The distance between the two points is about five miles. Over this line the new system is now in operation.

HERE IS THE "RUTHLESS EXAMINATION" THAT NEWSPAPERS OF A CERTAIN CLASS SHRIEK ABOUT.

MAKING THE TOURIST HONEST

By

CHESTER CARTON

CONSPICUOUS in the throng upon the decks of the *Kaiser Wilhelm II.* while she was being laboriously warped into her berth at Hoboken one day last September were fifteen dignified matrons. At least they tried to look dignified, but realizing that they were conspicuous, and being still more distressingly aware of the reason therefor, they made rather a poor fist of it. For all the fifteen were swathed in obstreperously new Persian lamb coats which would have been admirable garments for an Arctic winter excursion, and yet it was a grilling hot day. The seasons keep fashionably late hours in New York, spring lingering into summer and summer lapping over into autumn.

At the imminent risk of sunstroke the fifteen kept their new fur coats closely buttoned throughout the wearisome time that it takes to moor a big steamer. Perspiration streamed from their red faces as they staggered down the gang plank, and distributing themselves among the lettered sections of the torrid dock, began the vigil of their baggage. By the time her trunks were all assembled ready for the customs examination the lucky first one was on the point of collapse. When asked to acknowledge her signature on her declaration, she could only gasp and nod her head. The inspector to whom the document was handed glanced at it, then at the new Persian lamb coat.

"That is a handsome coat you have on, madame," he remarked, seemingly bent on making conversation.

"Yes, I think it is rather fetching," murmured the melting one, finding her voice again, for no woman is ever too far gone to rise to a neatly turned compliment.

"It has the real Parisian cut. You must have purchased it abroad."

"Oh, yes! You cawn't get such furs at home."

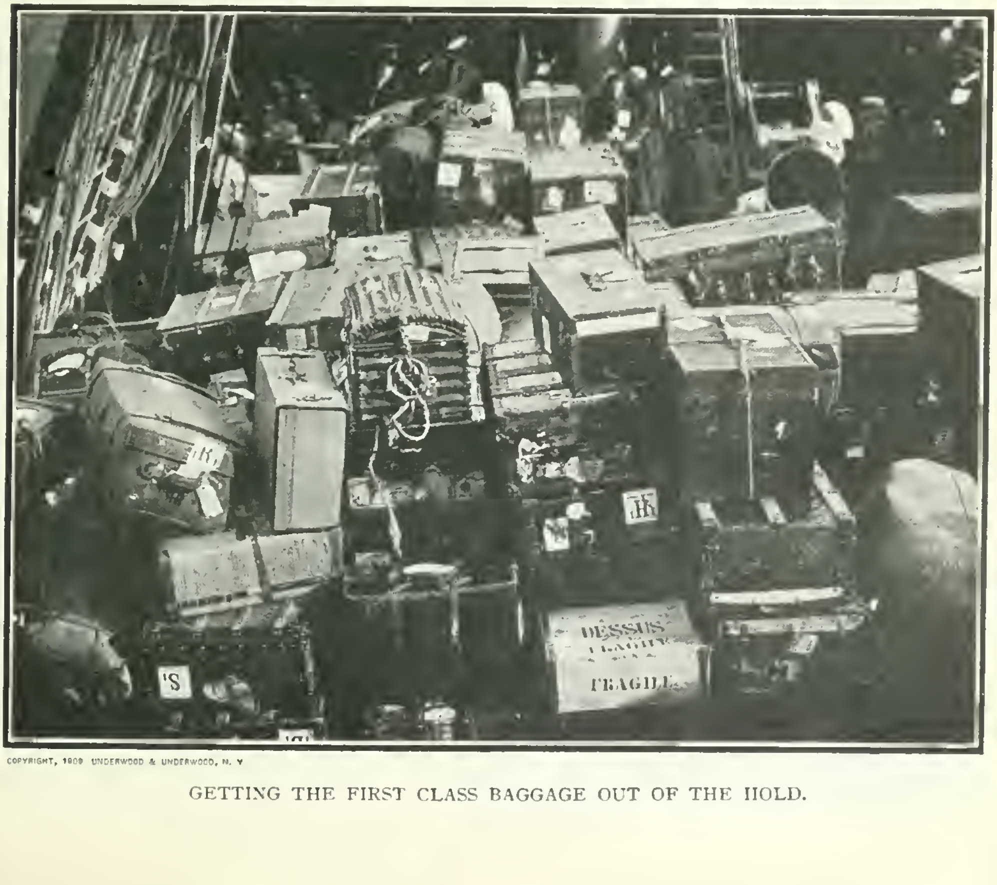
"I see you forgot to include it in your declaration."

"Why I'm wearing it. Don't you see? I'm wearing it."

"That makes no difference whatever. You will observe that the law distinctly says that only one hundred dollars worth of goods purchased abroad may be admitted duty free. If you will kindly step to the desk, madame, I think you will be allowed to amend your declaration."

No thermometer would have recorded that matron's temperature when she realized that she had sweltered in vain, and that she must pay $130 in duty before she could take her prize away. Her impotent rage was scarcely assuaged by the knowledge that each of the other fourteen were making the same discovery in other parts of the dock. There are times when misery is too much engrossed with its own unhappiness to care whether it has company or not.

Not until weeks afterward did a nebulous suspicion in the minds of the fifteen crystallize into a conviction that he whom they had thought such an agreeable young man on the ship coming home was a fiend in human shape, an abandoned wretch with a perverted sense of humor, who had played what he was



GETTING THE FIRST CLASS BAGGAGE OUT OF THE HOLD.

Customs Inspectors Checking the Declarations in the Dining Saloon While the Steamer Halts at Quarantine.

pleased to consider a practical joke upon them by telling them they would not have to pay duty on any of their European purchases they wore when going ashore. Being a gossipy person he had found out all about their purchases, had made the possession of those dutiable Persian lamb coats a bond of sympathy between them, and had been the arch conspirator in the pretended plot to trick the Government out of its just dues. But if any of the fifteen ever clap eyes on the scoundrel again ——

Amazing beyond comprehension is the tenacity with which seemingly intelligent persons will cling to popular beliefs in the face of the most explicit and emphatic refutations, backed up by authority and reiterated again and yet again. Somebody somewhere somehow sometime got the idea that anything that had ever been worn, or which was worn upon disembarking in America, no matter what it was, or what its value, or where it was purchased, was not subject to duty. He confided this hallucination to some one else who passed it on to another. This tariff delusion, thus started on its travels, has spread like a contagion from the Atlantic to the Pacific, from the Soo to the Rio Grande. Ninety-nine out of every hundred trans-Atlantic passengers believe it with their whole soul on their first trip. They believe it just as implicitly as they believe that anything offered for sale in Europe must necessarily be a wonderful bargain. So they spend half their time abroad shopping and the other half wearing their purchases in order to escape the tariff which in the abstract is a heavenly beatitude, provided it is only high enough, but which becomes an unjust, tyrannical, oppressive burden to be evaded by any artifice the moment it is brought home to the individual.

On every west bound liner that crosses the Atlantic may be seen a few women suffering from the tariff delusion. They can always be identified by the preposterously inappropriate costumes they wear on shipboard. They suffer the pangs of martyrdom, for they know all the other women are talking about them, and they perjure their souls with false explanations and apologies to hide what everybody knows, which is that they are suffering merely to trick the United States Government out of the money it so desperately needs to pay pensions. The shrewder tourists on their first trip take their purchases to a secluded spot in Switzerland where they wear them each for an hour, then sew in old labels they prudently brought from home. After the first trip they know better.

Some even think jewels purchased abroad are not dutiable if they take the precaution to wear them on going ashore. Thus, a tourist who shall be nameless here, returning on the George Washington, October 10, 1910, wore a new diamond ring and pin, his wife wore a diamond and sapphire ring and carried a silver mesh bag. None of these things were included in their declaration, yet they readily admitted they had been purchased abroad. Asked why he did not declare the jewels, the tourist triumphantly called attention to the fact that he and his wife were wearing them. He was overwhelmed when the trinkets were seized and he was obliged to redeem them by paying their full value plus 60 per cent duty with a fine on top of that for good measure.

Yet it is difficult to work up any sympathy for the victims of the tariff delusion when they are forced to pay three times what it would have cost them to be honest. Smuggling is merely a form of stealing, which is expressly forbidden in the decalogue. No one can make any mistake about the tariff law unless he does it wilfully. Early in the west bound voyage, so there will be plenty of time to examine it at leisure, the purser or his minions hands to each passenger a blank declaration on which to schedule his baggage, including foreign purchases, and a little blue folder. The declaration, which is numbered and has a coupon with a corresponding number attached, bears the most explicit directions for filling it out. But for fear the plain and simple language may be misunderstood, the little blue folder, which is headed "Notice to Passengers," begins by quoting paragraph 709 appearing in the free

CUSTOMS INSPECTORS LINED UP WAITING FOR ASSIGNMENTS.

list of the present tariff act governing passengers' baggage, which reads as follows:

"Wearing apparel, articles of personal adornment, toilet articles, and similar personal effects of persons arriving in the United States: but this exemption shall only include such articles as actually accompany and are in the use of, and as are necessary and appropriate for the wear and use of such persons, for the immediate purposes of the journey and present comfort and convenience, and shall not be held to apply to merchandise or articles intended for other persons or for sale:

PROVIDED, That in case of residents of the United States returning from abroad, all wearing apparel and other personal effects taken by them out of the United States to foreign countries shall be admitted free of duty, without regard to their value, upon their identity being established, under appropriate rules and regulations to be prescribed by the Secretary of the Treasury, but no more than one hundred dollars in value of articles purchased abroad by such residents of the United States shall be admitted free of duty upon their return."

Lest this legal phraseology should be misunderstood, the little blue folder takes it up phrase by phrase, expounding, elucidating, and explaining it until it would seem as if the law and the rules established pursuant thereto must be as plain as a pikestaff is alleged to be even to a rudimentary intellect. It is carefully pointed out that the exact number of pieces of baggage must be stated in the declaration; that after the declaration has been prepared and signed the coupon at the bottom must be detached and the declaration given to the purser; that after all his baggage has been landed upon the pier the passenger must present his coupon at the desk where an inspector will be detailed to examine the baggage; that the passenger must acknowledge in person his signature to the declaration; that all wearing apparel, jewelry, and other articles, whether used or unused, on their persons, in their clothing, or in their baggage, which have been obtained abroad by purchase or otherwise, with the foreign value or cost, must be declared; that all wearing apparel, jewelry, or other articles taken out of the United States which have been remodeled or improved while abroad so as to increase their value, must be declared, the statement to include the cost of such improvement. But for fear this twice repeated explanation that "wearing" foreign bought articles does not exempt them, it is explained all over again for the third time in a separate paragraph, in these words:

"Use does not exempt from duty wearing apparel or other articles obtained abroad, but such articles will be appraised at their present value."

All cigars and cigarettes must be declared and are not included in the one hundred dollars exemption. But each passenger over eighteen years of age is entitled to bring in free of duty and internal revenue tax either fifty cigars or three hundred cigarettes for his or her *bona fide* personal consumption. Smokers who have had to exist for a few months upon European made cigars will see in this a deliberate attempt on the part of the United States Government to affront them, for no one in his right mind would smoke European cigars if he could get any others.

Household goods of persons from foreign countries are admitted free of duty if actually used abroad by them not less than one year and if they are not intended for any other person or for sale.

All articles intended for other persons, for use in business, theatrical apparel, properties and sceneries, must be declared by passengers, whether foreigners or residents. Duties can not be paid by check or draft but only in currency. Passengers are also warned that to offer or give gratuities or bribes to customs officials is a violation of law. They are also explicitly invited to report any discourtesy or incivility on the part of the customs officers to the deputy collector or deputy surveyor at the pier; or if that doesn't work, to go to the custom house; or if that isn't satisfactory to go straight to the Secretary of the Treasury.

Great care is exercised in the distribution of the declarations and the little blue folders on shipboard. They are handed to each passenger personally and his attention is directed to them by word of mouth. If he fails to turn in his declara-

THE EXAMINATION HAS NO TERRORS FOR THE HONEST PASSENGER.

tion to the purser as requested, he is reminded of his neglect. The purser must turn over a baggage declaration for every passenger to the customs officers who board the ship at quarantine. Being numbered, every blank, including those accidentally spoiled, has to be accounted for.

All this seems plain enough, doesn't it? Yet a young woman from Chicago who arrived on the Oceanic last October included in her declaration only $920 worth of gowns and jewels purchased abroad, while the inspector found a great deal more. She was taken before Deputy Surveyor O'Connor to explain.

"Did you read the printed regulations for travelers distributed on the ship?" she was asked.

"Oh, yes! but I didn't pay any attention to them."

"Did you read the warning that failure to declare dutiable articles rendered the articles liable to seizure and you to arrest, fine, and imprisonment?"

"Why, yes, I read that, but really I didn't take it seriously."

After the usual exemption had been disallowed and she had been obliged to pay $1,800 in duties and penalties it is said the young Chicagoan took the law much more seriously. So, also, did a Brooklyn girl returning from Paris last October. In addition to the regulation warnings her father had written to her to be careful to include everything dutiable in her declaration. Yet she declared but three gowns at $364, omitting seven others worth $523. That omission cost her father $836. A superior young gentleman from Philadelphia who merely wrote "dutiable goods" across his declaration and then turned it in also took the law seriously after a very bad quarter of an hour with the deputy surveyor.

The inspectors who board the ship at quarantine do not make the examinations but merely see that the declarations are duly filled out and turn them over to the supervisor in charge at the pier. Incidentally they saunter through the deserted staterooms collecting empty jewel boxes, labels hastily ripped from foreign-made garments, scraps of paper, and other rubbish that any ragpicker would scorn, but which very frequently proves to be worth a good many thousands of dollars to the Government, for such things often turn out to be clues to attempts at smuggling.

Upon disembarking the passenger finds lined up and waiting for duty one inspector for each five first-class, and one for each ten second-class, passengers. There are also a couple of desks for each class in charge of uniformed men. Among those present, but not in uniform, are a number of customs detectives who have ways of their own of finding any dutiable articles that may happen to escape the regular inspectors. At regular intervals along the walls is a letter of the alphabet. The passenger takes up his stand in the space corresponding to the first letter of his name to wait for his baggage. When it is all assembled he goes to a desk, and presents the numbered coupon he tore from his declaration. The latter is fished from the pile, the inspector at the head of the waiting line is called to escort the passenger to another desk where the latter is shown his declaration and asked if the signature is his own. Then comes the examination.

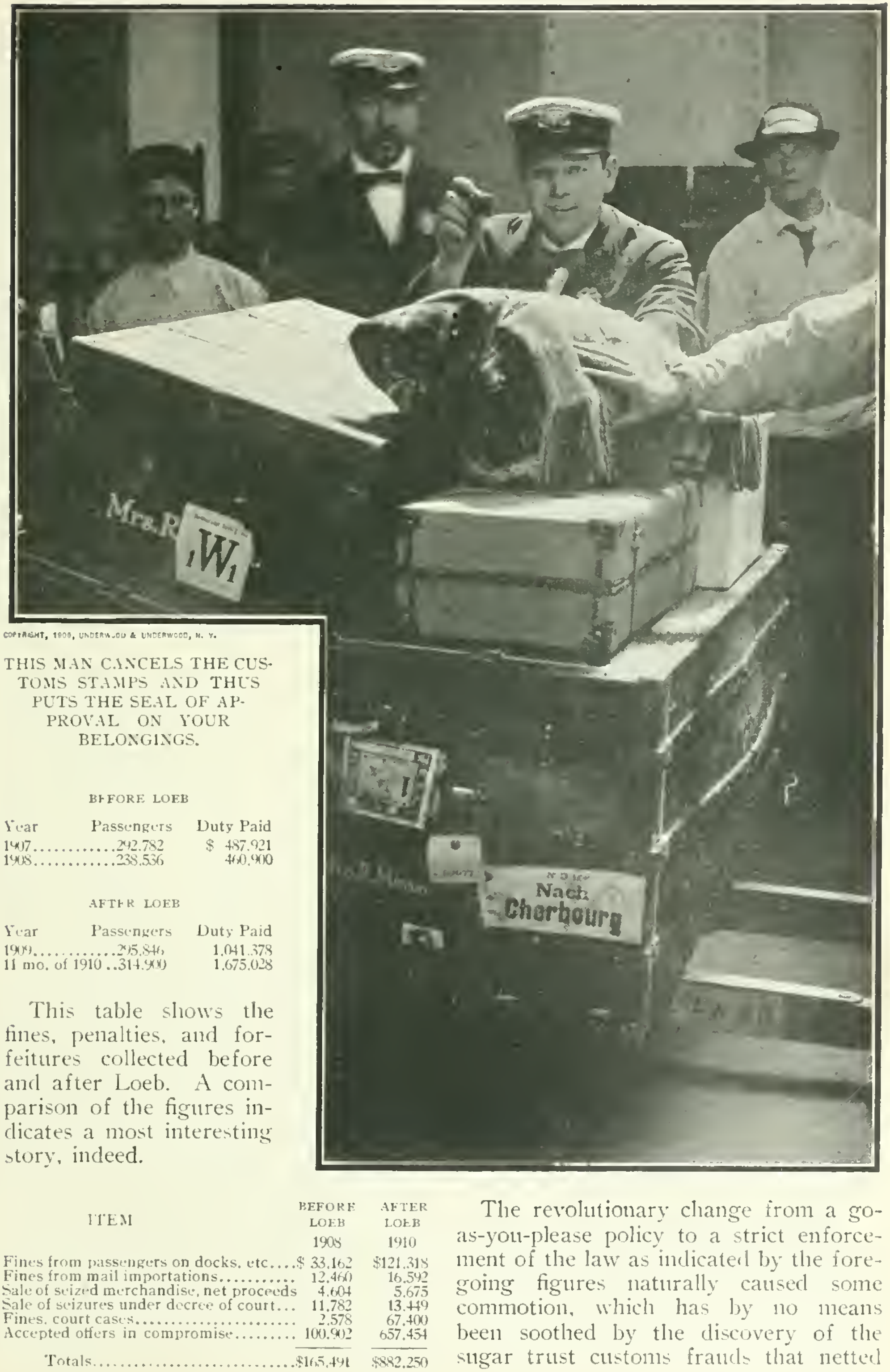
Such heart-rending pictures have been drawn by newspapers of a certain type of the "sufferings" of delicately nurtured ladies undergoing the tortures of the examination, alleged to be aggravated by the boorishness and brutality of the uniformed fiends who perpetrate it, that it seems a pity to spoil the illusion. But the unpicturesque truth is that all such stories are ordinary lies.

No man who does not know how to conduct himself decently can get a job in the customs service. Furthermore, he can not begin work as an inspector until he has graduated with credit from a two months' course in a school of deportment maintained in the custom house. The first and greatest lesson he is taught there is that he must be a gentleman, not part of the time, but all the time. His next lesson teaches him how to handle costly laces and dainty lingerie. He has to practice on real trunks full of things that travelers ordinarily have in their baggage until he is letter perfect. Then he is permitted to try his hand on immigrants' baggage at Ellis Island. From there he is advanced to second-class baggage arriving on the minor lines. Not until he has become proficient is he allowed to examine baggage at the piers of the important lines. There he is closely watched, and if he does not do his work properly he loses his job. If he shows up with dirty hands or unkempt clothing, unshaven or untidy, back home he goes, losing his day's pay. If he is impertinent or accepts bribes something unpleasant happens to him.

No, the passenger who makes out his baggage declaration honestly and correctly never has any trouble getting through the custom house. The examination is as brief and simple as is compatible with a proper performance of duty.

The inspectors must first of all be alert and intelligent, and intelligent men are not the sort who are either rough or discourteous. Indeed the worst boor could scarce be discourteous to most of the American women who are returning home. Inspectors, after all, are human beings.

There is a reason for the sensational yarns circulated about the customs examination at New York, and this reason is best expressed in the four letters—LOEB. The explanation is to be found in these little tables showing the New York Custom House before and after taking William Loeb, Jr., as Collector of the Port.



THIS MAN CANCELS THE CUSTOMS STAMPS AND THUS PUTS THE SEAL OF APPROVAL ON YOUR BELONGINGS.

BEFORE LOEB

Year	Passengers	Duty Paid
1907	292.782	$ 487.921
1908	238.536	460.900

AFTER LOEB

Year	Passengers	Duty Paid
1909	295.846	1.041.378
11 mo. of 1910	314.900	1.675.028

This table shows the fines, penalties, and forfeitures collected before and after Loeb. A comparison of the figures indicates a most interesting story, indeed.

ITEM	BEFORE LOEB 1908	AFTER LOEB 1910
Fines from passengers on docks, etc.	$ 33.162	$121.318
Fines from mail importations	12.460	16.592
Sale of seized merchandise, net proceeds	4.604	5.675
Sale of seizures under decree of court	11.782	13.449
Fines, court cases	2.578	67.400
Accepted offers in compromise	100.902	657.454
Totals	$165.491	$882.250

The revolutionary change from a go-as-you-please policy to a strict enforcement of the law as indicated by the foregoing figures naturally caused some commotion, which has by no means been soothed by the discovery of the sugar trust customs frauds that netted

The Stewards Look After the Steamer Trunks in the State Rooms.

ably they would not have paid duty if hobble skirts had not been in vogue last fall. It is hard enough to walk in a hobble skirt, as any one who has tried it can testify. But when in addition to hobble skirts one's freedom of movement is still further hampered by a huge muff drawn up over each l——well, the inspectors lined up on the pier actually laughed out loud when the Western ladies essayed the passage of the gang plank. The Brutes!

Not to linger over the harrowing details, the two westerners were politely invited back to their staterooms by some women inspectors. When it was all over those muffs had cost their owners just four times what they could have been purchased for in the home market.

This unfortunate affair of the sable muffs was not the only attempt on record to evade the payment of duties by guileful passengers. Bless your heart, no! Why, in six weeks last fall the customs inspectors gathered in five hundred thousand dollars' worth of jewelry from amateur smugglers, more than half of whom were women.

the Government three millions, by the indictment of a member of the sacred executive committee of Tammany Hall, and the arrest and indictment of some of the biggest art dealers on Fifth Avenue, New York, for swindling the Government out of millions in duties, not to mention hosts of smaller smugglers. Upon the whole, there is no wonder the custom house and everybody connected with it is very unpopular just now in certain circles having some degree of skill in vocalizing their unhappiness.

Two ladies from the West now cherish particularly uncomplimentary opinions of the New York customs officers. Each bought two splendid sable muffs in Europe last summer, and it did seem a pity to have to pay duty on them. Prob-

Contemplating the matter calmly it seems incredible that any one should try to smuggle since the custom house has been reorganized. Detection is about as certain as anything can be in this uncertain world, and as those who are caught are always caught literally with the goods on, there is nothing for it but to take one's medicine. It is only fair to say, however, that the customs officers are as charitable to the amateur smugglers as is consistent with their duty. When they find a trunk full of dutiable articles not declared they generally give the owner a chance to amend his declaration. Only in the more flagrant cases do they shut the gates of mercy on the culprit, and, to change the figure, exact the pound of flesh.

Attempts at smuggling seem still more foolish when it is remembered that all important sales of jewelry abroad are registered and that the books are open to the inspection of representatives of this Government. Jewelers in this country, who are naturally affected by smuggling, have their own agents on the lookout and they pay well for information leading to the arrest and conviction of smugglers. Added to all this, hosts of honest Americans seem to find peculiar pleasure in giving information of prospective attempts at smuggling. Finally, there is a stereotyped list of tricks and schemes outside of which the smuggler never ventures. As the customs officers have these by heart, they never make any mistakes. In nine cases out of ten they know in advance just whom to look out for, and so they go straight for their quarry with unerring precision.

In view of all this the kind of people caught in the customs net is certainly amazing. One of them was a former governor of New Hampshire. When he arrived on the *Lusitania* last May he declared nothing but one fur coat valued at $800. When his baggage was examined dutiable articles worth several thousand dollars were found. He was given an opportunity to amend his declaration and thus to escape with only the payment of duties. As he refused he was arrested and indicted by the Federal Grand Jury. He pleaded guilty when arraigned and was fined $2,000. Besides this he had to pay $3,400 as the foreign value of the goods and on top of all this was piled the regular duty.

Nor was this an exceptional case. A prominent doctor from Chicago whose declaration listed but $300 worth of dutiable goods seemed rather bulky for a fashionably dressed man when he arrived on the *Kronprinzessin Cecilie* last September. Tim Donohue, a customs sleuth, struck so many knobs and protuberances when he stumbled against the doctor that the latter was invited back to his stateroom. There the searchers found rings, brooches, chains, watches, *et cetera*, enough to stock a jewelry store. The whole outfit was seized and sold.

On the same ship was a wealthy carpet manufacturer of Yonkers. He, at least, should have been familiar with the tariff, because it was the tariff that made him rich. And yet he wrote in his declaration that his six trunks contained nothing dutiable. This statement he repeated on the dock. Yet an inspector found two thousand dollars' worth of dutiable articles there. This mistake cost the carpet manufacturer a painful day at the Custom House and $4,960 in cash. Yet he counted himself lucky because he escaped criminal prosecution.

Earlier in the year a society matron from Poughkeepsie, whose husband is a rich manufacturer, arriving from Europe with her daughter and the latter's chaperon declared but $385 in dutiable articles in the party's seven trunks and five pieces of hand baggage. As the customs officers knew she had purchased a very fine necklace in Paris they asked her three several times to amend her declaration. When she refused they asked her in plain words for the necklace. Not until she was threatened with arrest did she finally drag it from its hiding place in her hat. She tore up a letter from the jewelers confirming the sale and scattered the pieces on the floor; but the inspectors gathered up the pieces and put them together. Her husband had a great deal to say about the brutality of the customs examination until the necklace and the letter were produced. It cost him a fine of $5,000 and the value of the necklace plus 60 per cent duty, making a total of $17,000.

A society leader from a Boston suburb who tried to smuggle in a $30,000 necklace in 1909, was tried and convicted and fined $5,000. She also had to pay the government the cost of the necklace with duty added, making the total $39,000. Adding the original cost of the necklace and lawyers' fees, court costs, and other expenses, that necklace represents a grand total outlay of $75,000.

AN ENGINEER MADE RECORDS OF THE TEST FROM THE INTERIOR OF A FIREBOX CHAINED TO A FLAT CAR A SHORT DISTANCE FROM THE BOILER.

BOILER THAT CAN'T BLOW UP

By

M. M. HUNTING

IT is only within a comparatively short time that the public has been aroused to the fact that the steam boiler is one of the most prolific sources of destruction with which we have to deal. Lack of knowledge on the part of many intrusted with its care, and oftentimes willful neglect are the causes of a large per cent of the accidents, and because of this fact engineers have given up warning the public and have set about "making the thing foolproof."

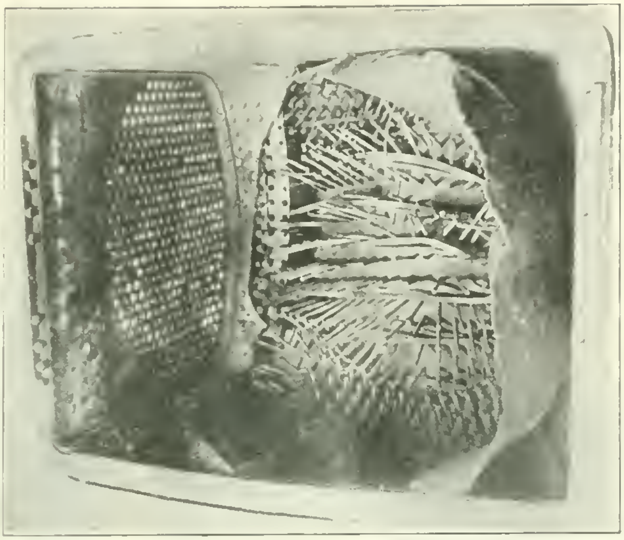
One feels that some effort along this line is due when it is realized that to all intents and purposes, the construction of the common steam boiler is the same today that it was seventy-five years ago.

Probably the most progressive step in this direction recently taken has been by the officials of the Atchison, Topeka & Santa Fe Railway, who have begun a series of experiments with what is known as the Jacobs-Shupert Firebox.

The most common cause for boiler explosion is low water. The gauges may become stopped so that they do not properly indicate the height of the water in the boiler; the proper amount of water may not be fed to the boiler because of the clogging of the pipes; or, through neglect, the water is allowed to fall below the level of the roof of the firebox, or crownsheet, as it is more properly called. When this occurs with a hot fire beneath, the crownsheet becomes red hot and consequently soft, and unable to retain the pressure of steam within.

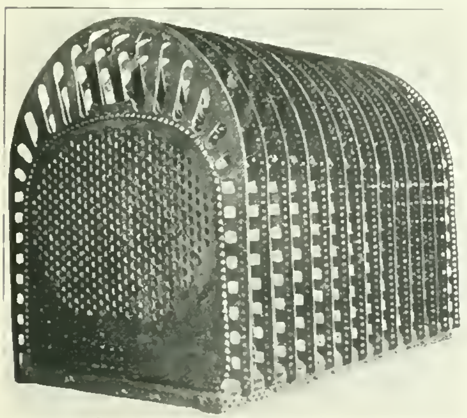
The result is a terrific explosion which sometimes carries the boiler a long distance from the scene, leaving death and destruction in its wake. The scattered fire is as much a menace to life and property as the flying débris, and with the danger of falling walls added, a more dreadful catastrophe can hardly be imagined.

With the usual form of boiler construction this is almost unavoidable. The crownsheet is usually supported from the roof of the boiler by a large number of iron rods called "stay bolts," riveted on the inside of the firebox where their heads are constantly subjected to the most intense heat. When red heat is attained in the crownsheet through lack of water, the heads of the stay bolts are the first parts to be affected, and under pressure from within, pull through and leave the sheets unsupported and at the mercy of the terrific stored energy.



THE FIREBOX OF AN ORDINARY BOILER AFTER EXPLOSION FROM LACK OF WATER.
The crownsheet has been torn away, leaving the stay bolts.

As far as the external appearance is concerned the Jacobs-Shupert firebox does not differ greatly from others, the unique features being within the boiler itself. One need only to glance at the photographs of the partly constructed firebox to realize the immensely superior strength it possesses over the old type. The top and sides instead of being made of single sheets as in the old design are constructed in **U** shaped sections a few inches in width, formed to the arch of the box, riveted together and reinforced by vertical plates running in retreat from the fire. The plates are perforated with large holes to permit the free circulation of water and steam.



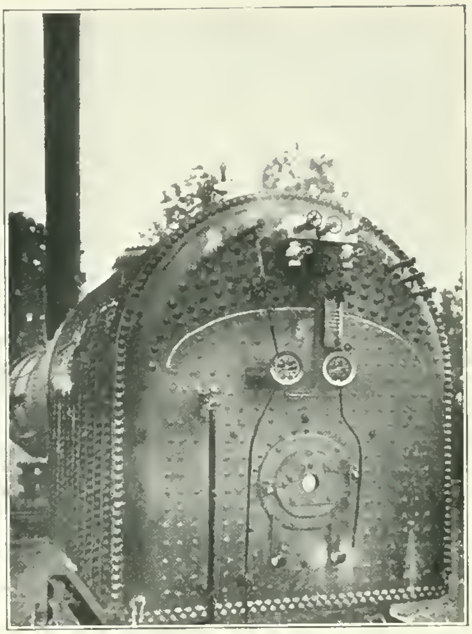
FIREBOX PARTLY CONSTRUCTED, SHOWING SECTIONS AND REINFORCING PLATES.

It is hardly necessary to state that this construction will withstand much more overheating than the common type of boiler.

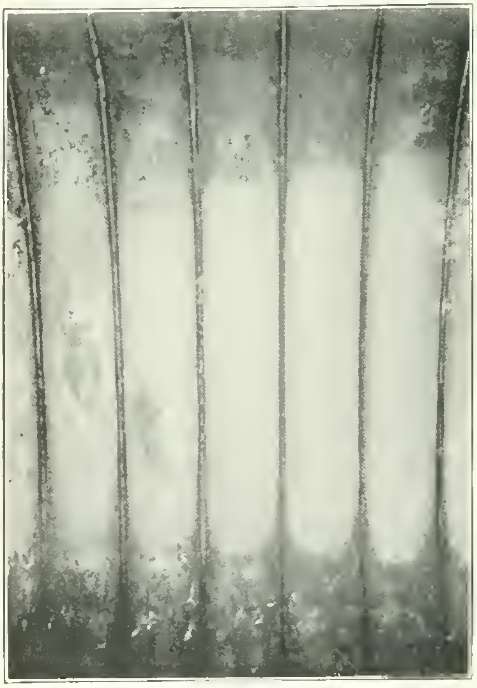
What we are all most interested to know is whether our lives will be safer on a train behind an engine equipped with such a boiler, and so a brief description of the test to which it was recently subjected may be of interest.

On September 26th last, in the presence of many engineers from various cities and two representatives of the Interstate Commerce Commission, the above mentioned railway officials subjected a boiler equipped with a firebox of this design to a low-water test. This boiler was taken from one of the company's highest grade locomotives and set up in a large vacant tract of land in the neighborhood of their shops. The firebox was equipped to burn oil. The boiler was fitted with two steam gauges, one to verify the other, and two water glasses, one to show the height of the water above the crownsheet, the other, the distance it might fall below during the test. A pump was also set up at a distance to supply water during the experiment.

When all was in readiness fire was started under the boiler and the steam pressure allowed to run up to 225 pounds. At this point three safety valves, with which the boiler was equipped, began blowing off and the water fell lower and lower in the boiler until it reached the top of the crownsheet, the location of which was indicated by a white line painted upon the front of the firebox. The fire was permitted to burn until the water glass indicated that the water had



NEAR VIEW OF THE BOILER DURING THE TEST.



THE INTERIOR OF THE FIREBOX AFTER THE EXPERIMENT, SHOWING THE EFFECTS OF THE INTENSE HEAT TO WHICH IT WAS SUBJECTED.

fallen about five inches below the crownsheet and a temperature of 1,125 degrees in the firebox was recorded by a pyrometer. In other words, the crownsheet had attained a good working heat. At this point the fire was shut off and cold water turned in the boiler until the steam pressure was somewhat reduced. In spite of this terrific treatment, and the fact that at the time the crownsheet was red hot, the boiler withheld a pressure of 230 pounds to the square inch, and showed no ill effects further than a few trifling leaks due to expansion of the plates under the intense heat applied during the test.

The pressure gauges, height of water, and records of temperature were observed by an engineer in a steel firebox chained to a flat car a short distance from the boiler. The remainder of the audience witnessed the proceedings through a telescope from a safe distance.

Statistics of the test are of little interest, but the trial is the most severe that has ever been given any boiler and one which the common type could not have withstood. It further demonstrates that a boiler so equipped could not, under the common conditions which cause explosions, create a disaster such as we so often read of in the daily papers. Because of the reinforcement of the firebox, little or no damage could result even if a blowout should take place in one of the sections, as it would be so small as to amount practically to the opening of a valve for the relief of the unusual pressure.

It is greatly to be hoped, if this form of boiler construction solves the explosion problem, that it may be adopted throughout the world, wherever boilers are in use.

DAMMING THE MISSISSIPPI

By

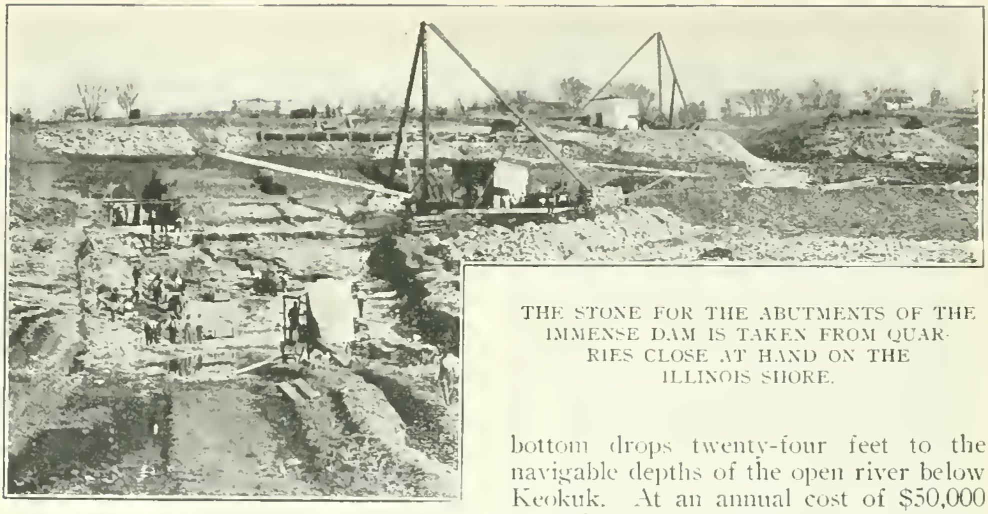
F. G. MOORHEAD

NOT far from the spot where Jim Bludsoe ran the Prairie Belle aground and "held her nozzle agin the bank till the last galoot was ashore," a mile-wide dam is being built which will completely change the contour and topography of the Mississippi River and the historic land thereabouts. Incidentally a steamboat canal, nine miles long, built forty years ago at a cost of $8,000,000, is to be completely drowned out, with not a stick or a stone left to show where it once made possible the passage of the treacherous Des Moines rapids.

The sons of the men who dammed the Mississippi a generation ago are now busily engaged in damming it. The work will occupy two years more, but already a thousand men are working, beaver like, to throw across the mighty river a structure of cement and stone which shall hold the rushing waters in check and subserviently render up to its master 250,000 horse-power with which to run the factories, mills, and workshops of the very heart of the grain belt. Already, on both sides of the Mississippi, the dam has begun to assume shape. Two gangs of men are throwing out abutments and creeping toward each other across a watery path. Twenty million dollars will be spent before the two gangs meet, but the investment is considered a good one by some of the shrewdest financiers of the country.

For over sixty years Keokuk has dreamed of harnessing the turbulent

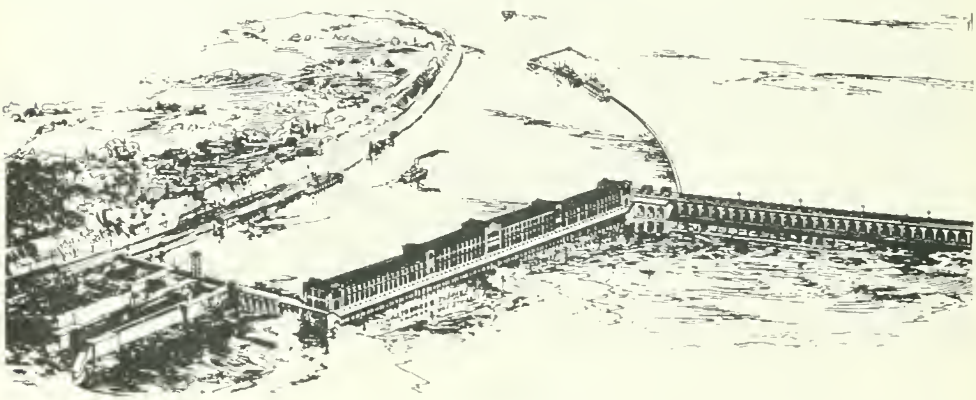
BUNK HOUSES OF THE WORKMEN ON THE IOWA SHORE.
Above, on the high bluffs, is the exclusive residence district of Keokuk, overlooking the dam.



THE STONE FOR THE ABUTMENTS OF THE IMMENSE DAM IS TAKEN FROM QUARRIES CLOSE AT HAND ON THE ILLINOIS SHORE.

waters of the Mississippi and making the Des Moines rapids do the work of man. As long ago as 1848 the Mississippi River Improvement Association was formed, with a capital of $1,000,000, its objects being to improve navigation and harness the water power that might be developed in the process. The Civil War passed and still the project remained a dream. The United States government went a long ways toward shattering the dream for all time by building a nine-mile canal alongside of the perilous rapids where many a steamboat and many a raft had met demolition, establishing three locks for the purpose of raising and lowering craft from one level to another. Flowing through the high, limestone gorges on either side, step by step the solid lime rock of the river's bottom drops twenty-four feet to the navigable depths of the open river below Keokuk. At an annual cost of $50,000 the government has maintained this canal for forty years. Within the next two years it will have disappeared under twenty feet of water, part of the bed of a new inland lake forty miles long and from one to five miles wide. For the dream of two-thirds of a century is being realized at last. Five years ago, after numberless disheartening failures, a bill was passed through Congress granting a franchise and the first glimmerings of a realized dream began to appear.

It was no small task to get both houses of Congress to agree on a franchise which establishes the precedent of building a dam entirely across the country's largest river. But the Keokuk boosters were shrewd. They introduced old river pilots and captains before the committees to testify that the dam would improve navigation rather than hinder it; they



GENERAL VIEW OF THE GREAT DAM AS IT

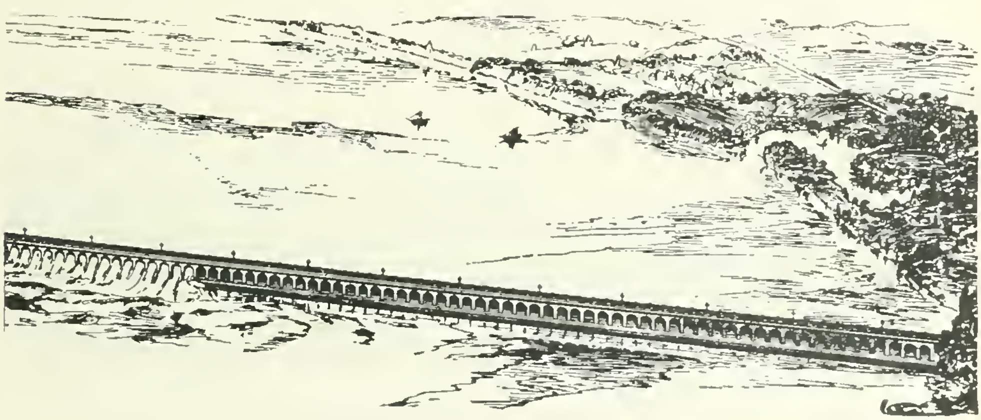
enlisted the co-operation of the army engineers and voluntarily agreed to replace the canal and its three locks with a single lock, which would answer every purpose, and the twenty-year old dry dock with a new one, and from now to the end of time to supply the power to operate the new lock and the new dry dock, absolutely free of charge. On January 27, 1905, the lower house passed the bill granting the desired franchise. On February 2, it passed the Senate and on February 9, 1905, President Roosevelt signed the bill.

Immediately there began the hunt for capital. The bill required that the work begin within five years and be completed within ten. It was not until a month or two before the five-year limit had expired that work actually began. Even then the doubters remained, crying that the limestone cliffs were being uncovered simply to keep the franchise and that the dam would never be built. But as the weeks passed and the gangs of workmen grew, from a few score to several hundred, and the approaches to the dam on the Illinois shore gradually began to show, the scoffers fled and all Keokuk joined in such a jubilation as the old Mississippi Valley has not known since the palmy days of steamboat racing. On January 8, 1910, definite announcement was made that the dam would be built. By the first of February several score of men were at work. The construction was continued uninterrupted from that time, and early in December, 1910, five hundred men started to work on the Iowa shore.

Mr. Hugh L. Cooper, the engineer in charge, has given Keokuk assurances that the work can be completed in thirty months. The first year has been one of preparation mainly, but the end of 1911 will find the dam well under way, extending out from both the Iowa and the Illinois shores, and the power house practically completed.

The project gives to the Mississippi Valley the largest water-power development in the entire country, with the single exception of the combined plants at Niagara Falls, and the largest dam in the world, with the single exception of the Assouan dam across the Nile in Egypt. There will be required in the construction 500,000 cubic yards of masonry, 500,000 barrels of cement, and 7,000 tons of steel.

The dam, including abutments, will be 4,700 feet long. It will extend from a point a little north of the center of the town of Hamilton, Illinois, due westward across the river to a point near the Iowa shore, under the bluffs at Keokuk, where the power house, 1,400 feet long, will link shore with shore. The mammoth dam will be of solid concrete, thirty-five feet wide on the bottom and about thirty feet high. The upper stream face will be vertical with a rounded top eight feet wide, the lower side ending in a curve connecting with the bottom, so that the water coming over will not fall, but slide down the face and be given a horizontal direction at the bottom of the river. The whole height is thirty-seven feet, the dam being locked into the rock bottom seven feet deep, to prevent any



WILL APPEAR WHEN COMPLETED IN 1913.

water getting underneath. Outside the power house there is already considerable depression in the rock, but the plan is to deepen and widen this depression so as to get rid of the water quickly as it passes under the power house and through the wheels.

The long power house will be divided into alleys forty-five and thirty-seven feet wide, respectively. Forty feet overhead in the alley facing the Keokuk side of the river will be thirty ton cranes, supported on the walls, for the handling of the main dynamos which are in use on the job.

Beneath the floor of the power house will be a series of forty-seven passages conducting the water to the turbines. These passages will be all formed in solid concrete, constructed so as to offer the least obstruction to the water. Each generator and turbine is arranged to be cut off by steel head-gates, which close the openings for the water, and allow them to be inspected. Heavy screens, consisting of iron bars, will stand in

BUILDING A BRIDGE TO THE ILLINOIS SHORE.
The beginning of work on the Iowa side.

the heavy machinery. In the alley nearest the river will be ten ton cranes for lifting the heavy screens guarding the entrances to the turbines and for the handling of the headgates for shutting off the water. There will be forty-seven immense generators of 4,500 horse-power each, working on a vertical shaft like the generators at Niagara. These generators will be twelve feet in diameter. On the same vertical shaft will be three different turbines, one over the other, about nine feet in diameter, all working together to drive the generator. Besides the big 4,500 horse-power generators, provision is made for three exciter generators, which are intended to furnish current to excite the magnets of front of each turbine opening, to prevent the entrance of sticks and stones, which would injure the blade of the turbines. The maximum head of water on the wheels will be at low water and will amount to thirty feet. At extreme high water the head is expected to be twenty-one feet. At high water, therefore, the plan is to use all three turbines to drive the generator, when the head is least, but the flow is abundant; at low water, when the head is large, two, or even one, of the turbines in action will be sufficient. The turbines will be made so they can be discontinued when not in use.

The dam will impound the waters until a lake will be formed which will overflow the lowlands along the Iowa and Illinois

THIS NINE-MILE CANAL, BUILT AT A COST OF $8,000,000, WILL, WITH ITS LOCKS, BE SUBMERGED TWENTY FEET BY THE BACK WATER OF THE DAM.

shores for a distance of approximately forty miles above Keokuk. Immediately adjacent to Keokuk the river is lined with high, limestone bluffs so that there will be little change in the contour thereabouts, the main alteration being the submerging of the narrow lowland shelf now occupied by the tracks of the Burlington railroad and their removal to a ledge of the bluffs or cliffs. On the Illinois shore, however, immediately adjacent to Hamilton, there will be hundreds of acres of lowlands, now annually planted to grain, which will be submerged. The Keokuk and Hamilton Water Power Company, which is building the dam, has already purchased three-fourths of the property which will be submerged and has options on practically all the rest. It is estimated that approximately $1,500,000 has been or will be paid out for riparian rights before the dam is completed.

The initial installation is expected to be 100,000 horse-power, of which 60,000 has already been contracted for by the Union Electric Light and Power, the Laclede Gas, and the United Railways companies of St. Louis, leaving only 40,000 to be disposed of in and around Keokuk. When entirely completed the project calls for 250,000 horse-power, although it is expected that 200,000 will be nearer the amount developed for some years to come. St. Louis, 167 miles distant, is in the market for a large share of the power, which can be sold there at $18 per horse-power per year. Steam power within 250 miles of Keokuk now averages about $55 a horse-power per year, so that the saving from the electric power is going to be great.

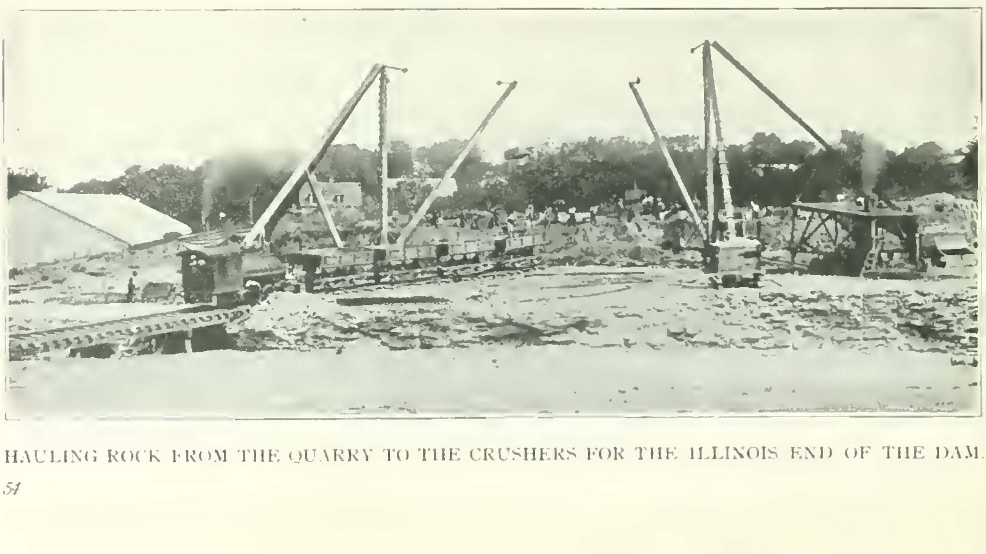
But Keokuk is not expecting to build this immense engineering project and then transmit the power to other cities, to grow at its expense. Known in the old historic trail and waterways days as the Gate City of the West, Keokuk lies at the convergence of three great states: Iowa—which leads the nation in the production of oats—Illinois—which leads in corn—and Missouri—which leads in hogs. Iowa has never figured very prominently as a manufacturing state, being content to rest on its laurels as an agricultural state. The same is true of Missouri and western Illinois. But the awakening has come and now these three states are looking forward to a time in the near future when their home-grown

THREE LOCKS, SIMILAR TO THIS, IN OPERATION FORTY YEARS, WILL BE COMPLETELY SUBMERGED.

THE BEGINNING OF THE DAM ON THE ILLINOIS SHORE A FEW MONTHS AGO.

raw materials shall be converted into the finished products of commerce and when they shall dominate the manufacturing world as they long have the agricultural. Iowa has numerous cereal mills, one of the largest being located in Keokuk. But its farmers have been obliged to send to Ohio and Indiana for their implements and machines. With cheap power available in immense quantities and with the Mississippi flowing unchecked at its feet, furnishing a cheap means of transportation to the north and south and east, Keokuk looks forward to the day when factories will line the bluffs and the city become a rival to Niagara Falls in very truth. Already plans are being laid to divert to Keokuk the shipments of bauxite, the clay used in the manufacture of aluminum, from Niagara Falls, where it is shipped by rail from Arkansas. Keokuk argues, and with apparent reason, that bauxite might far better come to a cheap water power by a cheap water route. Negotiations are also in progress for the establishment of a factory for the conversion of the limestone, with which the community abounds, into commercial fertilizer by electrolysis.

The man who is building the dam,



HAULING ROCK FROM THE QUARRY TO THE CRUSHERS FOR THE ILLINOIS END OF THE DAM.

Mr. Hugh L. Cooper, engineered the work on the wing dam in the Horseshoe rapids of Niagara, building out 800 feet into a millrace moving seventeen miles an hour and ranging from twenty-two to twenty-six feet in depth. Another feat of Mr. Cooper's was putting in the McCall Ferry dam in the Susquehanna river, 3,100 feet long, sixty feet high, and developing 135,000 water-power. The Keokuk dam presents no new or difficult engineering problems, immense as it is. One of the things which makes the herculean task easier is the fact that the building materials exist in almost limitless quantity right at hand. The Mississippi is lined for more miles than any man knows with bed upon bed of limestone. It is necessary only to uncover the surface strata of dirt and blast the rock into movable chunks for the huge crushers. Sand, also, is there in limitless quantity. Before the work was many months under way two rock crushers were at work, each of them capable of crushing 130 tons an hour into three-inch stone. A sand pump brought 15,000 yards of sand from the river bottom every ten hours. The cement fixers fell on this material and fed it into the mixing machines, capable of producing 1,200 cubic yards a day. With the concrete ready for the piers and abutments, the carriers, shovels, and miscellaneous equipment went chugging back and forth over the improvised track and the great dam began to appear; slowly, it is true, but surely, which is the main thing. After a year's work on the Illinois shore, a new gang of men was brought over to the Iowa shore. The cement storehouse on the Illinois shore, holding 10,000 barrels, gave up 2,000 barrels of its stock daily, while train loads of new cement kept the stock replenished day after day. During the first year of construction the daily demand was for ten carloads of cement and three carloads of coal.

A Sea Song

Oh, for a soft and gentle wind!
  I heard a fair one cry;
But give to me the snoring breeze
  And white waves heaving high.
And white waves heaving high, my boys!
  The good ship tight and free;
The world of waters is our home,
  And merry men are we.
There's tempest in yon horned moon,
  And lightning in yon cloud;
And hark the music, mariners!
  The wind is piping loud;
The wind is piping loud, my boys,
  The lightning flashing free
While the hollow oak our palace is
  Our heritage the sea.

—Allan Cunningham.

RAILWAY PROBLEM OF TOMORROW

By

LAURISTON BULLARD

AMERICAN electrical engineers must study in the immediate future as vast and vital a railway problem as any which has taxed the abilities of experts in the whole history of the development of the transportation system of the United States. "Electrification is bound to come"—that is the well-considered opinion of the president of one of the great railroad systems of the country, a man who in a statesmanlike way is leading the railway development of the time. Indeed, electrification is coming and it is coming fast. But the fact that various railways are employing various systems of electrification brings a danger and with the danger a problem, a danger which the men in control of the roads must very soon consider, and a problem which they must hand over to the very best engineers for solution.

There are in the world today about 1,300 miles of railroads upon which electricity is used for heavy service. Far the greater part of this mileage is in the United States. In addition there are 435 miles of electric elevated and subway lines in the cities of Boston, Chicago, Philadelphia, and New York. But the systems of electrification which are used upon these lines are not uniform.

For example, the New York, New Haven and Hartford has twenty-one

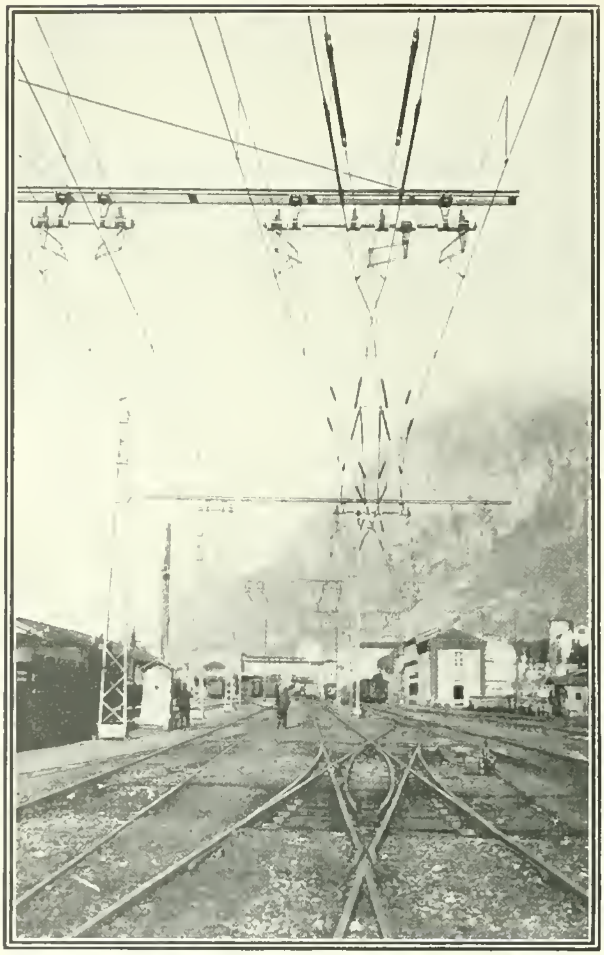
DOUBLE ELECTRIC LOCOMOTIVE TRAIN OF FOURTEEN PASSENGER COACHES.
Single-phase electrification overhead is the triangular or older form of construction.

ELECTRIC LOCOMOTIVE DRAWING "TWENTIETH CENTURY LIMITED."

miles of its main lines, making one hundred miles of single track, electrified by what is called the single-phase system. But the New York Central has thirty-three miles of four-tracked line, or 132 miles of single track, electrified by what is known as the continuous or direct current system. Now these two roads use the same depot in New York City. Practically all the New England railway service into New York City is over the four tracks of the New Haven line to a point twelve miles out from the Grand Central station, where the trains pass at full speed to the tracks of the New York Central over which they complete their run to the terminal. For the twenty-one miles of the run on the New Haven tracks the trains are operated from overhead trolley wires by alternating current taken aboard the locomotive at 11,000 volts. For the twelve miles on the New York Central tracks they are operated from the third rail by direct current at 650 volts. When the New Haven decided to electrify that twenty-one miles of its own lines it was face to face with the restriction imposed by those twelve miles of New York Central lines. Yet it decided in favor of the alternating current in spite of the twelve miles over which it would have only the direct current available.

The Erie Railway has thirty-four miles of single-phase electrification. The Pennsylvania has seventy-five miles of the direct current system. The West Shore has 106 miles of continuous current electrification, the Long Island Railroad has 125 miles, the West Jersey and Seashore 150 miles, and the Baltimore and Ohio seven miles. On the other hand, the Grand Trunk has twelve miles of the other system, the Colorado Southern forty-six miles, and the Baltimore and Annapolis Shortline thirty miles. There is a greater diversity in Europe. In Italy there is a considerable mileage operated by what is known as the three-phase system. The same

A PENNSYLVANIA ELECTRIC LOCOMOTIVE WITH TRAIN OF ALL-STEEL CARS FOR USE IN THE HUDSON RIVER TUNNEL.



OVERHEAD SYSTEM OF CONSTRUCTION ON AN ITALIAN RAILROAD.

system is used in the Simplon Tunnel and on the Gergal Santa Fe in Spain. The other two systems are used extensively in the countries of Europe. The three-phase system is used for a tunnel on the Great Northern line in the United States.

Now it is the opinion of those competent to form opinions upon so difficult a subject that what has been done in a small way by these and other lines will in time be done by the railroads throughout the country, and over long reaches of their lines, if not over their entire systems. In time these roads will face each other at meeting points in hundreds of places. Then will come the rub, the inconvenience and the outlay. If railroads with different systems of electrification are a thousand miles, or a hundred miles, or ten miles apart, it makes no difference whether they have their contact conductors in the same position or whether they use an electric current of the same character. But when they come together it will cost much money and cause manifold delays and vexations if their systems are unlike. It is here that the danger and the problem of the future emerge.

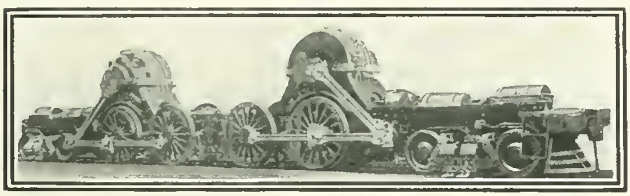
There was an analogous problem to be solved by the railroads thirty years ago. Its solution entailed financial burdens which lay upon them very heavily for many years. In 1878 in this country there were no less than twelve different gauges of railroad tracks, the standard gauge of four feet eight and one-half inches, and eleven others. By that time it had become evident that uniformity of gauge in the United States and Canada was absolutely necessary. In the early days of railroading the differences of gauge were of no moment. No one dreamed of an interchange of traffic, of using the engines and cars of one railroad upon the lines of another. Some men argued that it was an advantage to keep to a gauge that would prevent the engines and cars of a connecting line from running on its tracks. In some cases through passengers were kept in their cars while the trucks under the coaches were changed, and thus they went on to their destinations without change, although they ran over tracks of five feet, five feet six inches, and six feet gauges in succession. In time, in spite of the immense expense entailed by the change of gauge and of equipment, all the lines made their tracks conform to the present standard gauge.

This experience of thirty years ago explains the view of electrification that is held by the far-sighted and broad-

Arrangement of Motors Over Driving Axles.
For the single-phase and direct current locomotive—passenger and freight service—on the New York, New Haven and Hartford Railroad.

minded railroad men of today. They fear that each road will consider its plans with reference only to its own needs, that the road will treat its project as an isolated case. They desire that the roads shall take into consideration in addition the electrification of railroads in general, thus avoiding at some time in the future an expensive experience analogous to that involved in the gauge problem of thirty years ago. The problem of today, in view of the strides electrification is certain to make in the near future, is that involved in the selection of a general system of electrification, a system which shall be in its domain what the standard gauge has been in another department of railroading. Determine upon a standard system, which will make possible a complete interchange of traffic, and which will admit of the greatest extension of electrification, and in the future vast expense, and delay, and vexatious difficulties will be avoided.

The three systems of electrification now in use have their respective advantages. Each has its own method of conveying the power from the generating station to the locomotive, and each has its own type of motor. The three-phase system in successful use in Italy and Switzerland has been before the world for a number of years. The government of Italy is at present installing upon a heavy-grade line out of Genoa a service for which thirty-five locomotives rated at 2,000 horse-power are now being built. This is the system



The Pennsylvania's Articulator Locomotive for the New York Tunnel Service.
The underframe, motors, and driving mechanism are here shown.

which is used in the Cascade tunnel by the Great Northern. The alternating current is used with two overhead trolley wires.

The third rail system is now being extensively used for direct current. There are no overhead wires and in place of the trolley a third rail is used from which current is collected by a shoe sliding upon it. At present the general practice, except on very short lines, is to produce or generate alternating current at the power house and change this to direct current of proper voltage at sub-stations distributed along the line. The sub-station equipment includes transformers, converters or motor generators, and switchboard apparatus. This system has a large loss in power between the power house and car and the cost of equipment is quite high.

The single-phase system uses an alternating current and a single overhead wire. Just now the eyes of the railroad world are upon the daring innovation which has been put into use by the New York, New Haven and Hartford, which line has made the most important installation of this system thus far undertaken.

Each of these three systems has its own type of motor with important differences in speed performances. The direct-current motor is a sort of automaton,

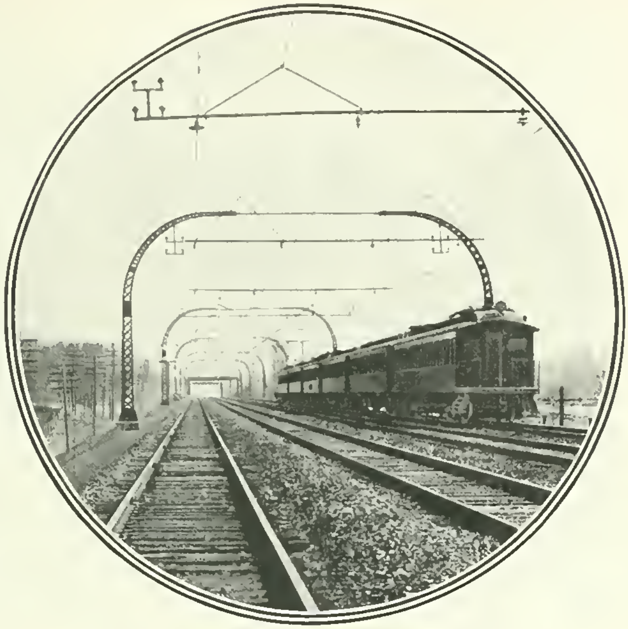
TYPICAL SECTION, SHOWING THIRD RAIL TRANSMISSION LINE, AND SIGNAL BRIDGE OF ELECTRIFIED PORTION OF THE NEW YORK CENTRAL AND HUDSON RIVER RAILROAD.

that is, it automatically adjusts its speed to its load. If the weight of the train is increased, or the grade becomes steeper, the speed slows in proportion. If the load and the grade remain constant the speed will not vary unless the voltage applied to the motor is increased. But the system of current supply implies a fixed voltage, and therefore even in emergencies it would be impossible to get a speed much above that for which the motor was constructed. On the other hand, the speed may be cut in half or it may be quartered. This is done by connecting the motors in series, dividing the pressure between two or between four motors, and by the use of electrical resistance. There are other practical objections to this system.

The motor of the three-phase system is inherently a constant-speed machine. With a light load or a heavy load it runs at the same rate of speed. Upgrade or on a level track it makes approximately the same speed also. But the high power required to climb the grade may be several times that needed on the level. On the other hand, however, the motor makes no greater speed on the level track than on an ascent. There are various devices by which lower speeds can be secured, all of them involving complications and losses. In no way can the speed be more than a trifle higher with a light load than with a heavy train. The motors are comparatively simple in construction, and when on a down grade they may return current to the line, a valuable thing among the mountains.

The speed characteristics of the single-phase series motor are similar to those of the direct-current motor. The speed at a given voltage is more or less as the load is lighter or heavier. But this motor has the advantage over others that by a simple controller its speed may be greatly varied according to conditions. Many voltages lower than the normal may be provided for lower speeds and various higher voltages to produce speeds above the normal. The steam locomotive has its throttle lever, and the single-phase electric its control lever, and in both cases the lever may be placed in any one of many notches to keep the required speed. The current comes aboard the locomotive at a voltage of 11,000 volts on the New Haven lines. But the motors do not use the current at such a high voltage. It is reduced by the transformers which are installed in the locomotives. As will be noted farther on, this means the elimination of the substation, a bold departure, with many advantages. It is the possibility of adjustment, of setting the lever for different speeds, which is a very valuable feature of this system. The limit of endurance with the vast supply of energy thus made available is determined by the safe temperature of the motor. In the steam locomotive ability to maintain speed with heavy loads depended upon the capacity of the boiler.

When it comes to the expense consideration the differences in these three systems is a matter not of motors primarily or of power-houses, but of the transmission of the power from the latter to the former. In the power-houses almost always the current that is generated is the alternating and at high tension. It is cheaper to transmit it even when for use it has to be converted into direct current.



Train for Suburban Service on the New Haven Line.
The new form of overhead construction is clearly shown.

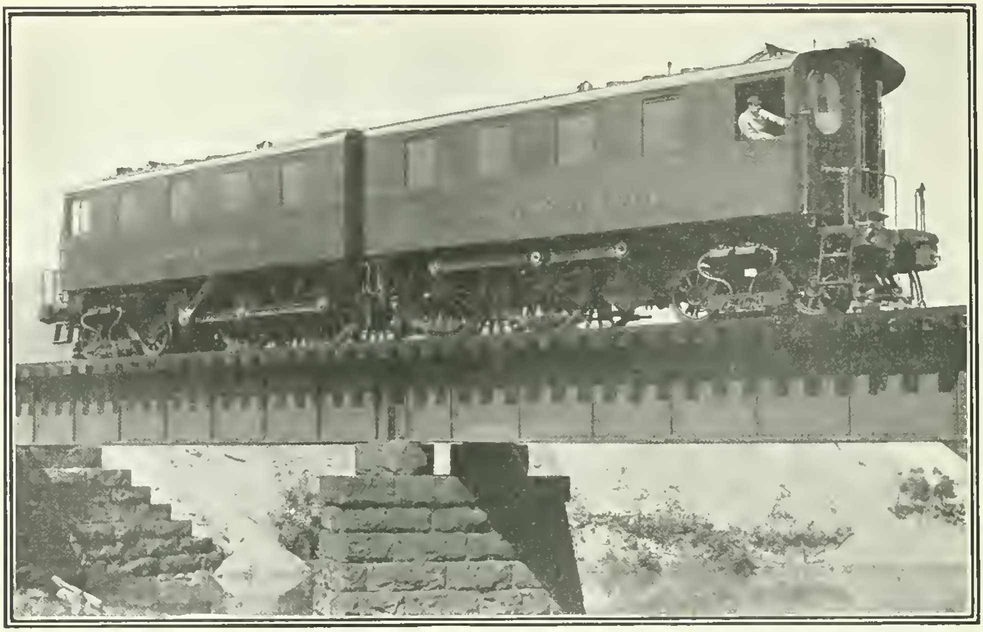
Each of the systems has a number of links or elements through which the power must pass between the moment of its generation in the power house and its application in the locomotive.

In the continuous current system using alternating current for transmission there must be a sub-station between the power-house and the locomotive. The current is generated in the power-house, raised by transformers to high voltage, carried by wires to sub-stations miles away, where transformers or motor generators step it down to a voltage low enough to use and converters change it from alternating to direct current; it is then carried by wires to the third rail or trolley wire.

In the case of the three phase system the current once generated is raised by transformers to high voltages, carried to substations about eight miles apart, and stepped down by transformers to low voltage, or the high voltage current may be carried directly to the two overhead trolley wires. In the latter case the voltage is stepped down by transformers on the locomotive. The low voltage three phase current is then fed directly to the motor. Two overhead wires are used and this involves a double system of overhead construction, which becomes quite complicated at cross-over switches. The wires have to be kept well separated and insulated from each other at equal heights above the train. The track in this system acts as a third wire or conductor. In the direct current system the return circuit is furnished by the track.

To get the current aboard the locomotive in the single-phase system, it may be generated in the power-house, raised by transformers to high voltage, carried by wires to sub-stations, widely-separated, where it is stepped down to a usable tension, and carried to a single wire strung over the railroad tracks. The single wire permits a wide range in height as the trolley adjusts itself automatically to the position of the wire. Usually the wire is strung on lines twenty-two feet above the track but passes under bridges at a height of fifteen and one-half feet. Once more the track acts as one side of the circuit.

But a remarkable part of the great feat of the New Haven was that it abolished the sub-station where the transformers intervened between the locomotive and the power-house. It took the current at high tension aboard the locomotive itself. This it could do because the length of the line on which the service was installed was but twenty-one miles. It was a daring bit of pioneer work to take the high voltage alternating current aboard the locomotive and lower it there to the low voltage current required for the motors, doing aboard the speeding locomotive what had been done in the sub-stations scattered along the railroad



FOR USE IN THE HUDSON RIVER TUNNEL.

lines. This saved the great expense of direct-current work and it secured a very high degree of efficiency.

If railroads consider electrification they ask of course about such matters as the cost of the respective systems and their comparative losses of power between generators and locomotives. The first cost of the single-phase installation is much less than either of the others. Although the locomotives cost a little more, the cost of operation is considerably less in case of the single-phase system.

This outline of the situation indicates what the problems of the electrical railway engineer are going to be. As the crocuses promise the spring so the electrifications already made presage the coming of the vast electric systems of the future. Almost every week witnesses some installation. The Michigan Central has just started its electric operation in the tunnel under the Detroit River. The very first thing that was done by the president of the New Haven lines when he became the actual president of the Boston and Maine was to send an engineer to the Hoosac Tunnel to devise plans for the electrification of the miles of underground line at that point.

In a comparatively short time the railroad work of all New England will be done by electricity. New York will soon be linked with Philadelphia, Philadelphia with Baltimore, Baltimore with Washington, by electric railways. Electricity will supersede steam between such cities as Cleveland and Toledo, Cincinnati and Columbus, Chicago and Milwaukee. Centers of electrification will come into being in various parts of the country. At last some long trunk line will come forward with electric power in use from terminal to terminal. And so, step by step, the complete, or nearly complete, electrification will arrive. How enormously desirable that this outcome shall be anticipated and that broad-minded and statesmanlike plans shall be made.

There are a few words to say about the work done on the New Haven line. On express trains and trains of great length two locomotives are used. This is not due, as rumor had it, to any error of design. The locomotives were made to develop eighty per cent. of the power for a maximum train load. The ordinary train load is not of the maximum weight. To have made more powerful engines would have been to waste them on trains so light as to leave unused a large fraction of their capacity. It is greater economy to double up the locomotives on the comparatively few trains that require that power in excess of what one will develop. The two may be operated without any additional crew, it must be understood.

These locomotives are very interesting. Tender, cab, cylinders, connecting rods, dome, smokestack, have disappeared. They look to be all cab. Only the cowcatcher and the headlight of the old order remain. The engineer and his assistant have about them only a few knobs and handles. The corridor running from end to end—for these locomotives have no front and rear; they are double-headers, needing no turntable at the end of the run—these corridors are walled with steel. Behind these walls are muzzled cyclones hard at work.

The countless millions of electrons rush from the transmission line to the motors, which are the essence of being of the locomotive. Here their energy is wrested from them and they are made to do work in driving the train, after which they return to the line to again complete their cycle.

It is true that direct current and alternating current in combination had been used before for light service on certain unimportant lines. But the enormous weight of the trains, the volume of the traffic, and the character of the service, make the New Haven's a real pioneer work. When its experts began to study the problem of electrifying these twenty-one miles they were told to keep in mind the ultimate electrification of the whole Shore Line route between New York and Boston. It now seems likely that this railroad thus has made a very valuable contribution to the great railway problem of the future—a uniform system of electrification.

True Liberty

When love with unconfined wings
    Hovers within my gates,
And my divine Althea brings
    To whisper at my grates;
When I lie tangled in her hair
    And fettered with her eye,
The birds that wanton in the air
    Know no such liberty.

When flowing cups pass swiftly round
    With no allaying Thames,
Our careless heads with roses crowned,
    Our hearts with loyal flames;
When thirsty grief with wine we steep,
    When health and draughts go free—
Fishes that tipple in the deep
    Know no such liberty.

—Richard Lovelace.

PHOTO ...

A MOUNTAIN WHICH LASTED BUT SIXTY DAYS.
McCulloch Peak, photographed by means of long distance lens.

NATURE TURNED SORCERESS

By

WILLIAM THORNTON PROSSER

"NOW you see it, and now you don't," is a sign that Nature might well display over a little group of islands in Bering Sea, where the great Mother of the Universe plays the part of sorceress, coaxing mountain-tops from the depths of the ocean and making them disappear again in the twinkling of an eye, amid a demonstration that only a favored few have witnessed. The stage that Nature uses for her works of magic is apart from the main lanes of ship travel just to the northward of the long string of Aleutian islands that swings from America almost to the Asiatic shore. In no part of the world do remarkable seismic disturbances more frequently recur than in this isolated spot. So often do these large-scale acts of legerdemain transpire that no visitor at Nature's black art theatre ever expects to see the conjured islands in the same form upon a second visit.

It was in September of this last season that the most recent performance was given at the Bogoslofs—for such is the name of the enchanted Bering Sea group. The officers and crew of the revenue cutter *Tahoma*, which had recently returned to Puget Sound from a summer cruise in the vicinity of Pribilof seal

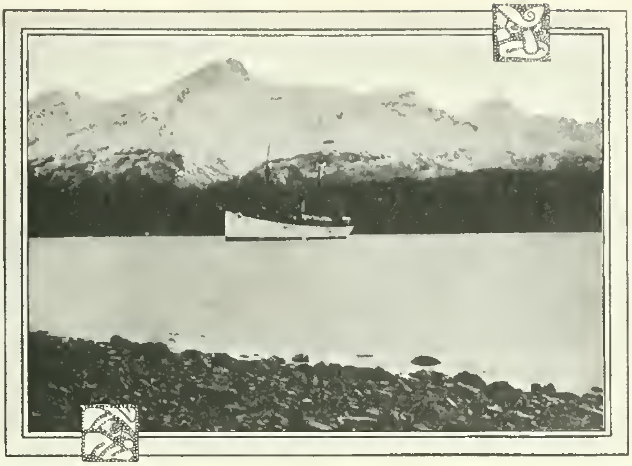


PHOTO BY LAGGER.

United States Cruiser *Buffalo*, Reconnoitering in Alaskan Waters.

rookeries, were spectators at the birth of a new mountain peak, and their description of the awe-inspiring sight as a steaming mass of lava was raised above the water's surface, sending a pillar of flame and vapor miles into the heavens, while lightning and thunder accompanied the spectacle, proves that every scenic effect was called into play to produce a mighty triumph of the cosmic forces.

Nor is the volcanic action confined to this one isolated spot in the dreary wastes of Bering Sea; for when Bogoslof plunges into a series of activities the effect as a rule can be felt a thousand miles and more along the Alaskan shore.

Accompanying the last upheaval of the Bogoslofs, Alaska's most active volcano, Mt. Makushin, near Unalaska, has been in eruption, and vessels plying between Seattle and Nome reported its sides and top covered with chocolate colored effluvia, while smoke and steam arose from its crater.

Originally Bogoslof was a jagged rock rising out of Bering Sea. With turrets and buttresses it looked like a feudal castle, and after the United States acquired Alaska from Russia it came to be known as Castle Rock. Admiral Bogoslof of the Russian navy had charted the island in 1790. Castle Rock seemed to alter its size and shape between the visits of different ships, and between the seasons of 1886 and 1887 there sprang into being a second island about four miles to the northwest. Castle Rock was about sixty miles to the northwestward of Unalaska.

When the United States revenue cutter *Perry* approached the islands in 1906 the officers found that a new peak had risen out of the sea between Castle Rock and Fire Island. This was named Perry Peak. Smoking and steaming, it looked like a gigantic new-made pudding. The three islands in the Bogoslof archipelago were estimated to be about 800 feet in height.

It was on the Fourth of July, of the following year, that the revenue cutter *McCulloch* passed the Bogoslof, and there out of the sea another peak had raised its head, this one right by the side of Perry Island and virtually forming a part of the year-old mound. This was called McCulloch Peak. Evidently it had just come into being, for it was formed of soft earth mingled with great boulders, and from its fissures great clouds of steam constantly arose to heaven.

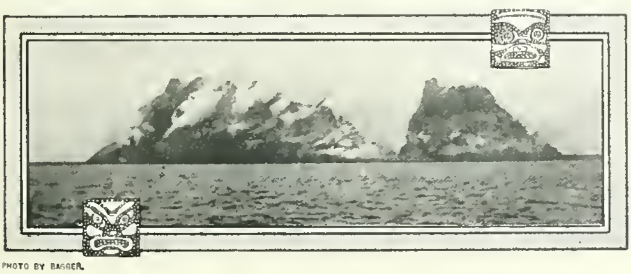


PHOTO BY BAGGER.

McCulloch Peak, Smoking and Steaming, at the Side of Perry Peak.

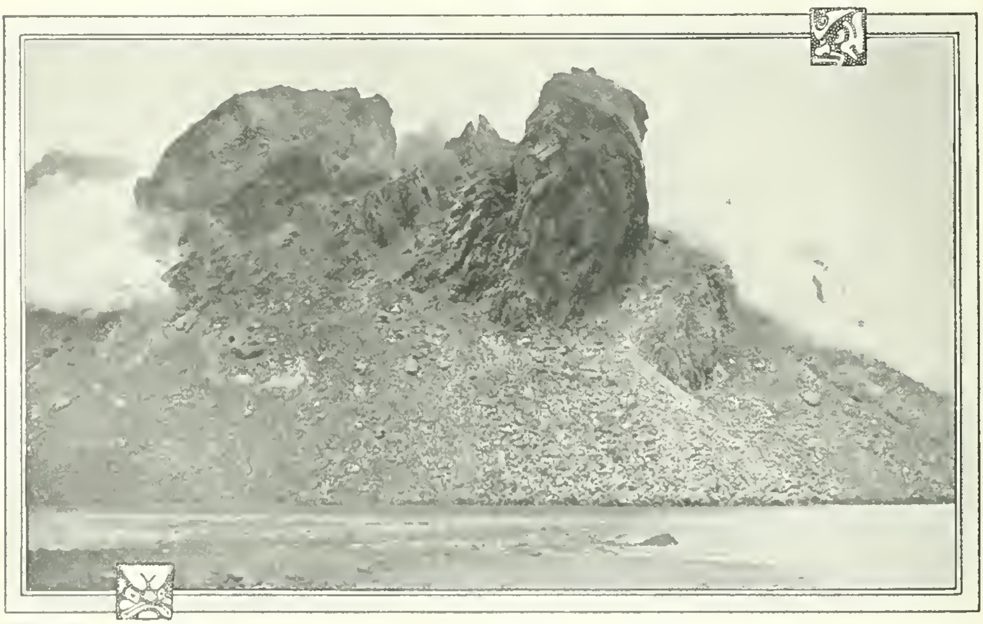
But this peak was destined for a short life. Passing the Bogoslofs September 1, 1907, the whaler *Herman*, of San Francisco, after a season in the Arctic, beheld the disappearance of McCulloch while flame shot up through clouds of steam and smoke, and the superstitious sailors foresaw the end of mundane things. It happened that the United States auxiliary cruiser *Buffalo,* commanded by Capt. Charles F. Pond, sent north to investigate the sealing operations about the Pribilof Islands, was not far away, and when Captain Pond heard of a shower of ash on the nearby islands he determined to head for the Bogoslofs and see what new act of legerdemain had been worked among those restless islands. When the *Buffalo* reached the spot Captain Pond found that since the visit of the revenue cutter *McCulloch,* earlier in the season, the strangest alterations had taken place, for the three islands had been merged into one, and the sea was 2,000 feet deep where McCulloch Peak had stood.

At one end of the new island stood Castle Rock, changed beyond recognition by the latest disturbance, and with its outline softened and smoothed by a coating of volcanic dust and lava. Perry Peak had been much reduced in height, and a low bar of land connected the three bits of higher ground.

"Rocks as large as a house were occasionally detached from the sides of Perry Peak," Captain Pond related, "rolling down with thunderous noises to the water's edge. Strange to relate, a colony of sea lions that for several years had made their home south of Castle Rock, were flourishing despite their proximity to the center of activity, and were apparently enjoying the warm waters that surrounded the island."

About this time the steamship *Pennsylvania* arrived at Nome with her decks sprinkled with ash, and reported that analysis of this effluvia showed the presence of gold. Coincident with the disappearance of McCulloch Peak earthquake shocks were felt along the coast of Alaska to the eastward and a number of uncharted rocks made their appearance, even in southeastern Alaska. It was a little later than this that the government cable between Sitka and Valdez was snapped by the sudden rising of a submarine mountain.

Perry Peak lived a few months longer, but it had disappeared when the United States fisheries cutter *Albatross* visited the Bogoslof group July 7, 1908. A narrow band of land then joined Castle Rock and Fire Island, but the officers of the *Albatross* beheld a new manifestation of the restive forces beneath the sea. What seemed to be the surface of the water adjoining the strip of land rose up



McCULLOCH PEAK, JUST BEFORE IT DISAPPEARED UNDER TWO THOUSAND FEET OF WATER.

PHOTO BY BAGGER.

Bogoslof Island and Its Peaks.
Castle Rock on the right, Perry Peak in center, Fire island on left.

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Daylight Disclosed Clouds of Vapor and Enormous Columns of Lava Spouting From the Crater.
Bogoslof Island, Alaska.

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A Distant View of The Smoky Island of Bogoslof.

in a gigantic dome-like swelling, as large as the dome of the capitol at Washington. Then it subsided, only to rise again. Before each subsidence there was a tremendous escape of gas, like a huge bubble pushing its way through the water.

Following this phenomenon great clouds of smoke and steam issued from the same spot, gradually growing in immensity until the spellbound spectators began to fear they would be engulfed in a terrific cataclysm. The sky was filled with seething clouds of vapor, while fire, smoke and white hot lava streamed from this sea-level volcanic crater. The column that rose heavenward officers of the *Albatross* declare was three miles in diameter.

The cutter *Perry* was the next visitor to the islands, and found a new-made peak on the site of the old Perry Peak. Members of the crew led by officers braved the danger and stood upon the shore of Bogoslof, but the heat was so great they could not long remain.

It was September 10 of this last season when the revenue cutter *Manning* first approached the Bering Sea volcano, and the adventurous spirits insisited on going ashore. Changes were many since the *Perry* had been upon the scene. Again Perry Peak had become two small mountains. Evidence of terrific heat was plain, not only in the coating of lava, moulten and dust, that covered the island, but in the skeletons of multitudes of sea-fowl that plainly had been roasted alive in the twinkling of an eye. The bones, scattered by thousands crumbled to fine dust at the touch.

The *Tahoma's* men found a crater fifteen hundred feet in diameter, seething with lava, fire, boiling water and steam. They describe it by likening it to a huge colander with streams of boiling water spurting upward through the holes, and a geyser in the center much larger than the rest. On insecure footing of baked mud, which in places gave way under their weight, the situation of the observers was perilous, and the roar of the crater drowned their voices.

Nine days later the *Tahoma* was again approaching Bogoslof when, at 4 o'clock in the morning, the lookout reported to Capt. J. H. Quinan that a terrific thunderstorm, with lightning of unusual brilliance was raging dead ahead. The captain issued orders to fix the vessel's lightning rods, and then inquired the exact location of the storm center.

"That's Bogoslof in eruption again," he exclaimed, and soon all the revenue cutter's officers and men were on deck to witness the display, which was then about twenty miles away.

Lieutenant F. E. Bagger gives a detailed account of the *Tahoma's* remarkable experience at the birth of a new mountain on Bogoslof:

"We were on a northeast course, making about ten knots an hour when the officer of the watch noticed perhaps twenty-five miles ahead flashes of vivid lightning. Through the gloom we could discern a mass of dark and lowering clouds, and as the day dawned one immense cloud hung over the group directly in our path. Flashes of blinding light lit the sea and sky to the horizon, and showed us the rough outline of Bogoslof as the center of the disturbance. Every eye was strained to watch the developments of the awe-inspiring spectacle.

"By six o'clock the *Tahoma* had drawn within twelve miles of Bogoslof. With the rays of the rising sun old Fire Island could just be distinguished at the edge of heavy clouds of ashes, steam and smoke that completely enveloped the remainder of the island.

"When the revenue cutter had approached within ten miles of the scene it was plainly to be observed that the flames, molten lava, ashes, steam and smoke were issuing from the old crater, which had been partly surrounded by a salt lagoon. Titanic forces were at work creating a prodigious disturbance, and the heat which was being freed from the center of the earth began to produce an eddying wind that even from our distance could be plainly felt. As we continued to near the land the force of the increasing wind began to scatter the clouds of smoke which hovered over the northeast end of Bogoslof, and by 6:15 o'clock the land sprang plainly into view.

"Soon the *Tahoma* had reached a point sufficiently near for the eye of the camera, and we obtained some very fine views of the spectacle. At 6:30 we were only six miles distant, and the heat began to be oppressive. The continuous shower of ash and lava dust made it necessary for us to keep to windward of the island.

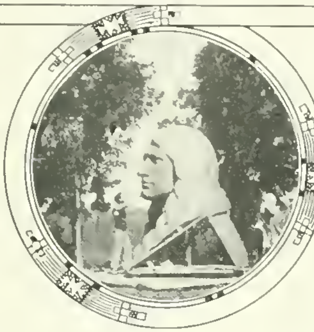
"A little before 9 o'clock we were only four miles from this belching, roaring volcano. A column of red-hot glowing lava was rising to a height of half a mile, through the center of the vapor and clouds. The steam from the crater reared its head as high again into the clouds, in immense billows. Even above the vapor streams of living fire rose and fell in a pyrotechnic shower.

"Accompanying all this display there was a constant roar while sounds like thunder issued from the cauldron on the island. Still keeping to leeward to escape the heat, we crept to within a mile of the shore. But we did not long remain there as ashes and sparks lighting on the deck told of our imminent danger, and Captain Quinan turned the *Tahoma's* prow about and we headed for the Aleut village of Chenofski, near Unalaska. But as we left we could see through the clouds of vapor that a new mountain had been born on Bogoslof, and doubtless it will be known as Tahoma Peak."

Since the *Tahoma's* return to winter quarters the coast of Alaska has been racked by quakes and jars, so that it is more than probable Bogoslof has assumed a new shape even since September.

Sculptor Takes Up Cement

By Roderick Peattie



WITH the ever increasing cost of lumber, the value of cement as a building material is growing more and more apparent. It is, moreover, becoming one of the most prized of materials to the engineer, who uses it for bridges, for retaining walls, for substructure and other purposes. For side walks it is unrivalled and has usurped the place of all other materials. Mr. Edison considers it one of the most pliable, esthetic and economical of house materials, and Mr. Lorado Taft, the sculptor, is demonstrating the fact that it is amenable to the purposes of art.

Mr. Taft is causing to be erected in Ogle County, Illinois, near the delightful village of Oregon, on the banks of the Rock river, a statue of Black Hawk, once chief of the Sac and Fox Indians, who possessed the rich and picturesque country of that region. A chieftain at once wise and brave, he is worthy of commendation, and Mr. Taft has chosen to place his statue upon a rocky bluff which commands a fine sweep of the river both North and South. Tradition says that this was a favorite retreat of Black Hawk's.

The dimensions of this statue are 48 feet without the pedestal, and being set as it is, upon a bulwark of rock, the effect from the river is one of melancholy and imposing grandeur. Mr. Taft has not attempted a portrait of Black Hawk, but has made what might be regarded as a composite face of the Indians of the Middle West.

As is his custom, the first figure Mr. Taft designed was but eight inches high; the next two feet; the third six feet. This figure was set in a frame which forms a part of a pointing machine, and by means of a system devised by Mr. Taft and his assistant, Mr. John Gottlieb Prasuhn, it has been possible to enlarge this figure seven times, and to preserve accurately every feature of the finely finished, six foot model.

The builders of this huge statue had no precedent by which to work, and the successful development of Mr. Taft's idea is the result of the ingenuity and mathematics of Mr. Prasuhn.

First a central tower of wood was built, and upon this and from it was developed an edifice which indicated the form of the figure. Small sticks were nailed over this at close intervals and numbered. These showed wherever there was to be a curve or a variation, and the extent of that variation. A sketch of the frame work in this condition, with each point numbered was then made on paper, and every proportion was tested with plumb line and square. When all corresponded to the working model—a correspondence which the pointing machine could prove or disprove by its infallible comparisons, with one end operating from the small model, and the other indicating the point at which a seven-fold enlargement was to be made—the whole surface was covered with chicken wire. Mr. Prasuhn began at the neck and wrapped this around and around the figure, and then modeled it carefully, fastening it with two-pointed tacks to the frame work. Next he draped it in two hundred yards of burlap, fastening this to the frame with nails, and once more modeling it all. The burlap was then sprayed with plaster water to stiffen it, so that the heavy plaster mold which presently was to be put on, should not intrude through the wire, and clay water was sprayed over the thin coat of plaster to separate it from the plaster mold.

A temporary plaster model of the shoulders and head were then made on the ground, and hoisted into place by means of a hinge derrick. It was not absolutely necessary that these should be placed upon the statue, but their presence gave meaning to the work, illustrated to visitors what was to be done and encouraged the men in their labors. It also determined the precise location of the figure, and the whole structure was swung around over a foot after the erection of the head, in order to present a cleaner profile to the road along the bluff. The derrick by which the great head was lifted in place was in itself a clever contrivance fashioned with a triangle on a boom, with a rope to each of the four derrick points, and a back guy.

The next thing was to prepare for the heavy concrete work. Four heavy steel beams each thirty feet in length, were placed on cribbing timbers and bolted together. Scaffolding was then raised, and a mold of common plaster and fiber was put on by hand. Around this scaffolding was finally put hoops of copper wire to prevent spreading, while within the statue was erecting a net work of strutting and cross beams to guard against crushing.

When the plaster mold was completed, the temporary head and shoulders were sawed up and cast to the ground, and everything was removed from within the now hardened mold. This mold was painted within with wall sizing to keep the plaster from absorbing the water in the cement. The solid rock at the bottom of the fourteen foot excavation beneath the statue was pierced and twenty-four rods of steel dipped in brimstone and plaster were anchored in the rock. Into this cement was poured making a solid substructure for the visible pedestal, which was six feet in height. On this was erected a steel tower, composed of rods, reinforced, and wrapped about with galvanized wire. A steel dome surmounted this, designed for the purpose of supporting the head and shoulders of solid cement.

READY TO RAISE THE HEAD. THE HEAD IN PLACE

The difficulties were many, and not the least of these was the securing of the water, of which many thousand gallons were required. A small Erickson air engine was pressed into use, and made to lift water from the river two hundred feet below, but as the power of this engine was not equal to the demand that would be placed upon it when the work of mixing the cement began, a reservoir was constructed and the water stored. A steam mixer capable of preparing a cubic yard of cement every six minutes was then installed. This had a hopper which held six barrels of

A Comparison of Heads.

cement for each dumping, and a continuous line of men with barrows was required. Cement sets in about thirty minutes, and to avoid unevenness, continuous work was demanded. Twenty-four hours finds cement in a condition to support itself, and a collapsible frame of steel was therefore devised, which could be lifted up in sections as the concrete hardened. The amount of cement used was about three hundred and fifty barrels, and no less than one hundred and twenty wagon loads of sand were required to mix the cement for the pedestal alone.

The molds for the shoulders and head were lifted into place, and the cement was poured in the top of the head until the upper portion of the figure was one solid casting.

One of the pictures shows the plaster mold over which the mold was made, being lifted into its temporary position.

Plaster Model Six Feet High from Which the Statue was Pointed.

The statue has been erected not only to celebrate Black Hawk, but also to leave a souvenir of Eagle's Nest Camp, where for years a group of artists, sculptors, writers and musicians have passed their summers. This is above Ganymede Spring, which the American authoress, Margaret Fuller, named on her visit to the West. Beneath the cedars at the crest of the cliff which arises above it, she wrote "Ganymede to His Eagle," as the tablet at the spring bears witness.

On a Punch Bowl

Then fill a fair and honest cup, and bear it straight to me;
The goblet hallows all it holds, whate'er the liquid be;
And may the cherubs on its face protect me from the sin,
That dooms me to those dreadful words—"My dear, where have you been?"

O. W. Holmes.

THE *OLYMPIC*, AS SHE WILL APPEAR IN JULY.

OLYMPIC, GREATEST OF STEAMSHIPS

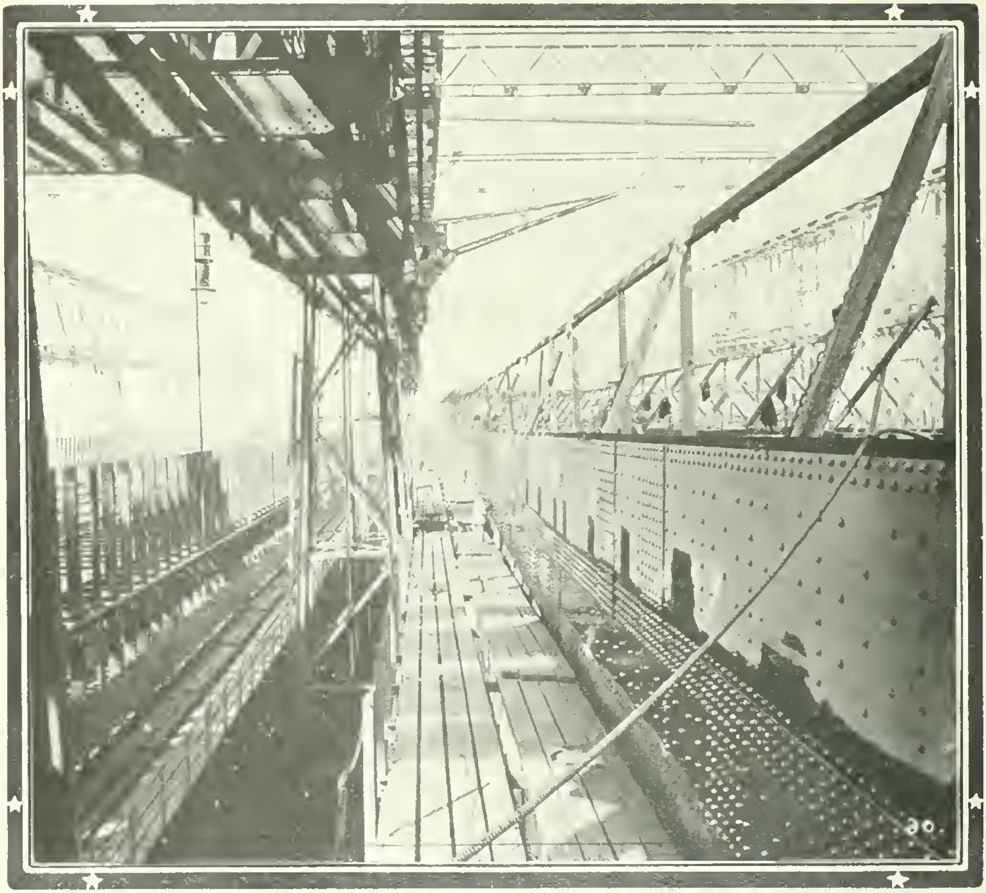
By

HENRY R. JEVONS

SOME day next July a skyscraper will come floating up Ambrose Channel, the Narrows and the North River to her berth at the new Chelsea docks in New York. For they are building sea-going skyscrapers these days and they are doing pretty well at it, considering. This particular skyscraper, the *Olympic*, the new White Star Liner, is only eleven stories, to be sure, but measured from the bottom of her keel to the top of her funnels she lacks only twenty-five feet of coming up to the new proposed building height limit in Chicago. Since the *Olympic's* foundation is salt water which is more unstable, if possible, than the quicksands which vex the builders in the Lake Michigan metropolis this must be conceded to be a pretty fair height. Nor are those funnels to be lightly considered in computing the height. They are very much more important than the ornamental lantern sometimes included in reckoning the height of a building. Though they do not look very big, so exquisitely is the new liner proportioned, they would make a good many suites of offices if they were arranged for that purpose, for there are four of them, each oval in shape, 24 feet 6 inches in diameter the long way and 19 feet wide. Placed end to end they would make a tunnel 640 feet long with ample room for two standard gauge railroad trains to stand side by side.

Everything else about this latest prodigy of marine architecture is on the same stupendous scale. Unfortunately, descriptive writers of former days exhausted the entire stock of adjectives in describing "leviathans of the deep" that sometimes reached the enormous size of five or six thousand tons, so that now when they are really needed to convey an idea of a craft of forty-five thousand tons there isn't a superlative left that is fit to be seen in print. The only thing

THE *OLYMPIC*, AS SHE APPEARED IMMEDIATELY AFTER LAUNCHING.



SIDE PLATING AND HYDRAULIC RIVETING ON THE *OLYMPIC* AND FRAMING AND PLATING ON THE *TITANIC*.

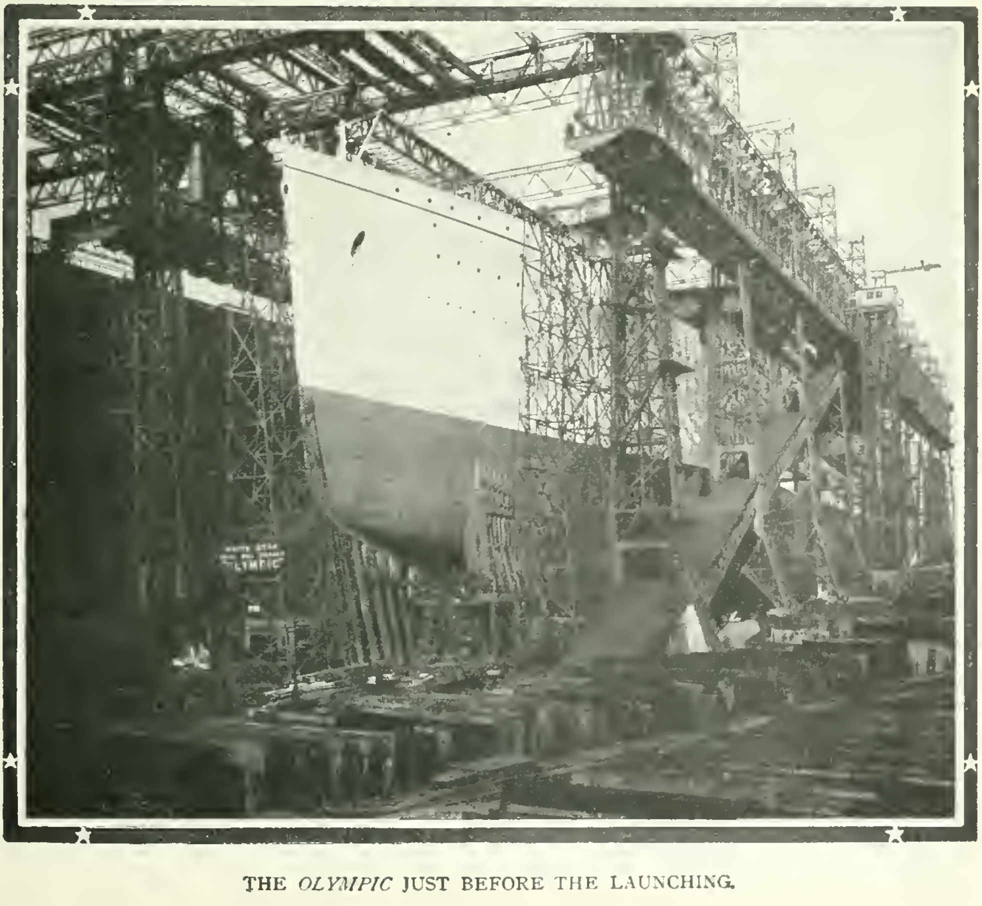
that can be done is to fall back on comparative statistics, and let it go at that.

As a starter it may be said that the length of the *Olympic*, 882 feet 6 inches, is 182 feet greater than the height of the Metropolitan tower in New York, the tallest structure on the continent, and four times the height of the Bunker Hill monument; and yet any one who has toiled up the steps to the top of Boston's proudest landmark will feelingly agree that it is not to be sneezed at. Also, the length of the *Olympic* and her sister ship, the *Titanic*, launched in February, 1911, is twice the height of the dome of St. Peter's in Rome and equals the total drop of the famous Bridal Veil falls in Yosemite Valley. Placed end to end beside the Brooklyn Bridge these two ships would completely span the East River and extend over the shore one hundred feet on each side. In short the *Olympic* is 97 feet 6 inches longer than the *Mauretania* and *Lusitania*, is 92 feet six inches wide over all, and 94 feet wide over the boat deck. From the boat deck to the bottom of the keel is 97 feet; from the top of the Captain's house to the bottom of the keel is 105 feet 6 inches, and from the top of the funnels to the bottom of the keel, 175 feet. There are eleven steel decks and fifteen watertight bulkheads.

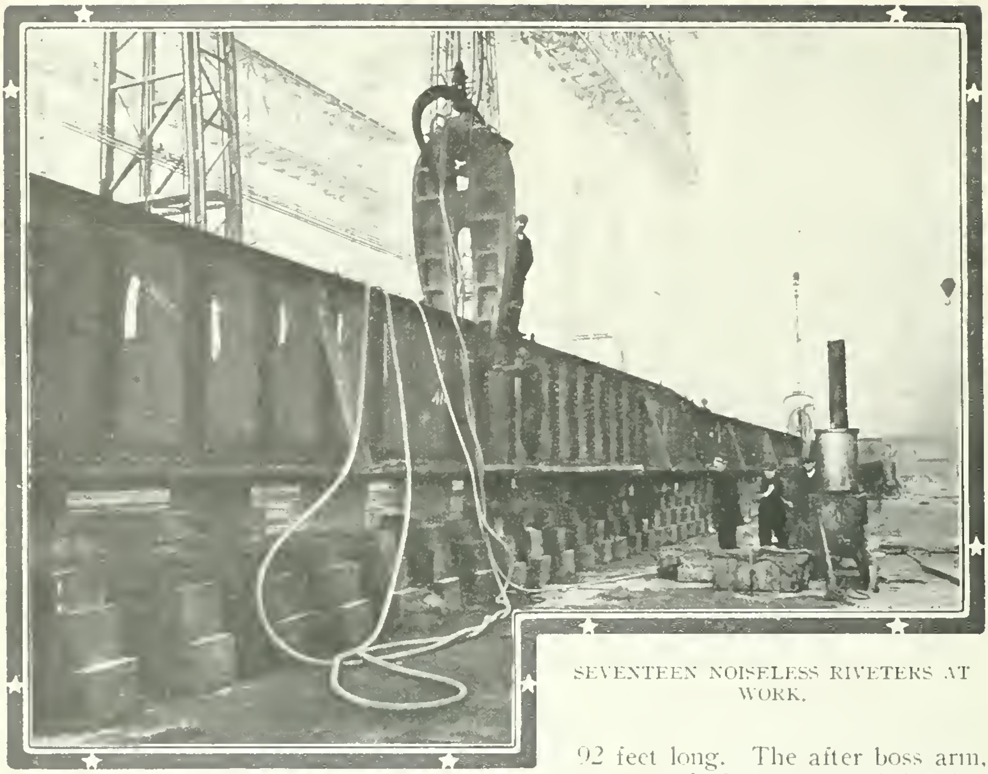
The launching of the *Olympic* alone cost more than enough to build a fine steamship. More than six hundred steers died merely to make her path into the water smooth, for twenty-two tons of tallow were used to grease the ways. Many a Belfast waterman made a modest little fortune (judged by a Belfast waterman's standard) picking up the floating tallow after the launch. The tallow, however, was too trivial an item for serious consideration when compared with the rest of the bill.

It cost the Belfast Harbor Board, which draws no share of the *Olympic's* earnings, $292,000 to get ready for the launching. Of this sum $146,000 went to deepen the channel to 32 feet. Opposite the berth a pit fifty feet deep had to be dredged in the bottom of the harbor to make room for the plunge of the stern before the bow left the ways. Then Harland and Wolff, the builders, had to spend $48,670 to strengthen Victoria wharf opposite the berth lest the terrific commotion kicked up when the monster struck the water should cause the wharf to collapse. Still, that was but a beginning. Three of the largest slips they had were converted into two for the *Olympic* and *Titanic*. Over the berth a double gantry had to be erected 840 feet long, 105 feet wide and 220 feet high and equipped with travelers and cranes capable of lifting from five to forty tons. Besides this there was a floating crane to be provided at great cost to transfer the boilers to the ships after they were afloat. Part of the works had to be entirely reconstructed, other parts were altered and special equipment provided, making the outlay for the plant for building these biggest ships more than two million dollars.

From the time the keel was laid, December 15, 1908, to October 20, 1910, the date of the launching, a fair sized army was steadily employed on the *Olympic*. For weeks before the launching two thousand five hundred men toiled night and day making preparations



THE *OLYMPIC* JUST BEFORE THE LAUNCHING.



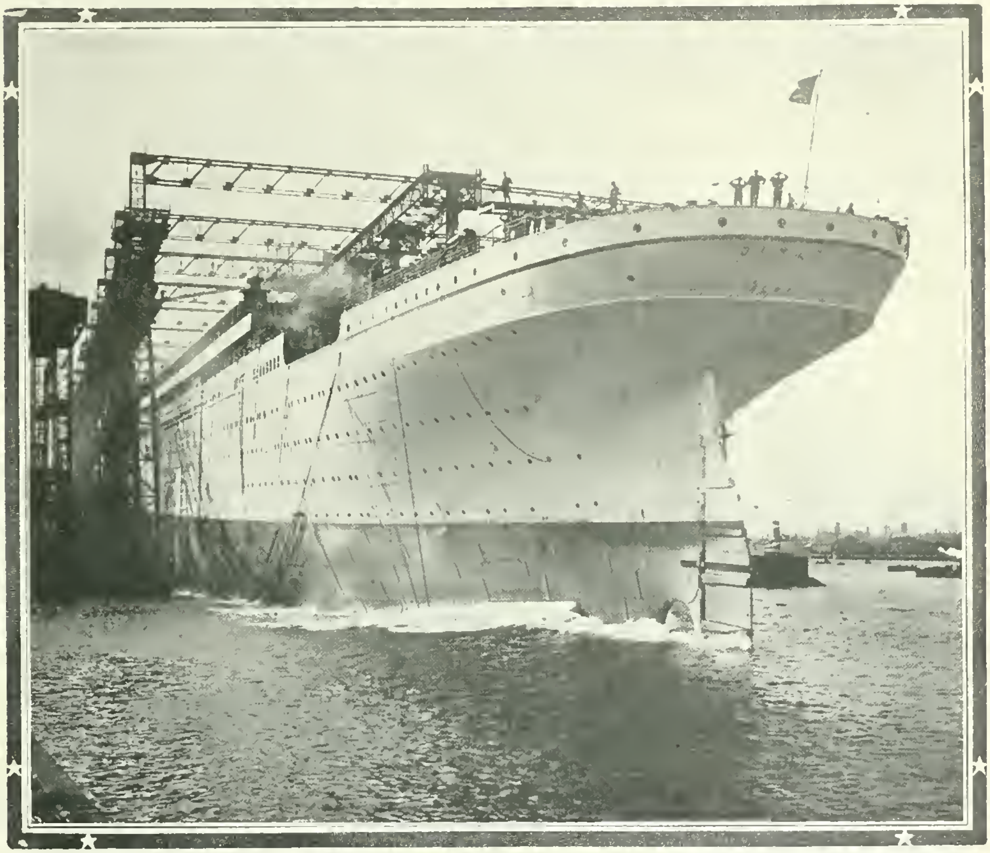
SEVENTEEN NOISELESS RIVETERS AT WORK.

for the great event. As the weight at launching was twenty-seven thousand tons, much the largest mass of steel ever put in the water at once, a great deal of careful planning and expert preparation were required to make ready for the sixty-two seconds occupied by the *Olympic* in making the plunge. From the time the hydraulic triggers holding the vessel on the ways were released until she was stationary in the water less than two minutes elapsed.

Since the *Olympic* represents an investment of $7,500,000 it was necessary that in addition to being the largest ship the world has ever seen, a distinction she will retain only until the *Titanic* is placed in service late this fall, when she will be one of the largest two, she should also be the heaviest and strongest. Five hundred thousand rivets, weighing 270 tons, were used in the construction of the double bottom alone. The largest rivet was 1¼ inches in diameter. This double bottom is 5 feet 3 inches deep. The largest shell plates are 36 feet long and weigh 4½ tons. The largest beams are 92 feet long. The after boss arm, a sort of three pronged bracket that tags along to hold up the outer ends of the propellers, weighs 72½ tons. The rudder, a dainty creation in steel, is 15 feet 3 inches wide with a stock 23½ inches in diameter and weighs a hundred tons, as much as a good sized locomotive.

But speaking of riveting, 3,000,000 rivets weighing twelve hundred tons, are required to hold the *Olympic* together. All the shell plating up to the turn of the bilge and much of the other work was done by power riveters, which in Belfast are very different things from the little hand tool sprouting from the end of a rubber hose, the blood-curdling, nerve destroying r-r-r-r-r-r-at-at-at-at-tat of which is so distressingly familiar to American ears. The Irish riveter is a ponderous affair weighing seven tons which has to be manipulated by means of a traveling crane. But it does its work so easily and so silently that it was considered quite the thing to invite ladies who visited the works during the building of the *Olympic* to step up and drive a rivet.

In point of power the *Olympic*, though much larger than the *Lusitania* and *Mauretania*, drops far behind the swift Cunarders. For each knot above twenty per hour added to the speed of a steamship the coal consumption increases in an ever-growing ratio that is out of all proportion to the advantage gained.



THE LAUNCHING OF THE *OLYMPIC*.

The luxury of a speed of 25.5 knots an hour comes so high that all the other steamship companies have enthusiastically agreed to let the Cunard Company monopolize it. So it happens that while the *Olympic* is a third greater in tonnage than the *Mauretania* her engines will have only fifty thousand horse power as compared with the Cunarder's seventy thousand horse power, which is only enough to enable her to jog along at twenty-one knots an hour. Still, a plant of fifty thousand horse power has by no means as yet become what might be called commonplace.

The arrangement of two wing propellers driven by reciprocating engines combined with a center propeller driven by a turbine has been tried out on the White Star liner *Laurentic*, plying between Liverpool and Montreal, with such gratifying results in economy and in eliminating vibration, that it has been adopted for the *Olympic*. It is alleged by the press agent that this absence of vibration abolishes that terror of the seas, mal de mer; but don't you believe it. There is but one infallible rule for the prevention of sea-sickness, and that is to stick to dry land. It is much cheaper than crossing the Atlantic, any way.

But to return to the wing propellers, they are each 23 feet 6 inches in diameter, weigh 38 tons each and are affixed to crank shafts weighing 118 tons each. These ponderous masses of metal are driven at a speed of 75 revolutions per minute by triple expansion engines with four cylinders, the high pressure cylinder being 54 inches in diameter, the intermediate 84 and the two low pressure 97 inches in diameter, while all have a stroke of 6 feet 3 inches. Each engine bedplate weighs 195 tons.

The center propeller, which is only 16 feet 6 inches in diameter, has to run at more than double the speed of the wing propellers, or 165 revolutions per minute. It is driven by the latest type of Parsons turbine, the rotor of which is 12 feet in diameter and 13 feet 8 inches long. From the company's standpoint the most attractive feature of this arrangement is not that it abolished sea sickness, as alleged, but that it keeps the coal bill down. Steam, generated in 20 double ended and 5 single ended Scotch boilers, all 15 feet 9 inches in diameter, the double enders 20 feet and the single 11 feet 9 inches long, is delivered to the reciprocating engines at 215 pounds pressure. The high pressure cylinders get all they can out of the steam, which is then passed on to the intermediate cylinders, which go after the elasticity in that steam like a Paris hotel keeper after a tourist's cash, then dole it out to the low pressure cylinders. Not

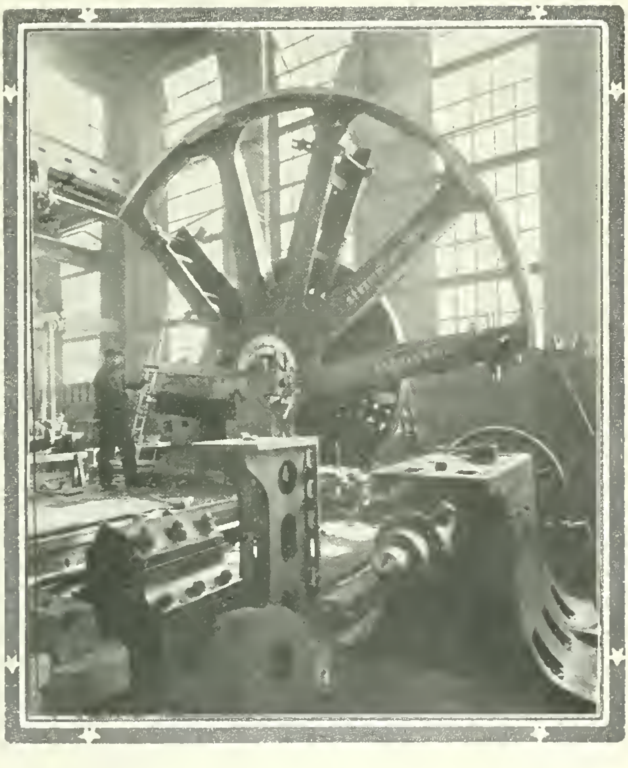
ALL PARTS OF THE VESSEL ARE GIGANTIC.
The boilers are 15 feet, 9 inches in diameter and 20 feet in length.

Bringing the "After Boss Arms" Into Position.
One of the gigantic parts of the *Olympic*. Weight, 72½ tons.

safety appliances that the ingenuity of man has devised. In this respect the steamship companies are exactly like the railroads. Every so-called safety appliance on a railroad today has been adopted for its economic value, the safety secured thereby being incidental—a sort of by-product, so to speak. However, when a passenger by sea or land is zealously guarded from harm it is no part of his business to analyze the motives that insure his safety. If some blundering steamer should run full tilt into the *Olympic* as the *Florida* did into the *Republic* it is safe to predict that the new giant will not only stay afloat long enough to transfer all her passengers, but that her bulk-

until every ounce of pressure that a reciprocating engine can get out of it has been extracted from that steam is it allowed to escape to the turbine. Although by this time the steam is so weak it can hardly struggle on, the turbine has become so wonderfully efficient that it contrives to develop a great deal of power out of this exhaust steam. When the turbine gets through with it the steam, which by this time isn't much more effective than hot water, goes to the condenser, and from there back to the boilers to begin the weary round all over again.

Still bearing in mind the outlay of $7,500,000, rather than from an inordinate solicitude for prospective passengers, the company has equipped the *Olympic* with the most elaborate



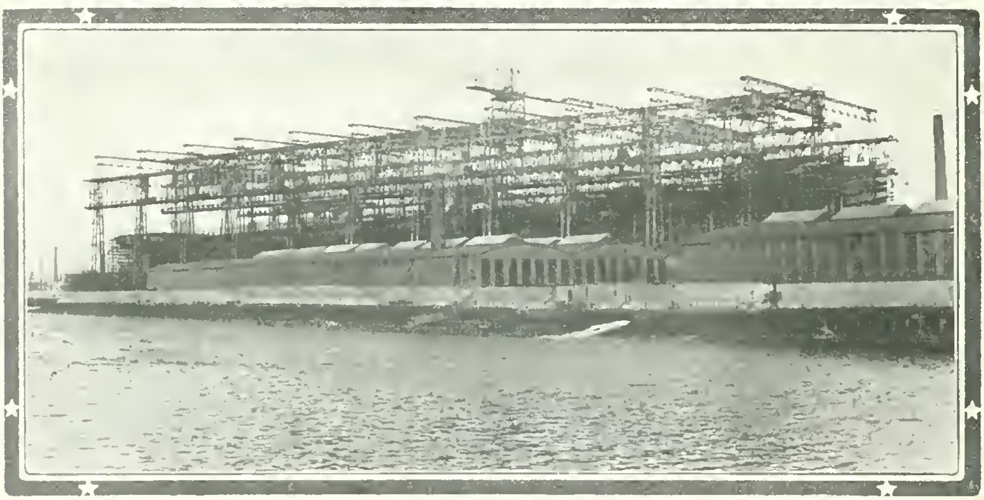
The Steering Quadrant of the *Olympic*.

heads will be found strong enough to withstand the strain of towing to port. There are the usual doors between water-tight compartments all closed at once by a touch on an electric button on the bridge, the submarine signaling apparatus that can pick up the tones of a warning bell seventeen miles distant and also tell the direction from which the warning comes, the wireless telegraph that will keep the ship in constant touch with the shore and with other ships and the elaborate fire protection system to be found on all modern liners. In addition to all these the *Olympic* has a new wrinkle in the arrangement of the small boats.

To quote from page 156, volume 16 of the Transactions of the Society of Naval Architects and Marine Engineers, "It is compulsory to provide a full complement of life boats and other life saving appliances together with davits which can be relied upon to lower the boats in a heavy sea without the least chance of mishap. . . . Provided a vessel is not afire and can float, even with a big hole in her side she is about the most comfortable and the safest place available in mid-Atlantic."

The laws of England and the United States do not require a vessel like the *Olympic* to carry small boats enough to accommodate all the passengers and crew, but even the number she does carry takes up a great deal of room the passengers would rather have devoted to promenades. By using sixteen sets of Welin double acting quadrant davits, which will swing a boat away from the ship's side and stay put at any angle in any kind of a sea, the *Olympic* is enabled to stow 32 boats and have most of the deck room too, for each set of davits handles two boats. This arrangement, which has been approved by the conservative British Board of Trade, not only reduces the cost, saves weight and gives greatly increased deck space, but also makes it possible to carry more life boats and still have them readily accessible in case of need.

Since there seems to be no limit to the sums otherwise sane Americans are willing to pay to be ferried across the Atlantic, every facility will be afforded the passenger on the *Olympic* for getting rid of his money. On any of the big modern liners one may pay from $112.50 for a single berth in an inside room down in the basement to two thousand dollars for an imperial suite on an upper deck where the passengers who like to stay up all night can congregate under the windows to gabble. Not many pay the minimum rate in the "high season," though: the steamship companies see to that. One of the big new German steamships quotes a minimum rate of $112.50 per berth but inquiry reveals the fact that



ELECTRIC CRANE EQUIPMENT USED IN CONSTRUCTING THE GIGANTIC TWIN STEAMERS, *OLYMPIC* AND *TITANIC*.

DELIVERING ONE OF THE FIFTEEN TON ANCHORS.

there are just three two berth rooms on the ship at that rate. The rest of the five hundred and twenty first class passengers pay two hundred to six hundred dollars a head. The distance across the Atlantic is about three times the distance from New York to Chicago. The total cost of a trip between these two cities, including berth and meals on the fastest and costliest trains is $38. Three times the distance would amount to $114. But the average rate on the new liners is about three times that amount. The rates on the *Olympic* have not yet been announced, but there is no reason to doubt that they will be ample.

In return for his money the first class passenger can eat his meals, provided he isn't too sick to think of victuals, in a main dining room seating six hundred persons, the biggest and most elaborate dining room afloat, or in a smaller dining room. Between meals he can loiter in sumptuous drawing rooms, the lounge or smoking rooms or library, or he can take a turn around the decks, counting about four laps to the mile, or he can work up an appetite in the gymnasium, or take a plunge in the swimming pool. If all these attractions pall he may seek relaxation in the ball room, the theater or the skating rink, all of which are combined in a single vast area of glass-enclosed deck.

Should there be any danger of his money burning holes in his pockets before he can get to Europe with it, the passenger on the *Olympic* can find prompt relief at the verandah cafe, where he can mingle sea-breezes with his liquor; or, if more heroic measures seem called for, he can get rid of his cash in larger wads at the tailor shop or dressmakers' parlors on board, or he can spend it still faster at the jewelry store. In fact there is nothing to prevent the passenger from achieving bankruptcy on the outward bound voyage so that he may return on the first homeward bound vessel. This will save time and simplify the annual hegira.

The *Olympic* will have accommodations for 2,500 passengers in all. To run the ship and wait upon this great throng will require a crew of 860 which will be commanded by Captain E. J. Smith, now of the *Adriatic*. The new liner will not lack business. Although sailing dates and rates have not been announced applications for berths have been coming in ever since last fall at a rate which indicates that some intending passengers may have to travel on other ships or submit to the perfectly dreadful and scarcely-to-be-thought of alternative of staying at home.

PICKING STRAWBERRIES IN THE AUTUMN.

STRAWBERRIES FOR THANKSGIVING

By

H. H. BRINSMADE

AFTER having their existence enveloped in much mythical uncertainty, fall strawberries have at last become an accomplished fact.

They were first tried out in Iowa. After a preliminary test, Mr. Lawrence J. Farmer of Pulaski, New York, purchased five hundred plants. These plants differ from other varieties only in the single particular that they blossom steadily from June until November. A large crop is obtained by pinching off the blossoms three weeks prior to the time that fruit is desired. If berries are desired by September first this may be secured if the blossoms be pinched or cut off in the first week of August.

At his farm near Pulaski, New York, Mr. Farmer last year had a fine crop of berries both fully ripe and green. The beds were covered so as to prevent damage from frost. Three pickings from Mr. Farmer's strawberry beds since August 15 averaged more than 600 quarts to the acre. A ready market at twenty-five cents a quart was found.

Ordinary berries produce but one crop in two years. This variety of strawberries produces a crop in the fall following the spring in which they are planted. The next crop is the following June and then again in the autumn, or two in one year.

An exhibit of strawberries in middle September is a most unusual spectacle. Just as the plants may be seen late in spring, resplendent in their fragrant blossoms, green fruit and ripe berries, so were they last fall in Mr. Farmer's garden.

Those of the chosen few who partook of the luxury declared that the fruit possessed a flavor fully equal to the berry raised in June.

IN READINESS FOR BUSINESS.
Automobiles of land agents which meet incoming homeseeker trains in a Texas town.

COMPETING FOR POPULATION

By

CARL CROW

WHEN the population figures were announced, Centreville was shown to be larger than Pinetown by about one thousand souls. Centreville papers had a good deal to say about it and Centreville citizens with friends in Pinetown sent them postal cards on which the population figures of the two towns were shown together with such cutting messages as they could think of on the spur of the moment. Pinetown residents passed the thing off as well as was possible under the circumstances and are absolutely certain that when the next census is taken their town will be leading instead of trailing behind Centreville.

These two towns are only ten miles apart and therefore the competition for population between them is keen. Of course each is distinguished for things entirely apart from population. Centreville is known over the state for its schools and for the fact that it is a beautiful and well planned city. Pinetown is a railroad and manufacturing center and with only half the population of Centreville would be far ahead in business interests. But population figures are the scores in the big game of town and community and state rivalry and it is as hard to prove superiority in any other way as to prove that the Cubs had the best baseball team after losing the world's championship to the Athletics.

Naturally enough the competition for population comes chiefly from towns, where a close community of interest makes team work possible and develops municipal pride. Rival towns result, each one trying to increase its population at the expense of the other. The game goes on all the time. Every ten years the score is called; in one town there is rejoicing; in the other much talk of the inefficiency of the census. Baseball is not the only game in which the umpire always gets the blame.

It is not alone town pride that brings about this competition. There is a new idea in town and city government which is that all residents of a town are joint stockholders in a business enterprise, that enterprise being the town itself. When the town grows the profits of the stockholders grow. The bootblack has more shoes to shine, the banker has larger deposits and more money out at interest. As the scheme of government in American cities does not provide for the execution of this new idea, hundreds of commercial clubs and similar organizations have come into existence, supplementing the work of the regular city administration. Theoretically, the city administration provides a good city in which to live, and the commercial club, corresponding to the sales department of a factory, advertises this fact to the world.

The commission form of government, which has grown rapidly in popularity, is a concession to this new idea. Under its provisions a city is governed by a small board of commissioners in much the same way that a bank is managed by a board of directors. Some people believe that in a short time the new idea of city partnership will be further recognized by the addition to the board of commissioners of a Commissioner of Promotion, whose duty it shall be to advertise the advantages of the city to outsiders. In many western towns the mayor now does this work and seeks reelection on a record of new factory smokestacks brought to the town through his efforts.

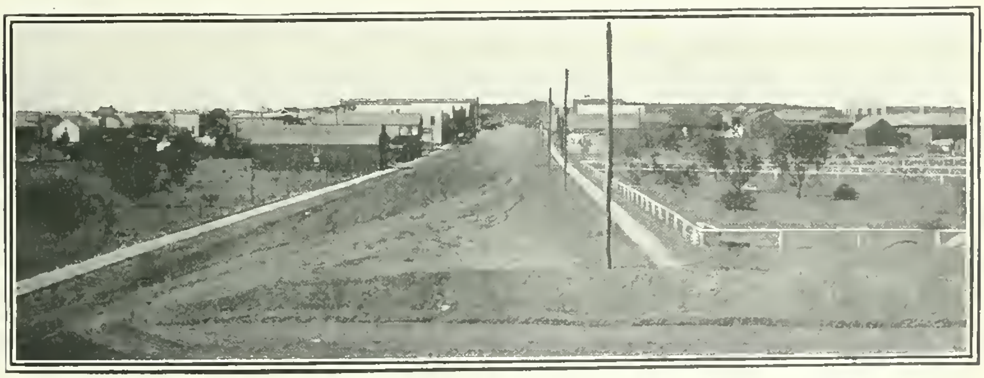
Among the Record Smashers.
Oklahoma City now has a population of 64,000, a gain of over 539 per cent.

The city partnership idea encourages town rivalry and when rivalry begins towns begin to improve. Build a town in the middle of an island where there is no competition from a rival and it will attain a large size before the advantages of parks and paved streets and good water systems are thought of very seriously. Start a rival town and the old one wakes up. It was that way at Smiths Corner, which was the county seat of Irving County. Smiths Corner had just grown up, acquired the court house and county jail, built a flour mill and was vastly contented with itself. One day a geologist went pottering around corn fields and creek bottoms and came back with the announcement that he had discovered coal. A coal mine followed, with a little town twelve miles distant. It was appropriately called Carbondale, because the mine and the town were in a little valley. Smiths Corner folks used to go over to the mine and look at it and carry back symmetrical lumps of coal as souvenirs and some of the boys went to work in the mines. There was no animosity, no competition. Carbondale was a coal mine. Smiths Corner was a town, with all of the dignity and importance given it by the possession of the court house, the residence of the county officers and the occasional sessions of the circuit court. A governor had made a speech there; a bishop had preached the high school baccalaureate sermon; the richest citizen was known to have money invested in railroads and lead mines. Carbondale was but a bunch of houses cluttering up what had been a well ordered corn field.

This went on for years until one Sunday morning the pastor of the First Baptist Church of Smiths Corner announced to his flock that he had been called to the pastorate of the Carbondale Church. It was learned that the Carbondale people, though not much addicted to religion, had offered him a larger salary. That was the blow that awakened Smiths Corner. The Baptists employed another pastor at a larger salary and filled up the mudhole in front of the church. A Ladies' Civic League was formed for the purpose of inducing residents to keep their front yards mowed and their front gates on hinges. Civic pride rolled up its municipal sleeves and started in to show the young and impudent Carbondale how a town should be run. Someone said Carbondale eyed the brick court house enviously. Smiths Corner began to build sidewalks, pave streets and paint the houses. A wagon factory and a Methodist school were added to the town. Now there are two very prosperous towns in Irving County each one keeping an eye on the population of the other. Neither one dares sleep out of fear that the other may be awake and each one keeps growing.

THIS CITY ALSO GREW.
Main street of Fort Worth, Texas, whose population increased 173 per cent. in ten years.

When the Indians began dying out rapidly in the Southwest, and venturesome capitalists started building railroads, new towns were projected so fast that the map makers were always several years behind. Everyone of these towns, as soon as it achieved a population of two hundred was afflicted with the court house fever. Indeed, for an ambitious town a month old and possessing a population of two hundred wandering and skittish souls, a court house is the surest anchor. It secures not only more permanent location but also an in-



ONE YEAR AGO A COW PASTURE.
Spur, Texas, with a population of 1,200 enthusiastic citizens.

A PLEA FOR HOME INDUSTRY.
How Fort Worth, Texas, appeals to local pride.

crease in population. Each new town watched the population of the old county seat and as soon as victory was sure an election was called and the court house moved. Then the old county seat watched its chance and worked to secure the county majority. This accomplished, another election was called and the court house moved again, taking a lot of population with it.

Vagaries of the Texas election law in its definition of a voter aided the frontier town builders in their work. One section of the law said that a voter's residence was maintained at the place where his washing was done. Resourceful town promoters soon saw the opportunity in this, and every town preparing for a court house fight became a great laundry center. Cowboys and railroad laborers, who were alike disdainful of the privileges of suffrage and the joys of clean linen, were bribed to give up their soiled shirts and receive clean ones in return and after a primary course in sanitation and politics voted with great skill and frequency. When the legislature met it always had to waste a good deal of time locating the new county seats. One session grew so peevish over it that a law was passed making it a felony, or a misdemeanor, or something of the kind, to move a court house in less than five years after its establishment. Since then competition for population between Texas towns has been compelled to develop in

FLOAT IN FORT WORTH PARADE TO ADVERTISE LOCAL SHEET METAL INDUSTRY.

other directions, in other words, the new development is *bona fide*.

In its early days San Francisco had a distinct advantage over all other American cities. It was founded under a Mexican grant which gave the city, in addition to the site for the city proper, a tract of four square leagues, to be owned by the city and used to provide free homes for its increasing population. With this land, enough to build a city the size of London, for the benefit of city homesteaders, any city of the present time would soon outgrow its rivals. Little of the San Francisco land went to home builders. Most of it passed rapidly into the hands of private owners in large tracts, and as the city grew anyway, the private owners became rich through lot sales.

This rivalry of the cities in their competition for population has been partly the reason for the vast increase in city population at the expense of the country.

GREAT CITIES HAVE GROWN OUT OF SMALLER BEGINNINGS THAN THIS.
Siena Blanco, Texas, whose citizens expect will grow into a metropolis.

PRETTY GIRLS ADVERTISE SWEET CANDIES.
An attractive float in a Fort Worth, Texas, home industry parade.

One hundred years ago a little more than three per cent. of the entire population lived in cities, the others being content to remain on farms in spite of the fact that none had rural telephones or rural mail delivery. During the hundred years the cities have been fighting for population, each one trying to be the biggest in its territory. They have acquired paved streets, libraries, museums, street cars, schools—a hundred new luxuries and conveniences until life in an apartment house in the modern American city offers the greatest possible amount of comfort at the least expense of money or care. In the meantime the farmers have secured, very recently, rural free delivery and a few rural telephones. To be sure the invention of farm machinery has lightened his labor. At the same time it has made the road to wealth easier and has sent the farmers scurrying to town in greater numbers. Every big crop year marks a corresponding increase in the city or small town population, a decrease in the number living on the farms. Indeed the only way to keep the farmer in the country has been to keep him poor. As soon as he can afford it he promptly sells his farm and as promptly moves to town.

In view of these facts it has seemed to be rather humorous that city dwellers should be preachers of the "back to the farm" idea. We go on making our cities more attractive so that they will compete for population with the country and then urge farmers to remain where they are or the city dwellers to go back to the farm.

Only recently have serious attempts been made by the states to attract farm population. Colorado now has a state immigration bureau, with an annual appropriation of $30,000 to be used in inducing farmers from other states or immigrants from Europe to settle on Colorado land. Missouri has a similar bureau and Kansas business men facing competition of this kind on the east and the west will ask the next session of the legislature for an immigration bureau.

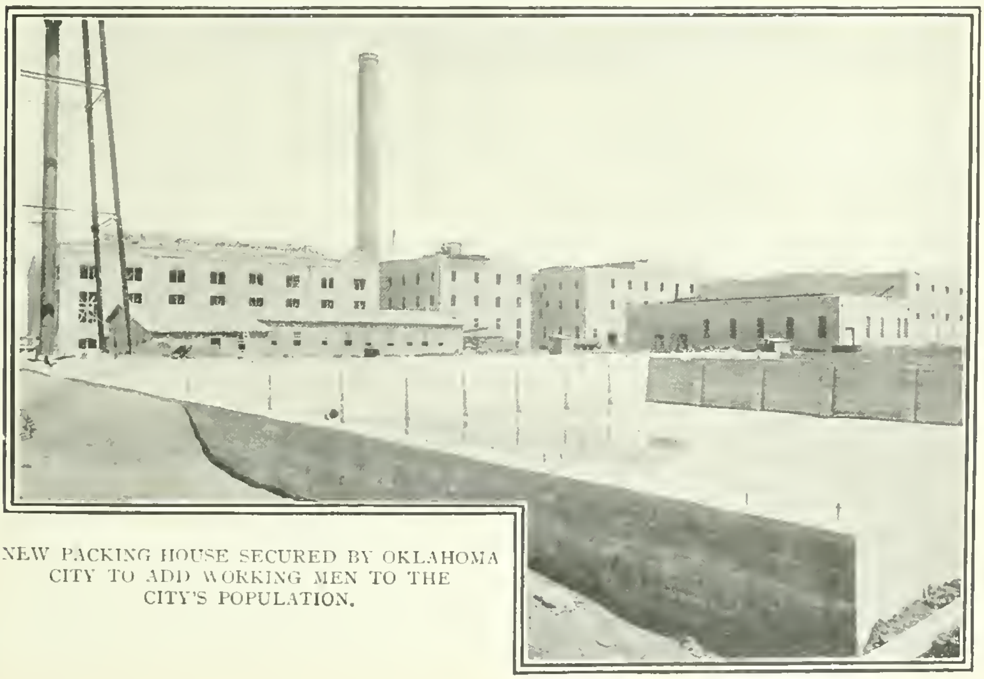
Before this work was taken up by a few western states the only attempts to attract farmer population were made by real estate and colonization agents with land to sell homeseekers.

Their methods are the same as those

of Hernando Cortez, who after conquering Mexico, sought to attract population from Europe by the enthusiasm of his reports about the richness of the country. The rapidity with which people crossed the ocean to the new land proved that Cortez was equally successful as a promoter and a conqueror. Stephen F. Austin, for whom the capitol of the State of Texas is named, was one of many colonization agents whose names are famous in American history. Austin took the first colony of Anglo-Saxons into Texas, while it was still a part of Mexico, and the literature he sent out descriptive of the country and its wonderful opportunities for farmers, would serve as a model for colonization agents today.

Competition for population moves in an ever widening circle, reaching from town to town, county to county, state to state and finally from east to west. Ever since the first colony was formed on the shore of the Atlantic the west and east have been competing, with the west winning all the time. In 1790, the center of population was twenty-three miles east of Baltimore. At the end of the century it was west of that city and it moved westward for a hundred years at the rate of five miles a year. Between 1850 and 1860 the movement was the most rapid, when it jumped from Parkersburg to Chillicothe, Ohio, a distance of eighty-one miles. Between 1890 and 1900 the westward movement dropped to fourteen miles but it is still moving. It has been a fight between the factories of the east and the cheap lands of the west, with the cheap lands winning all the time.

American population has spread over the map according to the opportunities for business, whether the business be farming or factories but long before towns began looking forward to census returns and boasting of the size the figures indicated, kings and armies decided the fights of rival cities or countries for population. Babylon was a struggling village five thousand years ago. Then King Hammurabi, who was a town builder with original ideas, started on his campaign of city building. He removed many rival cities from the landscape and made others pay big taxes for the privilege of existence. Babylon real estate advanced rapidly in value and many suburban additions were put on to take care of the increased population. The boom he started continued for 1,500 years until Cyrus, the Persian, captured it and



NEW PACKING HOUSE SECURED BY OKLAHOMA CITY TO ADD WORKING MEN TO THE CITY'S POPULATION.

then the real estate business suffered a sharp decline.

In later days some Levitican cities had a great advantage over their rivals in the fight for population, because of the fact that they were cities of refuge. Three of these were located on each side of the Jordan and to them anyone might flee and thereby escape the vengeance of the relatives of the man he had slaughtered. Bezer, Ramoth, Galan, Kedesh, Shechem and Hebron were the cities favored in this way. As there was a good deal of slaughtering going on at that time the roads leading to these cities were kept clear and signs marked the way to them. As an easy means of building up depopulated cities, this plan has been used with success in modern times. Louis XI made Paris a sanctuary in 1467, and some have been unkind enough to say that the growth of the city in population dates from that year.

The rules of the game have changed considerably since that time, but the results are accomplished in much the same way. Cities which control manufacturing interests collect taxes from their rivals with much more certainty than was ever accomplished by royal warrant. When a city secures concessions in railway rates it already has its rivals crying for mercy. A city which possesses milling in transit privileges immediately becomes a grain center. A city with favorable rates becomes a wholesale and jobbing center and all of these advantages bring with them the population increase which marks the prosperous and growing city.

In this respect the hustling rival cities of Texas (Dallas, San Antonio, Fort Worth and Houston are all hoping to be the metropolis at the next census) work under unique conditions. The Texas State Railroad Commission was formed twenty years ago, with almost autocratic authority over rates. It immediately adopted a policy of building up many centers of city population instead of allowing one or two cities to take all the business in sight. With the co-operation of the railroads a system of "sealing rates" was worked out. Surrounding each town is a zone in which the rates increase in proportion to the distance. This means that wherever two railroads cross, a jobbing center has sprung up, able to compete with its rivals no matter how large they may be.

OKLAHOMIANS ARE ENTERPRISING.
They know that well paved and parked resident streets bring an influx of desirable citizens.

In one sense the most serious rivals of any town are those located far away. Key West, with its large production of cigars, is the rival of every town which could support a local cigar factory. Battle Creek, Michigan, is the rival of every town to the extent that its breakfast foods have replaced home grown pork sausage or home grown ham and eggs. Every time a town buys from another anything it could make at home, it is encouraging and supporting a rival, even though the place be a thousand miles distant. Any town which starts in tomorrow to make its own flour, cigars, brooms, wagons, and do all of its own printing will immediately begin winning in the fight for population. This is not always possible but some cities have profited over their rivals by consistently patronizing home industry.

A few years ago a Home Industry League was formed in a Southern town by a few business men, mostly retail merchants. The city had a population of barely a hundred thousand, but members of the league found more than two hundred manufacturing establishments located there. Many of them consisted only of cigar factories employing one or two men. Other establishments employed several hundred. Members of the League called these manufacturers together and outlined a campaign to increase the home production of home-manufactured articles, thereby adding names to the local payrolls. Thousands of cards were printed bearing a pledge whereby the signer promised to give the preference to articles made at home, and, so far as possible, to buy them to the exclusion of others. The newspapers printed a good deal about the organization and nearly everyone in town signed the cards. As a climax to the cumulative campaign, a big street parade was given in which everyone of the home factories was represented by a float. The campaign attracted a good deal of attention and helped to increase the sales from local factories and encourage the establishment of others. Now the city observes a home industry week each fall. The merchants loan their show windows to the local factories and goods made at home are displayed in them. The town is decorated, carnival attractions are brought in and the week made a combination of pleasure and business united. It is a kind of annual revival for city pride backsliders.

Creed

'T is not the wide phylactery,
  Nor stubborn fast, not stated prayers,
That makes us saints; we judge the tree
  By what it bears.

And when a man can live apart
  From works on theologic trust,
I know the blood above his heart
  Is dry as dust.

—Alice Cary.

UNCLE SAM'S PROTECTED PIRATE

By

EDWARD B. CLARK

SHALL it not astonish the gentle minded people of the United States to know that the protecting arm of the Federal government has been thrown about a robber and a despoiler, a freebooter and a pirate to whom theft is pleasant and murder joyous?

Shall it not astonish the keepers of the commandments unto the last letter of the tenth of them to know that the winter home of the brigand and cut-throat is the Capital City of the United States; that man is forbidden by statute to molest him, and that his quarters are watched with jealous official eye lest his goings and comings be hindered, his peace of mind disturbed, and mayhap his life threatened?

[illegible] U. S. [illegible] AL SURVEY, BULLETINS, A. K. FISHER, HAWKS AND OWLS.

"THE PIRATE."

"The subject of this sketch," as the biographer wearied with repetition puts it, has been called within the space of two short paragraphs robber, despoiler, freebooter, pirate, cut-throat and brigand. The names are all taken from the dictionary of invection drawn on by Washington men for free and expressive use when they have found the forces of the government between them and him whom they would kill. The list could be made longer and perhaps more dignified by the inclusion of Rob Roy and Captain Kidd, for by use of the names of the Highlander and Sea Rover the milder tempered enemies of the villian have sought to epitomize the evil of his life.

The robber, despoiler, freebooter and the rest is a bird, and when any one of several names are given him the ornithologist will know him thereby—Duck Hawk, Peregrine Falcon, Wandering Falcon—the Falco peregrinus anatum of the scientist. Wandering falcon is the name which suits the bird best, for it is a wanderer on the face of the earth. It knows Africa and Asia and Europe and America and the Isles of the Sea. Its flight is typical of the freedom of the fields and in its eye there is the wildness of remote woods.

It was eleven years ago that the falcon chose the gray tower of Uncle Sam's Post Office Department building for his winter aerie. His life has been demanded many times and denial has always come.

One President of the United States, Theodore Roosevelt, made the bird his special charge and gave orders that if anyone were found in an attempt to molest it, "let me be notified at once." Four Doctors of Science of the Biological Survey have kept watchful eyes on the tower through the years lest some scorner of Federal law should seek the falcon's life. Twice the Police Department of the District of Columbia has interfered to save the bird from the multitude (word used advisedly) clamoring for his life. Twice the Postmaster General of the United States has interposed to prevent the waylaying and the killing of the hawk as it made its way back to its tower home. For eleven years the populace now and again has sought the falcon's life, and for eleven years it has been safeguarded by Uncle Sam.

This winter the falcon is once more at home in the City of Washington. It goes forth daily on marauding and murder intent, and before the day is ended it has known desire's fulfillment. The Government is solicitous for the welfare of the falcon for several reasons. Uncle Sam as represented in Washington, in two departments at least, is both a scientist and a sentimentalist. The Duck Hawk is a rare bird and a true falcon. Its courage is as the courage of ten. There is no fear in it. Its habit of life arouses a keen interest which is only equaled by the bird's own keenness of sense and flight when in pursuit of its quarry. The harm that it does is held as nothing when weighed in the balance with sentiment and interest. To exterminate the tribe of falcons the bird lover holds would be like cutting down a forest of great oaks because their shade interfered with the growing of one row of corn.

Every morning in winter from his gray tower overlooking the life of Pennsylvania Avenue the falcon puts forth to find its breakfast in the marshes of the Potomac. It is the epicure of the bird kind. It disdains mice and barnyard fowls and lives almost wholly upon game. Its delight is in the chase and it easily overtakes the teal in its "mile a minute" flight and seizing it, bears it away for a feast.

Once in a while extreme cold drives the water fowl of the Potomac marshes far away to the South, and then the falcon unwilling to leave its stone tower which it doubtless believes is a crag raised by nature for its special use, is compelled to turn for food to the hitherto disdained domestic pigeons of the city.

One day two years ago the wanderer, perhaps because it was not particularly hungry and perhaps in the sheer wantonness of a wild humor, dropped the body of a blue rock pigeon fairly on the head of a passerby on Pennsylvania Avenue. Then trouble for the freebooting baron of the gray tower began.

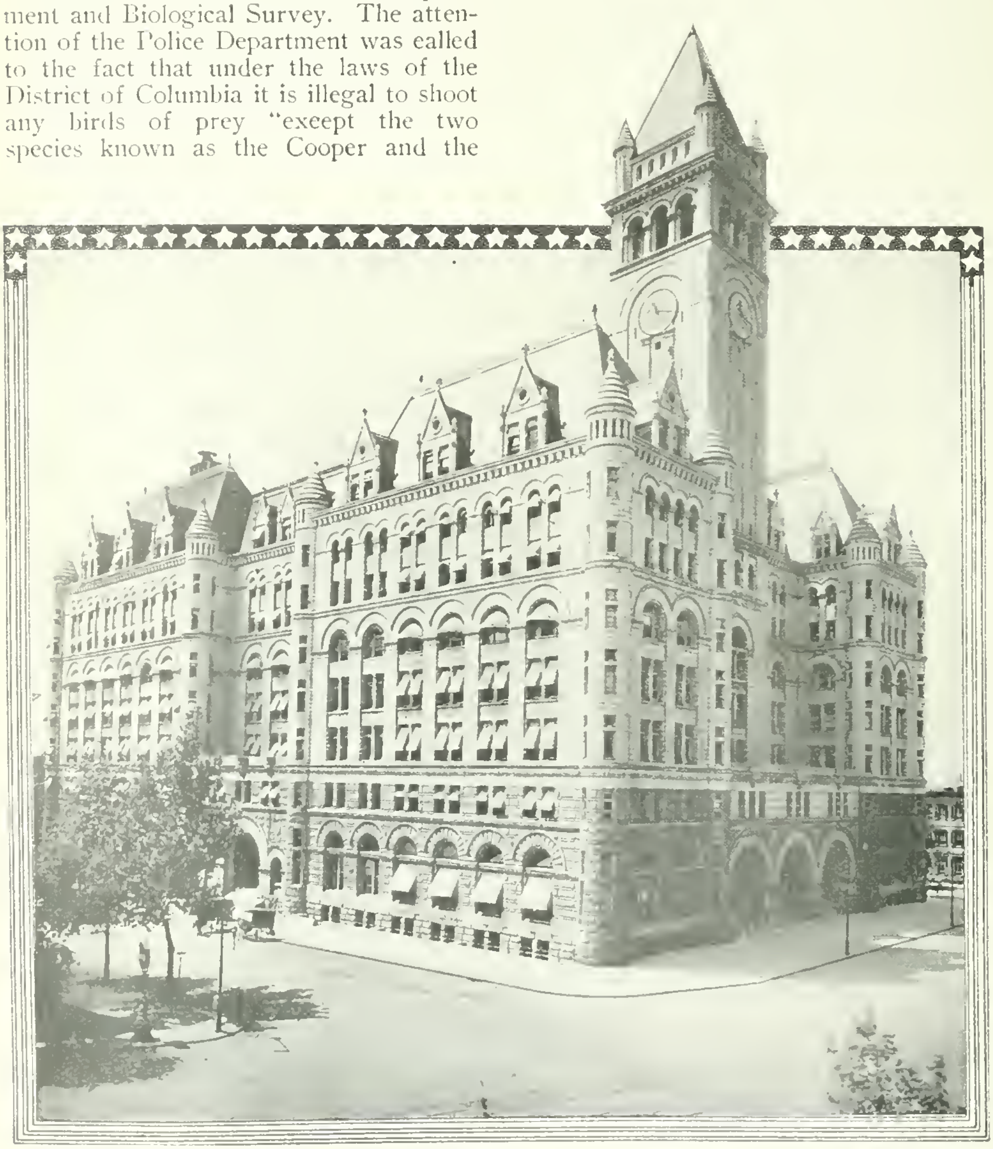
Complaint was lodged with an underling of the Post Office Department who knew hawks only as hawks, and knew them all as bad. A man with a shot gun went to the roof of the department building and took station just below the entrance to the tower. The falcon was seen returning, but it spied its enemy afar off and betook itself to sailing in magnificent circles about the tower, always just beyond range. Inviting pieces of raw meat was secured to tempt the bird down. The man with the shot gun did not know the daintiness of appetite of the wandering falcon. While the designing, but rapidly getting hopeless gunner was lying in wait on the roof an immense crowd collected on Pennsylvania Avenue and every man in it called for the life of the pigeon killer.

While the threats of the years had been many the wandering falcon for the first time was hovering near death. Then into the crowd on the streets came one of the bird's friends who knew its history and that its life was of more value than the lives of many pigeons. Call for help messages were sent to the White House, to the Biological Survey and to the Post Office Department. The Post Master General of the United States it happens is an ornithologist. It took about one minute to drive the gunner from the roof and another minute to nail up the door leading to the tower stairway. The falcon came down unmolested to its retreat.

The mere official act of throwing a gunner down a flight of stairs and of nailing up a tower door did not serve to cool the indignation, nor to curb the desires, of several Washington residents to make Rob Roy pay the penalty of his pigeon appetite. The bird of the tower had one day's rest from persecution and then his life was sought again from points of vantage other than the department roof, by dead-shots who had secured permission from the Police Department to kill "within the District a murderous bird bent on killing all the Washington pigeons."

Once more the hawk's friends rallied from White House, Post Office Department and Biological Survey. The attention of the Police Department was called to the fact that under the laws of the District of Columbia it is illegal to shoot any birds of prey "except the two species known as the Cooper and the Sharp Shinned hawks." The shooting license issued the day before were revoked and several disappointed dead shots put their guns back into their cases. The Federal law had saved the life of the "feathered pirate."

One year later "excitement came again" on Pennsylvania Avenue under the shadow of the tower. Word had been passed that "Baron Rob Roy, freebooter and murderer" as the daily press put it,

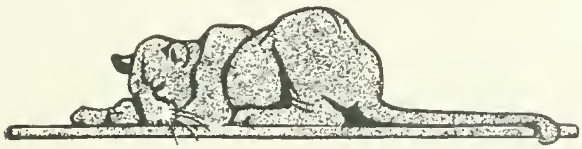


IN THE TOWER OF THE POST OFFICE DEPARTMENT BUILDING, WASHINGTON, ABOVE THE CLOCK, THE PIRATE HAS HIS LAIR.

had been caught in a steel trap while engaged in the degrading pursuit of trying to steal a restaurant keeper's chickens. In a yard within a block of the department building the pirate, confined in a chicken coop iron grated for the occasion, was shown to an exulting and enthusiastic crowd.

Word went forth at once that the Baron's days of freebooting were over and that while the Federal law said that he neither must be killed nor caught, yet it made an exception in case he was caught red-clawed in the act of murder. Quickly friends went to the scene of the imprisonment and there they found not the Baron, but an ordinary, rat loving, red shouldered hawk whose caste is ninety-nine degrees lower in the bird family than that of the falcon.

Before the exulting ones knew that their triumph was vain, a shadow passed over the chicken coop prison. Looking up the crowd saw Baron Rob Roy going down wind hot-paced to the river for a game dinner. He is still making the same daily journeys. His enemies still wait their chance. Uncle Sam says it will be a long wait and Uncle Sam is probably right.



The Hunting Season

A hunter popped a partridge on a hill;
It made a great to-do and then was still.
It seems (when later on his bag he spied)
It was the guide.

One shot a squirrel in a nearby-by wood—
A pretty shot, offhand, from where he stood.
It wore, they said, a shooting-hat of brown,
And lived in town.

And one dispatched a rabbit for his haul
That later proved to measure six feet tall;
And, lest you think I'm handing you a myth,
It's name was Smith.

Another Nimrod slew the champion fox.
He glimpsed him lurking in among the rocks.
One rapid shot! It never spoke nor moved,
The inquest proved.

A "cautious" man espied a gleam of brown:
Was it a deer—or Jones, a friend from town?
But while he pondered by the river's rim,
Jones potted him.

—Philadelphia Public Ledger.

How Ridiculous

THE FRIEND—"Your wife doesn't appear to be in very good humor."

HUSBAND—"No; she thinks I've invited you to dinner."—*Jean Qui Rit.*

The Polite Conductor

"CONDUCTOR!" exclaimed an irate woman who carried many bundles, as she paused on the platform of the crowded car, "I thought I told you that I wanted to get off at Fifty-second street."

"But, madam——"

"Don't you say a word! I know all about your car being very full, and not being able to remember where everybody gets off. I've heard all that before."

"But, madam, I——"

"You may be sure that I shall report you, sir; and for your impudence, too!"

She alighted, the conductor rang his bell and as the car started he said politely, as he touched his cap:

"I'm very sorry, madam, but Fifty-second street is half a mile further on."—*Chicago Record-Herald.*

Feline Creatures

SLIMM—"Our landlady says she likes to see her boarders have good appetites."

SMART—"Well, some women are naturally cruel."—*Boston Transcript.*

Domestic Bliss

"Do YOU and your wife agree?"

"Oh, yes, always—at least, I do."—*Cleveland Plain Dealer.*

What the Maid Said

MRS. DALTON had become very tired from shopping, and, slipping on her kimono, prepared herself for a period of rest. Her colored maid appeared just at this point and announced a caller.

"No, Anne," said Mrs. Dalton; "I cannot see him. Please tell him to excuse me as I am in negligee."

When the message was delivered Mrs. Dalton heard her visitor laugh so heartily that it even penetrated to her bedroom.

Calling Anne she asked the maid the cause of the hilarity.

"I dunno, ma'am, I really dunno," answered Anne.

"What did you tell him?" asked Mrs. Dalton.

"Why I done tole him to please 'scuse you, as you was naked as a jay."

Many Such

"KATHERINE SHREWSBURY is engaged to be married." "Who is the lucky man?" "Her father!"—*Town Topics.*

Her Memory

A YOUNG woman who forgets faces very easily and is painfully conscious of so doing, was riding in an open car one summer day. She felt a hand on her shoulder and heard a voice saying, "I beg your pardon, but you have forgotten——"

"Oh, not at all; I remember you very well," hastily interrupted the other, whereat the lady

of the hand at once straightened up and in a most frigid tone said: "I have not the pleasure of your acquaintance, but you have forgotten to button your waist."

And Will Be Again

FRENCHMAN—Pleasant woman, that! Is she unmarried?

CHICAGOAN—Yes; twice.—*Harper's Weekly.*

Worst Fears True

"How about this barefoot act you've booked for the op'ry-house? Some of the leading citizens are a little worried about it."

"We have suppressed all the objectionable features."

"That's just it. We was afeered you would."
—*Louisville Courier-Journal.*

How About Chain Armor

"Is it to be a street gown, madam?"

"Yes; something suitable for rioting in. I've joined the suffragettes."—*Kansas City Journal.*

As Language Is

"WELL, now that you have brought the subject up, Miss Dobbson," said little Fribley, "how old are you?"

"Oh, I am as old as I look," smiled Miss Dobbson.

"Really?" said Fribley. "I'm astonished. You really don't look it, you know."—*Harper's Weekly.*

Hard to Please

"WHAT is Bliggin's grievance against the railroad company?" "He has two grievances; one is that some of the trains don't stop at his station, and the other that after he gets on board the train loses time by stopping at other stations."—*Washington Star.*

Justice at Last

BREATHLESS URCHIN — "You're — wanted — dahn—our—court—and bring a hamb'lance."

POLICEMAN—"What do you want the ambulance for?"

URCHIN—"Muvver's found the lidy wot pinched our doormat!"—*Punch.*

Located

ONE OF THE STRIKERS—"I've lost me best hat-pin, Lizzie!"

ANOTHER—"Where did you leave it last?"

THE FIRST—"I left it sticking in that scab, Rachel Lispinsky!"—*Puck.*

The Virtuoso on the Farm

NEW BOARDER—"Haven't you got any fancy dishes here?"

RURAL LANDLORD—"Sure thing! Mame, bring the gentleman that mustache-cup your grandfather used to use!"—*Puck.*

Her Johnnie No Rose

A YOUNGSTER who was attending a public school in one of the large cities was sent home by the teacher for being untidy. The teacher wrote a note to the boy's mother requesting that Johnnie be given a bath. The boy returned to school the next day as untidy as before with a note from his mother to the teacher. The note read as follows:

"My Johnnie is no rose, don't smell him, learn him."—*National Monthly.*

We All Know Him

ONCE there was an old goat that tried to pass himself off for a sheep.

The watchful shepherd at once detected the imposture.

He killed the goat. But he sold the flesh for mutton.—*Chicago Tribune.*

Usually So

"I HAVE difficulty in satisfying my wife. She has a thousand wants."

"I have difficulty in satisfying mine, and she has only one want."

"What is it?"

"Money."—*Baltimore American.*

The Only Joy There Was In It

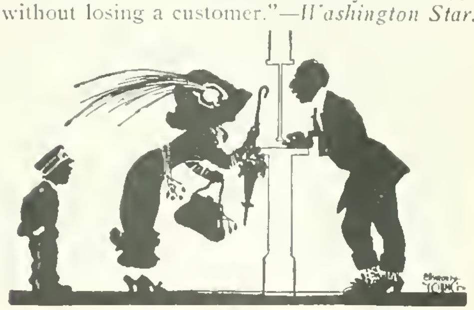
HE—Let us keep our engagement a secret for at least six months.

SHE—A secret? The only reason I got engaged to you was that I thought it would be nice to have my picture on the society page.—
Chicago Record-Herald.

Erratic Popular Taste

"YOUNG man," said the woman at the ticket office, "why don't you answer me when I ask you whether this is a moral and proper show?"

"Because," answered the theater treasurer frankly, "I'm not a good enough judge of human nature to know which way to answer without losing a customer."—*Washington Star.*



POPULAR · SCIENCE & MECHANICS SUPPLEMENT ·

HOW TO HOLD AN ALLIGATOR

ALLIGATOR catching is a strange occupation. The commercial value of these strange reptiles is, of course, their skins, and for this reason quite a small army of men hunt them regularly not only in Florida but their cousins, the crocodile, on the banks of the Nile and also along the Ganges. These creatures live to a great age, many in the East being known to be 500 years old, and by the tremendous strength which they can exert when occasion calls for it, one would imagine that the older they live the stronger they grow. Besides an un-

RIDING A ZEBRA IN GERMAN EAST AFRICA—A FAVORITE SPORT.

THIS IS THE PROPER WAY TO HOLD AN ALLIGATOR.

usual amount of pluck and resource in handling the alligator, one needs to have a keen eye and a quick hand. To secure your animal you must grip it instantly and then keep its jaws closed. As one alligator catcher remarked, "to hold the same jaws open would be an experience gained too late to be of use." For the alligator in its native land is not, as it appears to be, safely imprisoned at the zoo, a sleepy and slow-moving creature, but very quick and lively in all its movements.

BRICKS FROM VOLCANIC LAVA

A PLANT for the manufacture of bricks to be made of lava is now being erected near Honolulu, Sandwich Islands, under the direction of J. Rice, of San Francisco, Cal., and will be in readiness for active service within less than two months from date.

It is the expectation of the promoters to be able to contract with the United States government to furnish lava bricks

FIRING A WEAPON FROM THE MOUTH.

for the construction of military posts at Fort Shafter, Schofield Barracks, and also at Pearl Harbor and other points where the government is planning extensive buildings.

FOOT PADS, LOOK OUT

THE artist, Otto Neumann, in Berlin, has invented a firearm which can be shot off with the mouth. This peculiar gun can shoot a bullet of the caliber of a small revolver up to that of an ordinary army rifle. The apparatus is very carefully constructed, and the inventor secures as good results in shooting at the target as a good rifleman. As a matter of course the apparatus has to be used with great care to prevent the powder from exploding inside the mouth. It requires also strong nerves for the detonation is much louder than when a revolver or a rifle is shot off. It seems, however, to work satisfactorily in other respects.

STEEL FOR COFFERDAMS TO RAISE THE *MAINE*.
A shipment of 1,400 tons on its way from Buffalo to Philadelphia.

Graynella Packer.
Wireless Operator of the *Mohawk*, New York to Charleston.

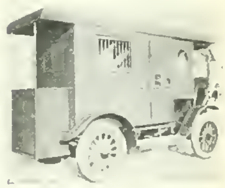
CHAMPION SNAKE KILLERS

TWO birds new to the eyes of Americans, are the curious pair of secretary birds, male and female, received at the New York Zoological Park, from South Africa. These stately, long-legged birds, with ashy grey plumage and tail feathers two feet long, are the champion snake killers of the world. The secretary is really a hawk, adapted especially for ground hunting. The male stands four feet high, the greater part of this being made up of legs and neck. The bird gets its odd name from a crest of long, dark plumes rising from the back of the head, which gives it a fanciful resemblance to a clerk or secretary, having a bunch of quill pens stuck behind his ears. All the food of the secretary must be alive, and two garter snakes, about a foot or so in length, form a favorite daily meal. When a snake is thrown on the ground for the bird to eat the wiry secretary does not fly upon the prey at once but cautiously approaches the snake with wings partly outspread so as to be ready to escape any sudden lunge of the enemy. The secretary slowly circles around his antagonist, keeping well out of danger; suddenly like a flash the secretary raises one of his powerful feet, with sharp talons, and strikes the snake a hammer-like blow fairly on the head.

The Secretary Bird in Action.

Four-Foot High Snake-Killer.

A Natty New Suffragette Costume.

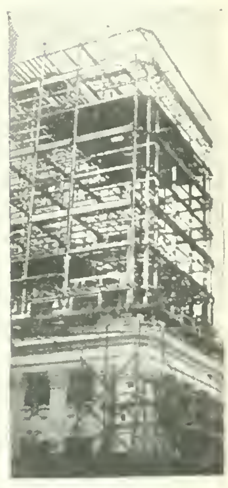


Armored Auto Bank, Said to Be Burglar Proof.

DROPS 100 FEET

THE only remarkable thing about this photograph of a modern skyscraper in Los Angeles is the fact that a structural iron worker recently fell from its topmost girder to the roof of a one-story building, a distance of one hundred feet, and sustained practically no injuries. He went almost through the roof of the small building, but as this was very elastic his fall was broken so that he received only bruises and slight fractures which disabled him but a few days.

A remarkable claim is made that a recent rain had wetted the structure, making it an unusually good conductor of electricity and that contact with a live wire had charged the whole frame. While working on a scaffold the iron worker touched the charged girder and jumped back off the building.

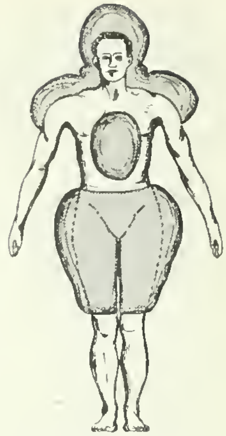


Workman Fell from Top and Lived.

PALM TREE GROWING THROUGH ROOF.
A 60-foot curiosity of Los Angeles, that is due to owner's sentimentality.

RUBBER ARMOR FOR AIR MEN

RUDYARD KIPLING has designed a costume which he suggests should be worn by aviators as a protection against injury in accidents. "As far as I can make out at present," he says, "men go up with less protection, except against cold, than the catcher of a baseball team, and with less body-guards than a baseball player. A little protection about the head and shoulders might make all the difference between life and death at the moment of the smash." Mr. Kipling's idea of protection is an air-inflated suit. With a view to protecting the spine and head he suggests a helmet of rubber inflated on the crown and around the back and over the collar-bones. What is needed, he points out, is the protection of the neck against a backward or forward wrench. The weight of the padding on the shoulders ought to cushion off the worst of a sideways wrench. To protect the spinal cord from being snapped and the dome of the head from fracture, the rolls under the chin would have to be made thick so that the head could be driven down on them without too much harm.



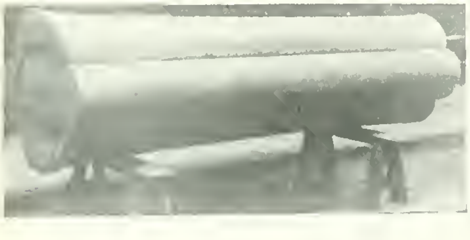
SOMETHING SOFT FOR AERONAUTS.

ONE OF THE BIGGEST GUNS IN THE WORLD.
This piece of artillery is of the so-called wire design and has been undergoing tests near New York City. It has a new form of disappearing carriage.

CHINESE COFFIN

A CHINESE coffin is constructed in a very substantial manner. There is about four times as much wood in it as in the average American casket, and it is wood of a much better quality than is employed for the cheaper grades of caskets in this country. The coffins are unusually heavy, and the four outer slabs of which they are made, are from six to eight inches wide. The logs are cut concave inside, as the picture would indicate, and little in the way of decorating or upholstering is done. There is none too much room inside, and the Chinaman is laid away in crowded quarters just as he lives in his sadly over-populated country or in his American "Chinatown."

The poor "heathen Chinee" seems destined to be hampered for elbow room, not only in this vale of tears, but in the world beyond—a sad fate, indeed, for the "yellow man."



THE FINAL DWELLING OF A CHINAMAN.

PIGS REARED ON BOTTLE

OUR photo depicts a litter of pigs recently born in the north of England, and who on account of their mother's death and no foster mother being available, were reared "on the bottle." The ingenious proprietor of the pigs has had a special trough made which holds five oblong bottles from which the pigs feed through teats inserted in the necks.

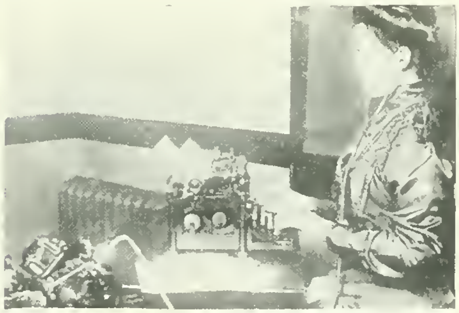
Five Little Pigs "Raised Just Like Humans." Feeding from the bottle.

BLIND GIRL STENOGRAPHER

TOTALLY blind yet heroically rising above her misfortune and pluckily earning her living as an expert stenographer and typist, Miss Mary C. Hays of Pittsburg, Pennsylvania, is a splendid example of the good results of applied charity and special education. Miss Hays was educated by the state at the Western Pennsylvania Institution for the Blind, Bellefield, and all the teachers and officials are justly proud of her. Miss Hays takes dictation from a phonograph and turns out flawless copy without assistance. She is one of the very few blind girl stenographers in the world, and is the only one, so far as known, who is working from phonographic dictation and turning out such a mass of work.

Here is one of those cases, which every now and then come to light, of a determined soul who simply refuses to be overcome by any handicap that nature or misfortune may put in the path, and who seems to be placed as an example for the less courageous to follow.

Triple Lawn Mower for Cutting Grass of Different Lengths and Its "Power."



Blind Stenographer Who Takes Dictation from a Phonograph.

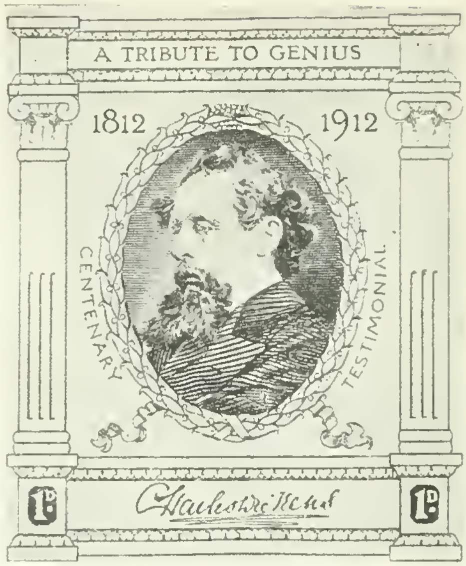
PREHISTORIC AVIATOR

COULD some subtle influence restore the inhabitants of the animal kingdom of prehistoric ages, and make it possible for us to see the living form of the petrified remains shown in our illustra-

This Creature Used to "Aviate."
A Pterodactylus, or flying reptile, of prehistoric times.

tion, we might mistake its flight through the air for some venturesome aviator of the present day. Our illustration shows the petrified remains of what is known as a Pterodactylus, or flying reptile, whose species has been long since extinct. Its elongated fingers had a flying membrane attached somewhat like a bat, and when in flight must have resembled the planes of an airship, as it was of colossal proportions, measuring about twenty feet from point to point. Its body measured sometimes as much as four or five yards, while the head was entirely out of proportion and developed abnormally, its jaws being almost thirty inches in length. A number of these petrified remains have been discovered in the Smoky Hills of Kansas.

The posterior limbs of this creature reached a development sufficient to carry it over the ground in half running flight, similar to birds, and like birds it could also lift itself into the air. Its jaws and mouth, although of such huge proportions, were not of powerful build, and authorities tell us that it was considered of feeble strength considering the development of parts of its body.



A New Way to Recompense Literary Heirs.
Proceeds from sale of these stamps will go to Dickens' descendants

This Lady Is Neither Sitting Nor Deformed
The strange fore-shortened effect is produced by taking photo from above.

DICKENS TESTIMONIAL STAMPS

THE first of the proof sets of the Dickens testimonial stamp has been forwarded to the King by his majesty's express desire. Each stamp bears a water mark as a safeguard against forgery. The committee hopes that at least ten millions of these stamps will be sold as a centenary testimonial to the descendants of Dickens. It is not yet decided how the money shall be spent, but it is hoped that a memorial to Dickens may be included in the scheme. Americans ought to have a share in the purchase of these stamps, if only because this favorite English author became amazingly popular here largely without profit to himself, because of piratical publishers. In the old days, before the enactment of an international copyright law, English authors were at the mercy of American publishers, who paid them not one cent in royalties.

BATHING SUIT A LIFE PRESERVER

SOMETHING entirely now in the line of a life preserver has been recently discovered by a German scientist. It is made in the form of a lining to bathing suits and possesses the peculiar quality of floating the wearer upon the surface of the water. The material and process of manufacture is probably a secret one as no information seems to be available as to its character. It possesses, however, fully as useful qualities as the bullet-proof-cloth that has been much experimented with as a lining for army uniforms. The buoyant qualities do not interfere in any respect with the persons performing all the customary feats of swimming, but should any injury befall the swimmer the material supports the wearer in the water until someone can come to his aid. Bathing suits of this material are also of particular advantage to beginners at swimming schools, it being impossible for them to go under water.

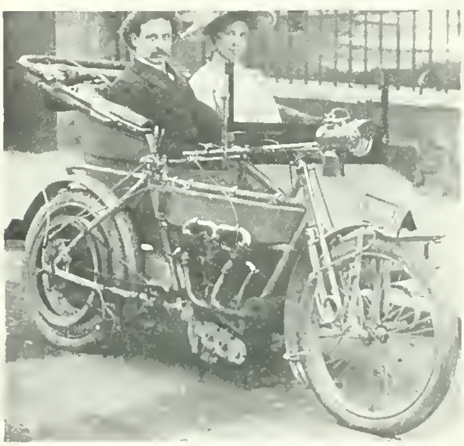
BATHING SUITS AS LIFE PRESERVERS.
A new idea that has appeared in Germany.

BIG YIELD OF ALFALFA

FARMERS in the lower Rio Grande Valley of Texas are finding alfalfa a very profitable crop. Near Mercedes, one of the new towns in that rapidly developing region, is a field of alfalfa that was planted December 20, 1910, and within a period of twelve months after the seed was sown it yielded nine cuttings. Each cutting averaged one ton per acre or nine tons per acre for the twelve months. It is stated that alfalfa always produces a larger yield after the first year. The wonderful results that are being obtained from this and other fields of alfalfa in that section are attributed to the ready manner in which the roots of the plants take hold in the soil and the attention that is given by the farmers in irrigating the growing crops. The success of the alfalfa industry is causing considerable attention to be given to raising hogs by these farmers. It is proven to be an ideal feed for the animals and they quickly fatten on it.

REMARKABLE ALFALFA FIELD IN TEXAS.
Nine cuttings were made on these acres within a twelvemonth.

"Will You Walk Into My House?" Says the Man to the Fly.



Neither Auto Nor Motorcycle.

SCIENTIFIC FLY TRAP

OF late years the house-fly has been recognized as a carrier of disease, and consequently any invention which will check its pernicious activities is of importance. The western invention illustrated herewith is a cylindrical trap of wire netting, which is attached to a window pane by means of a vacuum rubber support. Below the cylinder is a semicircle of metal arranged in such a way that flies walking on the pane will be led to the entrance of the trap and, once in, they are unable to find their way out. This ingenious little device is really built on scientific principles as the inventor has evidently studied the habit of flies on the glass and has noted the propensity to follow any obstacle they meet instead of turning back.

MECHANICAL FREAK

OUR photograph well depicts to what lengths the London manufacturer will go in search of novelty. The vehicle shown below, which is half motor car and half cycle, is striving to attain popularity amongst that intermediate class of people who are not rich enough to buy a motor car, but who want something more than a motor cycle.

UNUSUAL PUNCTURE

AUTOMOBILE tires have a way of collecting a great many articles more or less detrimental to the life of the tire. The wit's definition of a puncture—a hole in the tire where all the pleasure of motoring goes out—must have been felt by the owner of the car whose tire picked up the rather unusual souvenir shown in the illustration. Automobile tires in order to increase their usefulness and life should not be run when in a soft condition. This was the cause of the railroad spike attaching itself to the tire in such an unusual way. It is a well known fact among the makers of automobile tires that a hard tire is able to resist picking up objects along its path much more readily than when not properly inflated.

NEW SUB-IRRIGATION

AN entirely new type of irrigating tile overcomes the difficulties met with in other pipe and tile system of irrigation. It is claimed that it solves the problem of sub-irrigation. This tile is of cement construction. One-half of the tile is cast of pebbles, which have been thinly coated with cement. This leaves that part of the structure porous and permits the water to flow freely into the ground. At the same time, the pores or openings through the gravel wind about in such tortuous courses that it is an effective protection against them being obstructed by roots or dirt, it is claimed.

GEORGIA WATER POWER

THE southern part of the United States is awakening to the possibilities of water power, and one of the greatest projects along this line is the construction of a power plant near Macon, Ga. The dam is ninety feet high and will hold back approximately a billion gallons of water when the sluice gates are closed.

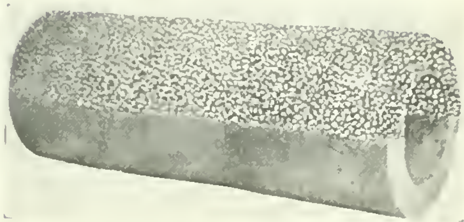
Electricity will be generated and transmitted to Macon and Atlanta at a pressure of 100,000 volts, the amount of current generated being sufficient to light both cities and run local street and interurban cars as well.

NEW TRAVELING CRANE

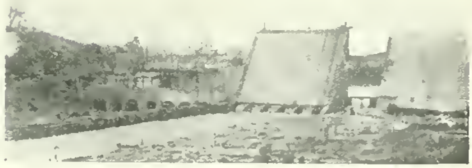
THE new traveling crane which is shown by the accompanying photograph is in operation in a large factory in a suburb of Paris. It is a rolling bridge composed of a large, movable horizontal iron beam placed at a certain height above the ground, which carries the crane proper. This beam turns about a fixed pivot, placed at one extremity, while the other extermity is placed on a rolling circular aerial road supported by posts. The crane, which is operated by an electric motor, can be moved the entire length of the beam.

By the rolling, aerial circular track, material may be carried to any place in the vicinity of the shops, even though they are placed irregularly.

Spike Punctures Auto Tire.



Tile for Sub-Irrigation.



Huge Power Plant at Macon, Ga.

Variation in Traveling Crane.

A Car for Sick People on an English Train.

WHERE THE CABLE LANDS

IN the accompanying photograph is depicted the typical sign and cabin which is to be found around the English Coast at such places where submarine cables "come to land." Inside the cabin is contained the transmitter, etc., with spare supplies which can be drawn upon in time of necessity. The cabin shown here stands near Dover, England, and is the sea terminus of one of the Paris-London cables.

SEA TERMINUS AT DOVER, ENGLAND, OF PARIS-LONDON CABLE.

A GRUESOME CHAMBER

IN some of the churches and monasteries of Rome there are chambers decorated with human skulls and bones obtained by the monks from the catacombs. The latter are rightly regarded as one of the sights of the world. Although they do not extend beyond three miles from the city walls, the total length of the galleries is estimated to be about 600 miles, and the number of graves at some two million. The galleries are usually about eight feet high and from three to five feet wide, and the graves are niches cut in the walls. It was in the catacombs, too, that the early Christians held services and hid during the time of the persecution. To-day nothing is to be seen in the graves, the skulls and bones having been re-

A CHAMBER OF HORRORS IN ONE OF ITALY'S RELIGIOUS INSTITUTIONS.
Skulls of Christians who lived in the days of the Roman Empire

CUTTING A SECTION OF HENRY CLAY'S MONUMENT IN STONE.
Sculptor's model is in background.

moved, but in a number of religious institutions in Italy may be seen chambers full of these skulls of the early Christians as depicted in the accompanying photograph.

A Freak, One-Tined Fork Bicycle from France.

RESTORING HENRY CLAY MONUMENT

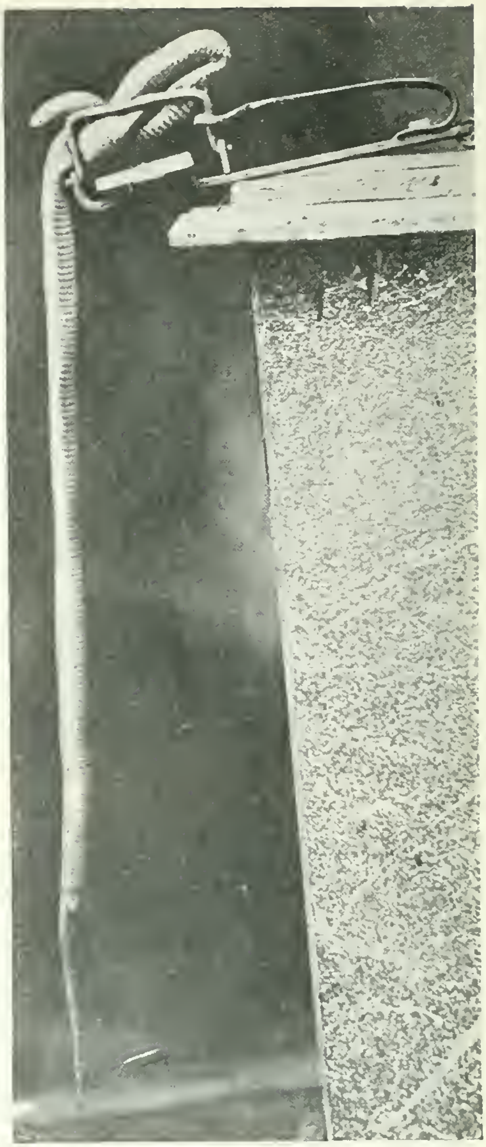
THE historic monument to Henry Clay standing one hundred and thirty feet high over the tomb of the great Commoner at Lexington, Kentucky, is now undergoing its second restoration, after having been twice struck by lightning. When it was first shattered by the elements about two years ago, the Kentucky legislature appropriated $10,000 for its replacement or the execution of a new statue and this work had been completed only a few months, when lightning again selected the famous memorial for its target and tore a large section out of its side. Sculptor Charles J. Mulligan of Chicago has been again called to the work of restoring it, which it is expected will not necessitate such heroic efforts as did the first course of repairs.

When the appropriation was made for the repairing of the statue after its first stroke, the committee in charge was in doubt as to whether the historic memorial could be saved at all, and the committee was empowered to contract for a new statue if it was thought advisable. They accordingly instituted a competition among sculptors and architects for suggestions. The plans of Mr. Mulligan met with the most favor.

Boy Wonder in the Chess World.

NEW BOY WONDER

A BOY chess "phenom" is astonishing the veteran players of Philadelphia. E. M. Edwards, the new wonder, is a thirteen-year-old schoolboy. He can be seen almost every day playing the cracks of the Mercantile Literary Chess Club, and compelling many of the best players of that ancient organization to admit defeat. Recently Edwards played a simultaneous game against six opponents at the Norristown Chess Club. He played, in all, eleven games, winning six, losing one and drawing four. Young Edwards has tried his skill unsuccessfully against Dr. Laskar, the world's champion. He recently played a game with Capablanca, the Cuban prodigy, and lost by a narrow margin. With years he should develop into one of the famous chess players of the world.



Reptile a Victim of Rabbit Trap.

SNAKE CAUGHT IN TRAP

IT is seldom indeed that the wily snake is caught in such a homely contrivance as a wire rabbit trap, but this fine specimen of a grass snake was recently caught in a Suffolk—England—field. It is interesting to notice too how completely his body has been enfolded in the trap, in fact his body is bent and caught twice between the teeth of the wires.

A Hobo of the Dark Continent.

AFRICAN "WEARY WILLY"

AFRICA has her tramp problem just as we have and the eccentric costume worn by this "son of rest" in Basutoland is one of the picturesque features of the village of Mesari. As he absolutely refuses to work the villagers feed him and clothe him in the strange assortment of rags and tatters shown in the photograph.

A Shark That Was Caught by an Angler.
Vicious wolf of the sea taken after fierce struggle.

THE HAMMER-HEAD

ONE of the oddest catches on record in southern California is the weird looking sea monster shown herewith, a variety of shark known as the hammer-head. It will be seen that its head is really shaped like a mallet with one eye at each end, a broad, shovel-like snout and under it a formidable array of teeth. This is one of the fiercest members of the shark family, and its large size makes it a pretty ugly customer to handle, as it often attains to the length of twelve feet or so. This one was caught in Long Beach after a desperate struggle with the angler, who is—and quite properly—very proud of his catch.

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HANS VON KRAMER, INVENTOR OF WIRELESS PHONING FROM MOVING TRAIN.

BANISHING THE WHEELBARROW

AN invention which seems to do away with the wheelbarrow, at least as far as the laying of brick pavement is concerned, is shown in the illustration. The device, which is known as a roller brick carrier, looks like a long steel ladder laid in an inclined position from the sidewalk to a point near the center of the street. What appears to be the rungs of the ladder are really steel rollers set very closely together and running on ball bearings, upon which the bricks are laid and allowed to run down to the street by gravity. To keep the bricks from running off the sides, the rollers are made with flanges at the ends. Among other advantageous features, the carrier delivers the bricks to the exact point where they are to be used, saving the two handlings which are required when the material is delivered with the wheelbarrow. Such an invention as this makes for speed, profit, and efficiency.

WIRELESS PHONING FROM TRAIN

MR. HANS VON KRAMER is the inventor of a wonderful system of wireless telephoning from a moving train. He has just conducted highly successful experiments on the London and Brighton Railway, and the company have decided to install the system, making a start with the Southern Belle Express. Passengers traveling in the train will be able to send and receive messages, no matter at what speed the train is traveling.

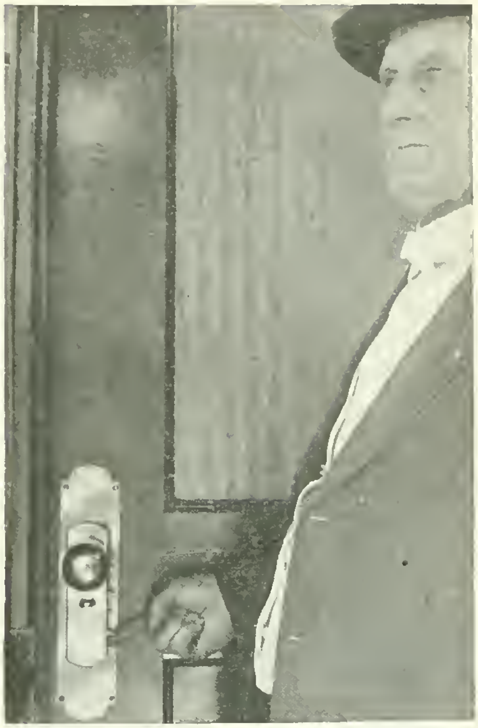
OAK, HUNDREDS OF YEARS OLD, IN HAMPTON COURT PARK, LONDON, PROTECTED BY ENGLISH GOVERNMENT.

ROLLER BRICK CARRIER BANISHES THE WHEELBARROW.

A KEYLESS LOCK

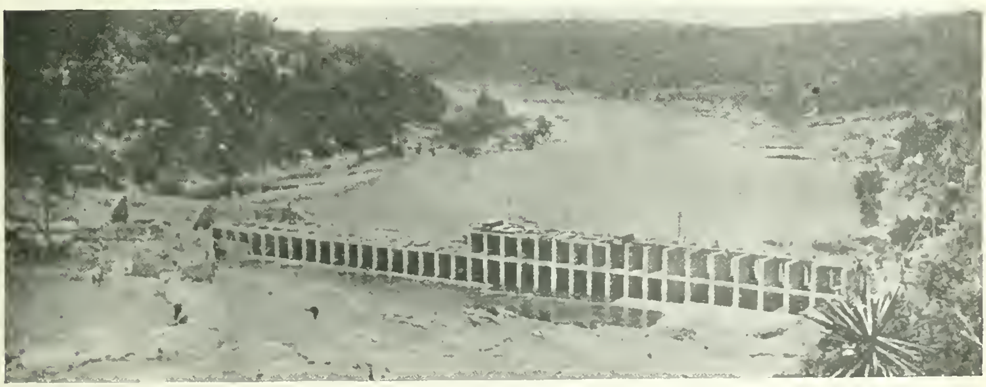
A KEYLESS lock, recently placed upon the market, resembles in appearance almost any other door lock in a general way, having a handsome door plate and knob, but at the right side and a little below the knob is a series of four small levers. These operate in various combinations known only to those who are permitted free access to the house, and can be changed to a different combination when necessity demands. The lock can be adjusted so that it will lock on closing or by turning the small button underneath the knob. It is opened by pulling upward one or more times on one or more of the levers at the side. So simple is its operation that a child too small to unlock a door by means of a key can readily gain admittance with the keyless lock. This keyless mechanism can be attached to any standard lock so that the purchase of an entire new lock is not necessary in order to have the advantages of the keyless lock. A keyless padlock is also manufactured with 38,005 different combinations.

These are days when more brains than ever must be used if burglars are to carry on their profession profitably.



A KEYLESS LOCK THAT IS OPERATED AFTER THE MANNER OF A SAFE COMBINATION.

"CLOSED IN ALL AROUND."
An auto that keeps everyone warm, including the chauffeur.



REMARKABLE DAM BEING BUILT ACROSS THE COLORADO RIVER AT MARBLE FALLS, TEXAS.
The flow of water through the concrete chambers will be regulated automatically by means of steel gates.

REMARKABLE PHOTOGRAPH OF AIR-FLIGHT

The ill-starred Moissant in his course around the Statue of Liberty. The goddess seemed almost to be holding her torch for the purpose of lighting the path to this too-daring aviator.

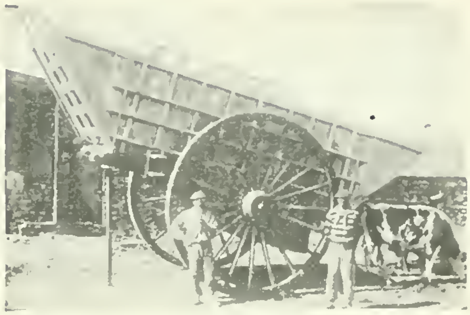
Sculptured Glass.
Beautiful work done in artificial crystal that resembles cameos.

SCULPTURED GLASS

A WONDERFUL example of the glassmakers' art is that depicted in the accompanying photograph. It is a piece of sculptured glass in the form of a beautiful plaque. It has the appearance, too, of a delightful cameo. This effect is produced by fusing a thin layer of opaque white glass on a thick layer of dark brown glass. The design is carved upon the white surface, and the various depths of the carving allow the dark background to tint the white glass to different shades, exactly as in a real cameo. Naturally, the work has to be done by a skilled artist by hand and it occupies a great deal of time. The plaque shown took eighteen months from start to finish and is valued at several hundred dollars.

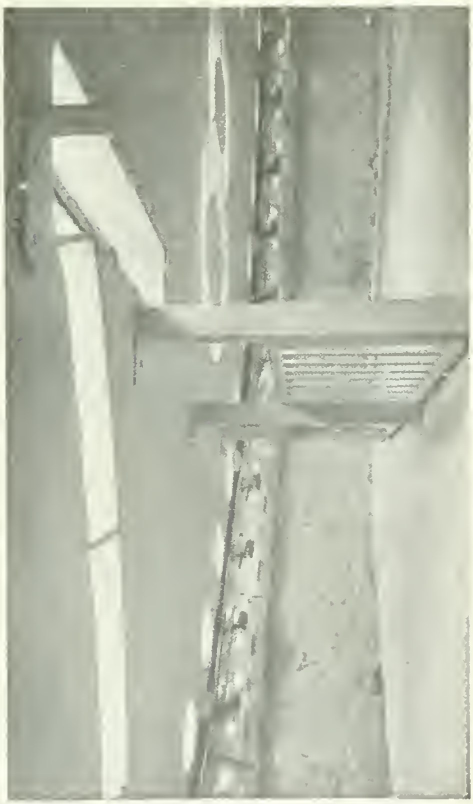
A HUGE CLOCK

HALF-WAY up the 700-foot white tower of the Metropolitan Building, New York City, at the 26th story, are the four dials of the most remarkable timepiece in the world. The dials are 26 feet 6 inches in diameter, with Arabic numerals 4 feet high and 60 circular minute-marks each 10 inches in diameter. The clock and its no less remarkable auxiliaries, the chimes at the 46th story and the flashing lantern at the tip-top of the tower, constitute a stupendous advertisement. The time can be read from



Where Wheels Grow Large.
Mighty oxcart used for hauling bulky articles in India.

a long distance, by day or by night, on the dials, and every quarter-hour between sunrise and sunset the chimes peal out in strong, harmonious tones. From sunset to sunrise powerful flashes of red and white light, streaming from the tower tip and visible on clear nights for fifteen miles, announce the hour.



Inside a Huge Clock.
How one of the figures on the dial of a great timepiece appears at close hand.

MIXING THE MORTAR.
The women helped from the very beginning of the task.

PUTTING ON SHINGLES.
Here the ladies of the church found more employment.

THE STAR PERFORMANCE
Here was the women's triumph when the work was done.

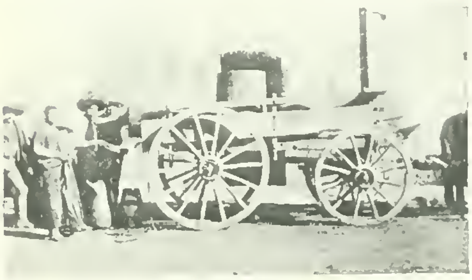
CHURCH BUILT IN SEVEN HOURS.
The finished structure and its builders.

CHURCH BUILT IN SEVEN HOURS

JUST to show how expeditiously a labor of love can be performed, a church was built in Long Beach, California, recently by more than one hundred men and women in the remarkable time of six hours and forty minutes. This did not include the foundation which has been laid several days in advance in order to allow the mortar to set; but it did include everything else. The building was done by volunteer labor, sixty members of the local carpenter's union and sixty business men working together in harmony and at top speed. They were assisted by the women of the congregation who not only furnished a good meal for the laborers at noon but also got out and mixed mortar and nailed shingles like professional builders.

Work began promptly at eight o'clock on the morning of Labor Day, Sept. 5th, and the work was so well systematized that there was no confusion. The pastor was as industrious as any, clad in overalls and valiantly wielding a hammer, and some of the most prominent women in the church did not scorn to roll up their sleeves and hoe in the mortar bed or risk pounding their thumbs while assisting the shinglers. Other ladies, who were not needed in preparing the lunch, carried bricks to the masons who were building the chimney, and finally when at 3:40 the last nail was driven the women washed all the windows and cleaned out the building so that it was ready for a service that same evening. Every detail was complete, even to the locks on the doors.

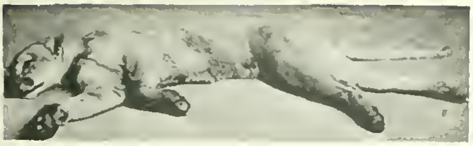
AN ISLAND THAT FLOATS.
Extraordinary formation of lands on water's surface at Lake Sadawga, Vermont.



PEDDLING PULQUE.
Wagon that conveys intoxicating liquor about the streets of Mexican cities.

FLOATING ISLAND

IN Whitingham, Vermont, on a small body of water known as Lake Sadawga, one can see the unusual phenomenon of seventy-five acres of unattached soil locally famed as "The Floating Island." This island consists of a vast nexus of roots of reeds and trees which are overspread by a thin layer of earth. Quantities of moss, flags, cat-tails and other vegetation which favors moist localities, are found in great profusion. The trees are mostly beeches and firs, some of which are of great age, but they grow to a height of only about twenty-five feet, and at that point the growth is arrested, probably on account of interference with their nutrition. Fishermen cut holes through the soil and fish through them just as one fishes through the ice in winter.



A Panther with a Record.
Marauding beast killed on a Texas ranch after much damage to stock.

DESTRUCTIVE PANTHER

THE panther shown in the accompanying illustration had a record of slaughtering three yearling colts, one three-year old horse, one two-year old mule and a number of calves and sheep upon the ranch of A. B. Collins, near Uvalde, Texas, during the period of six days immediately preceding the final hunt which ended in its death. It was chased for eighteen hours by a pack of hounds and a party of cowboys, led by Mr. Collins, who shot the animal when it was brought to bay by the dogs. The panther weighed 246 pounds and measured seven feet four inches from the root of its tail to the tip of its nose. Panthers, wolves and coyotes are very destructive to the live stock interests of the ranch territory of Texas and other parts of the country. It is estimated that in Texas alone these animal pests destroy annually cattle to the value of more than $500,000.

PLACE TO EAT LOBSTERS

PROBABLY the most unique and least known of all the summer establishments at Newport, R. I., is the red frame structure, startling in its simplicity, which is of more than ordinary interest, however, as it is the lobster eating bungalow of Mr. J. Pierpont Morgan. When here the great financier makes it his business to lead the "simple life," and to enjoy the delicious fresh crustaceans especially trapped for him in the near by ocean. These are served broiled in old southern style. The bungalow is picturesquely located on the rocky bluffs a short distance from Bateman Point, on the famous Ocean Drive. It has wide porches commanding an extensive panorama of the Atlantic. Mr. Morgan's one-story structure stands in marked contrast to the other magnificent mansions.

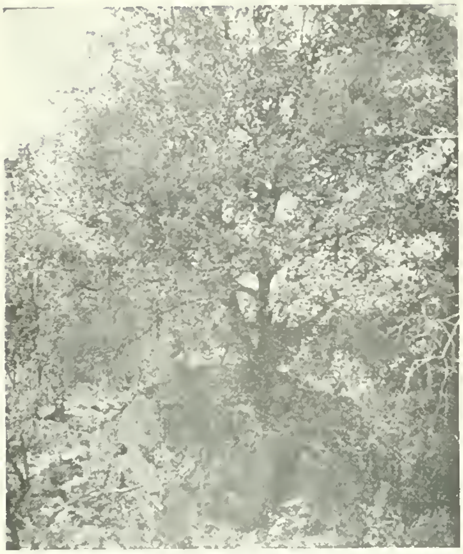
School's Own Oil Well.
Oklahoma district school owns a valuable bore that produces revenue.

SCHOOL'S OWN OIL WELL

ONE school district in Oklahoma is not only self-supporting, but has a surplus in the bank toward building a larger and finer school. It is in the Oklahoma oil district and a well in the school yard pumps enough oil to pay the expenses and bank a balance, after having paid in addition to that for the present building. The photograph shows the oil pump as it stands in the rear of the schoolhouse.

Lobster Eating Bungalow.
House built at seaside near Newport by J. P. Morgan, for enjoyment of sea-foods.

Interior of Bungalow.
Simple surroundings satisfy rich connoisseur in pictures and shell-fish.



LIVE OAK SPLITS ROCK.
Growing tree breaks huge boulder in two near Yosemite.

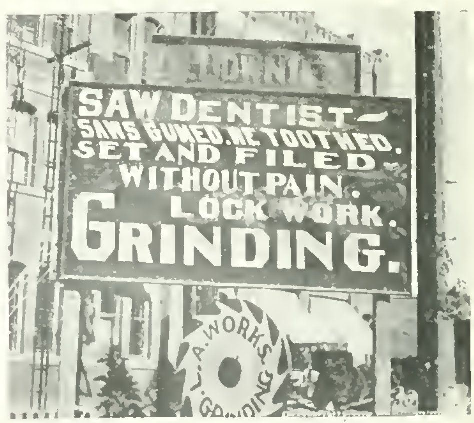
LIVE OAK SPLITS A ROCK

SOME idea of the force exerted by the roots of a growing tree may be gained from an inspection of the accompanying illustration. The tree is a live oak, growing at El Portal, close to the entrance to Yosemite National Park. How the tree happened to start growth in so unfavorable a location is, of course, unknown; but having started, its tiny rootlets forced their way into crevices of the great sandstone boulder upon which it grew, and, as they enlarged, they split the boulder asunder. Residents of the neighborhood can remember when the boulder was only slightly cracked by the roots of a slender sapling. The sapling has grown into a fair-sized tree, and its expanding roots have parted the big rock.

STRANGE PLACE OF BURIAL.
Doorless house, with windows nailed on the outside chosen by Indian chief for his final resting place.

UNIQUE BURIAL HOUSE

THE Makah Indians, living on the northwest coast, have a curious custom of depositing all the effects of a deceased person in the grave with the body, believing these articles may prove of use in the happy hunting grounds beyond. Huge canoes are often dragged long distances and left to moulder by the grave of the departed owner. Recently, when a chief died, his dwelling was torn down, and a new house built over his grave from the pieces. This house, which is shown in the reproduction, might be said to be hermetically sealed, for no provision whatever is made for ingress or egress. The windows are simply nailed to the outside. One pole has a blanket fluttering from the top; the other a whirligig, to frighten away evil spirits.



ODDITY IN BUSINESS SIGN.
This ought to be a business getter, and is. It is the sign of a Western saw-repairer.

Snow-plowing by Motor.
Device in European city for removing clogging snow from pavements.

Home of an Old Sea-Dog.
Pilot house of dismantled steamship utilized as a dwelling.

SNUG HARBOR

THAT one can be contented in cramped quarters is shown by the accompanying photograph, which pictures the habitation of a man in a Western seaport. His house is exactly seven feet by six feet, being the discarded pilot-house of a Puget Sound tugboat. In this miniature house is a bed, stove, table, chair, and shelves for books, provisions, etc. The owner, who is a retired seafaring man, declares he has ample space to accommodate a roomer.

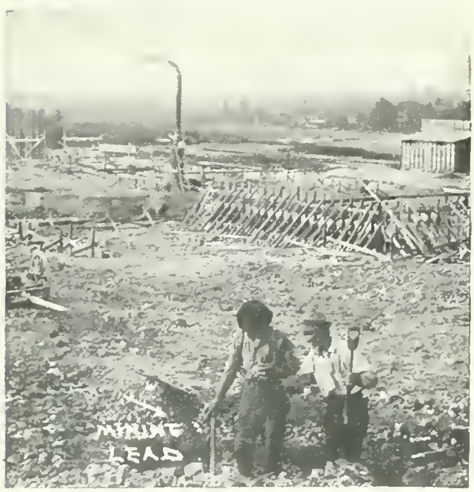
ITALIAN MILITARY BALLOON

THE accompanying photograph illustrates the construction of the military dirigible balloon which made its first trip from Bracciano to Rome passing over Lake Bracciano from its shed at Vigna Volle. Some most interesting and successful experiments in Aerial Navigation have been undertaken in Italy with a view to their use in the Italian army service.

ORE AT THE GRASS ROOTS

LEAD ore, in paying quantities, has been encountered at a depth of two feet beneath the surface of the ground by workmen excavating for the new Union depot at Joplin, Mo., the metropolis of the Missouri-Kansas-Oklahoma zinc and lead district. Turn-ins from the shallow mine shown in the accompanying photograph have amounted in value to more than $300 a week, while the aggregate valuation of the finds is in excess of $2,000.

Italian Military Balloon.
The Italians do not make much noise about their air-flights but they, too, are experimenting.



Lead Ore at the Grass Roots.
Odd discovery on site of new railway station at Joplin, Mo.

Sacred Mountain in Silk.
Curious fancy-work piece picturing the Japanese Fuji-yama.

A Thorough Smash.
All that was left of a small old-fashioned engine, recently struck by a newer giant near Holt, Mo.

A Riddle in Stones.
Symmetrical arrangement of these boulders has puzzled scientists.

Motor-car Made from Junk.
Automobile built by Mariposa man, from parts of old well-digging and farm machinery.

FUJI-YAMA IN SILK

ONE of Japan's principal industries is that of silk culture, and this is certainly well represented at the White City. By means of models, photographs, and charts every process of sericulture from sweeping the egg-cards to the removing of the woven fabric from the loom is minutely shown. What is claiming no little admiration in this section is the wonderfully realistic representation of Fuji-yama, the sacred mountain of Japan, built up of hundreds of thousands of silk cocoons. As the model is 180 feet in length and towers some 18 feet in height it will be seen that it is a no mean attempt to reproduce this famous mountain.

RIDDLE OF THE SOUTHWEST

ONE of the most curious of American archaeological riddles awaits solution in Northern New Mexico, a few miles from the Indian Pueblo of Taos. Large, rounded cobblestones are unusually abundant for a locality so far from the river, and the cobblestones are distributed with a system and regularity that makes it certain that they were placed by human hands. They are arranged, for the most part, in rectangles, with here and there a circle, covering an area not less than twenty-five square miles in extent.

It is plain that these were the foundation stones of an adobe city, but nowhere else in America have ruins been found of any prehistoric city at all approximating this in size. How long ago it flourished, or by what sort of people it was inhabited, is a point upon which the myths and traditions of the Southwestern tribes are silent. The Pueblo of Taos is known to have occupied its present site for at least four hundred years.

LIFE-SAVING CARS

LIFE-SAVING cars that are expected to prevent the loss of hundreds of lives annually in the coal mines of the United States, were put in operation November 1 by the new federal Bureau of Mines. The cars, six in number, will occupy stations in the centers of the principal coal mining regions.

MINE RESCUE CAR.
Special coach owned by the United States Bureau of Mines and used in mining districts for emergency, rescue and hospital work. It is fitted with all hospital arrangements.

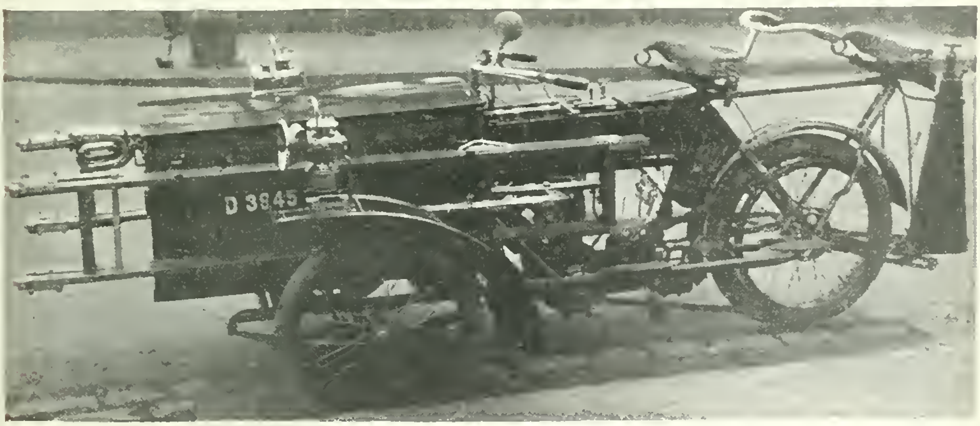
MINIATURE FIRE BRIGADE

HERE is reproduced a photograph of a miniature and complete fire brigade which has just been placed on service in a fire station in one of London's suburbs—Beckenham. The miniature fire fighter is a 12 horse-power auto tricycle with two seats and completely equipped with scaling ladders, extinguishers, fire hose, hand pumps and all the accessories necessary for first aid. It can travel 40 miles an hour and already has done splendid service.

NEW SHIPYARD IN ENGLAND

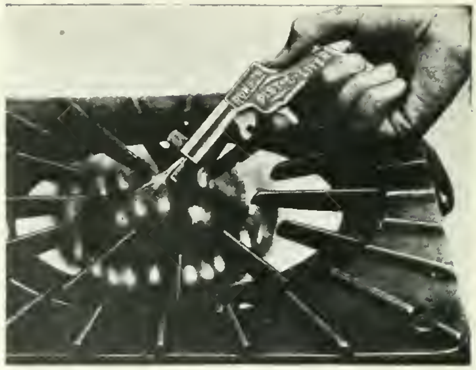
A DESCRIPTION and plan of a new seventy-acre shipyard near New-Castle-on-Tyne are on file in the bureau of manufactures. In clearing land and making the river frontage, $2,500,000 will be spent before the works are begun.

An Artist in Fruits.
Here is the worker making the dishes of fruits which are pictured on the opposite page.



MINIATURE FIRE BRIGADE.
Small emergency motor fire apparatus used in Beckenham, a suburb of London, England.

World's Mightiest Ship.
The latest leviathan of ocean liners after she was successfully launched.



Lighting Gas by Pistol.
Ingenious arrangement of flint and steel for use of housekeepers.

BACK TO THE FLINT

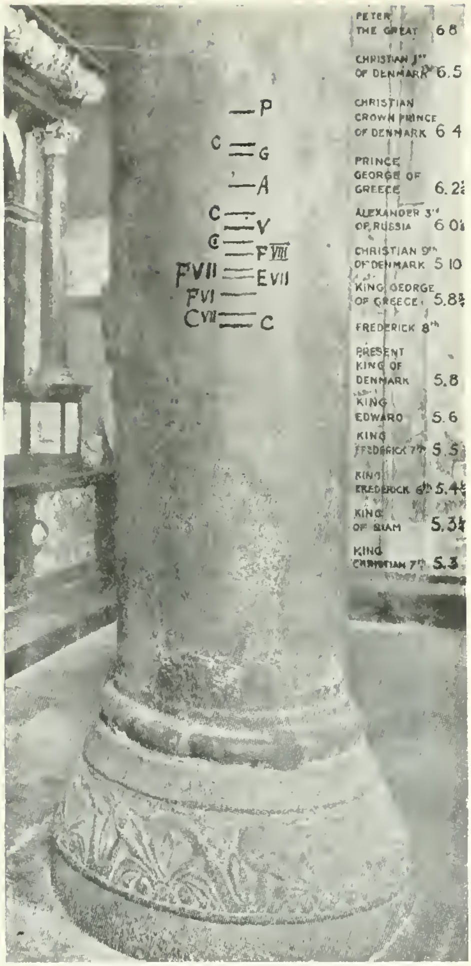
THE story is told of an old lady who saved matches by keeping the gas burning all the time, and yet ridiculous as this may sound, the millions of matches manufactured each year by the numerous match factories in this country, bear silent witness to the fact that it is no small item of expense in American life. In order to eliminate the necessity of carrying the match a versatile inventor has revived the flint and steel of our grandfather's day and placed it upon the market in a new and unique form. The lighter looks like a pistol and is so constructed that when a trigger is pulled a steel bar, having its surface roughened, issues for a short distance from the muzzle and in doing so passes across a piece of flint. This produces a shower of sparks sufficient to light any gas jet.

LAUNCHING OF THE OLYMPIC, WORLD'S GREATEST STEAMSHIP.
This vessel represents all that is newest, best, fastest and most luxurious, as well as biggest, in ocean greyhounds. She is 860 feet long and of 48,000 tons burden.

Japanese Tallow Trees.
Experimental planting of trees that yield a high grade oil useful in the arts.

JAPANESE TALLOW TREES

EXPERIMENTS made at the United States government's plant testing gardens at Fort Brown, Texas, in growing the Japanese tallow tree have proved so successful that many of these trees have been distributed among the farmers of the lower Rio Grande Valley section and considerable attention is being devoted to their cultivation. It is stated that the nuts of these trees contain an oil which is used in the manufacture of a high grade of varnish and that the product is in great demand in this country. The climate and soil of the extreme southern portion of Texas where the trees are being grown seems splendidly adapted to them. The trees, of ornamental appearance, are of quick growth.



Where Kings Are Measured.
Column in Roskilde Cathedral, near Copenhagen, where the height of many sovereigns is registered.

TINY MODEL OF A TROLLEY CAR.
Made by Lester L. Kneeland of Lynn, Mass. It is perfect in mechanism but not even big enough to hold "little son."

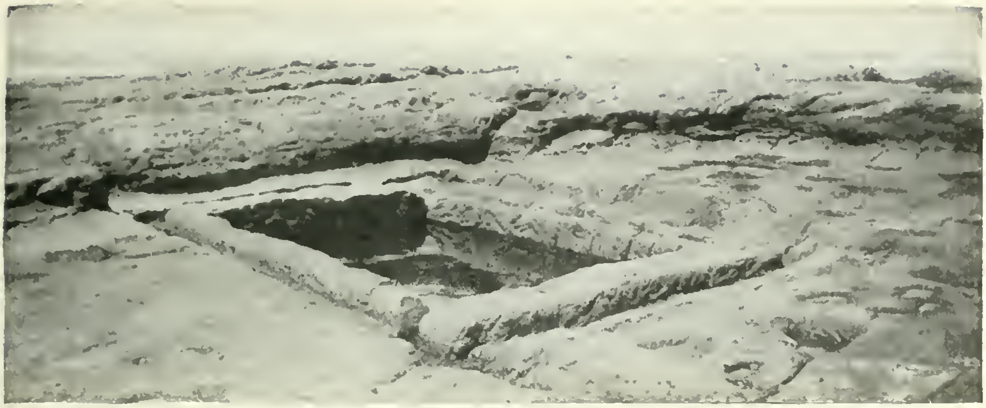
BUILDING A CONCRETE BRIDGE IN A DAY.
Remarkable scene on the Pennsylvania, where a bridge was built in a day at York, Pa., without delaying trains.

INDIAN IRRIGATION.
Man and wife drawing water to put on the fields with what is known in India as the donkli. The most primitive way to water crops. Labor and life are equally cheap.

CONCRETE BRIDGE IN A DAY

PROBABLY never before in the history of railroading has a permanent bridge been erected as quickly as that recently built by the Pennsylvania Company in the suburbs of York, Pa. It is built of nine large slabs of reinforced concrete, which after being molded to exact dimensions were placed alongside the railroad, convenient to the bridge that was to be replaced. At the appointed time two immense steam cranes, mounted on cars, tore up one-half of the old bridge bodily, tracks, spans and all, and deposited it on the solid ground. One by one the great blocks of concrete were lifted into place, but so rapidly was the work accomplished that in thirty minutes after the first half of the old bridge was removed the new section was there to take its place, with track all laid ready for the passage of trains.

The other half of the bridge was replaced in much the same manner, and the entire structure was completed in a single day and not a single train delayed on account of the work, and the bridge is located on one of the busiest sections of the road, trains following one another very frequently.



ANCIENT BATH-TUB.
Curious excavation in the rocks near San Diego, California, believed to have been once used for bathing purposes at time of low tide.

ANCIENT INDIAN BATH

AT a point on the Pacific Coast, a few miles below Delmar, California, there is to be seen in a rocky ledge a peculiar basin which has been cut in the solid rock. It is some six feet by four and of a depth of about five feet. At high tide the basin is filled, but at low tide it and the surrounding rock ledge are exposed. About the basin are gutters which allow the surplus water to run off. It is supposed that the basin was used by the Indians in early times as a bath, the sea-water being heated by means of hot stones, and that invalid redskins made visits to the scene to seek

HERE'S WHAT THE IGUANODON WAS LIKE.
Curiously resembling the Kangaroo in its general appearance this prehistoric beast was of colossal size and was a dangerous customer. He stood twenty-five feet high when upreared.

THIS FELLOW WAS SIXTY-SIX FEET LONG.
He is called the Diplodocus and his back seems strong enough to carry the epithet.

relief from their skin diseases or other afflictions. The bath is quite symmetrical and is conveniently placed for such a purpose.

BEASTS OF A BYGONE AGE

AT Mr. Carl Hagenbeck's famous animal park at Stellingen, near Hamburg, there are now being erected life-size representations of the great monsters that inhabited this earth millions of years ago. The idea of the proprietor is to present to public view faithful and accurate specimens, so far as science can tell, of the great beasts that roamed this globe in the distant past.

In all, some thirty are to be erected. The work is being carried out by Mr. J. Pallenburg, a well known animal sculptor. They are being built around the shores of a delightful little lake, some three acres in extent. These weird beasts of almost countless ages ago are being built up of that very handy substance, cement, and at the time of writing some fifteen were already out of the builders' hands.

THESE WATER DWELLERS ARE KNOWN AS TRICERATOPS.
They look like the mistakes that nature made in her first attempts to produce animals of strength and beauty.

APRIL

INDIANS OF THE GREAT FUR COUNTRY OF THE NORTH.
The aborigines initiated the white men into the mysteries of trapping, and made possible the big fortunes derived from the fur industry.

THE TECHNICAL WORLD MAGAZINE

VOL. XV APRIL, 1911 NO. 2

TO MUZZLE THE FREE PRESS

In the closing hours of the session the "rider" increasing magazine postage was withdrawn and provision was made for the appointment of a committee to investigate the whole subject of second-class mail matter and its cost.

THE TECHNICAL WORLD MAGAZINE—like every other established standard magazine—represents an investment of several hundred thousand dollars. On this large investment the present net return is very modest—less than could be safely secured in other lines of business.

The increase in postal rates from one to four cents a pound on all magazine advertising pages, which the administration attempted to force through Congress, would probably wipe out the profit entirely and might leave a deficit.

It is admitted, then, in the first place that this magazine opposes the postal increase for purely selfish reasons. But if there was nothing more involved than a financial loss to its publishers they would make up the deficit—or go out of business—and not attempt to bother the reading public with a statement of the case.

But, with no desire to make rash charges, with every wish to be generous and fair in its judgments of public men, this magazine is forced to the conclusion that there are involved in the postal increase consequences of the gravest import to all the people of the United States.

By way of clearing the way, let it be said that the TECHNICAL WORLD MAGAZINE does not ask—nor will it knowingly accept—anything in the shape of a subsidy from Congress. President Taft and his advisers may urge the granting of ship subsidies; they may approve in the highest terms the passage of a tariff bill which gives vast subsidies to wool trusts, steel trusts and other dropsical infant industries. This magazine prefers to stand or fall on its own merits. It is not only ready but anxious to pay a fair price for postal service.

But it submits to the fair-minded public that in determining what is a fair price for postal service and in putting any change into force, the following principles, among others, should be followed:

1. The fair price should be—can be—determined only after a full and careful investigation, such as would satisfy any reasonable business man.

Postmaster General Hitchcock declares that the present postal deficit of $6,000,000 is due to the fact that it costs many millions more to carry second class matter than is paid for the service.

Mr. Hitchcock is an ambitious politician who has been Postmaster General for about two years. His statement is questioned by Senator Boies Penrose of Pennsylvania, the chairman of the great

Post Office committee of the United States, who, speaking in the Senate within a year, said:

"It is idle to take up such questions as apportioning the cost for carrying second class mail matter or the proper compensation of railroads for transporting the mails until we shall have established business methods in postoffice affairs by a reorganization of the whole postal system."

Senator Carter of Montana, also speaking in the senate, said in March, 1910:

"I deeply sympathize with the earnest desire of the department officials to get rid of the deficiency they are fated to encounter every year, but I submit that the first real movement toward that end must begin with the substitution of a modern, up-to-date business organization for the existing antiquated system."

Senator Carter is also an old member of the Post Office committee and is thoroughly acquainted with its problems.

The total gross receipts of the post office department for the last fiscal year were $224,000,000. The total deficit for the same year was 2.6 per cent. To the man on the street, who knows something of the way politics has entered into the administration of the post office department, it will appear perfectly reasonable to believe that a saving of less than three per cent of the gross receipts of such an enormous and complicated business may easily be made by the adoption of approved business methods.

In the meantime it is safe to take the word of Senators Penrose and Carter —both experts in postal matters—that until the post office is put on a nonpolitical and business basis it will be impossible to make such an investigation as to fairly apportion the cost of transporting and handling any class of mail matter.

Postmaster General Frank H. Hitchcock, Who Advocates Increased Postage Rates on Magazines

Since, however, Postmaster General Hitchcock insists on blaming the magazines, it is to be noted that in 1870, before second class mail matter was put on the pound basis, at all, the deficit was more than twenty-one per cent of the gross receipts of the department. In 1880 the first year after the pound rate went into effect—when there was a sudden jump in the amount of second class matter—the deficit was less than ten per cent of the gross receipts.

Five years later—in 1885—the law was passed which reduced the postal rate on second class matter to one cent a pound. And between 1880 and 1890 the total weight of second class matter had been multiplied by three. Yet in 1890 the postal deficit—staggering as it should have been under this awful burden — dropped to less than nine per cent.

After 1900 the increase in the weight of second class matter was stupendous. And with each year's increase the postal deficit decreased, until in 1902 it amounted to only 2.4 per cent of the gross receipts. Deficits since then have been due to the appropriation of millions for free rural delivery — in which the Technical World Magazine fully believes. The loss on free rural delivery in 1910 was nearly $30,000,000—the total deficit of the department was less than $6,000,000.

It would appear hard indeed to show any connection between magazine advertising and deficits in the postal department.

2. The same rate of postage should apply on all varieties of mail matter

falling under the same class, without, at least, unfair discrimination among them.

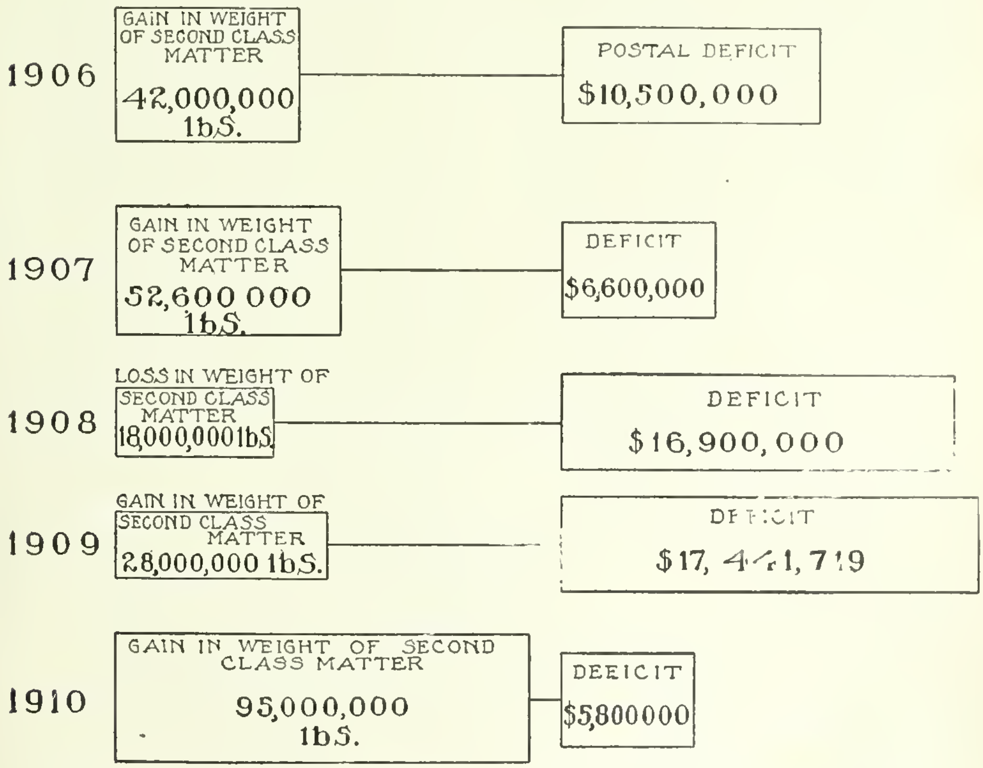
The gross weight of newspapers mailed yearly in the United States is several, times greater than the gross weight of magazines. Both come under the head of second class matter. Yet Postmaster General Hitchcock says that the increased cost of postage shall apply only to magazines and that newspapers shall be carried at the old rate of one cent per pound. His reason for this discrimination is that the magazines are on the average carried through the mails for a longer distance than the newspapers. Therefore they should pay more for the service. It costs, says Hitchcock, five cents to transport a pound of magazines and two cents to transport a pound of newspapers.

But the handling and distribution of mail matter costs much more than its mere railroad transportation. The average magazine weighs a pound. It takes four or five average newspapers to weigh a pound. Therefore there is four or five times more work to be done in handling and distributing a pound of newspapers than a pound of magazines.

Mr. Hitchcock's own figures—which we think inaccurate and misleading—make his argument ridiculous. To haul and *handle* a pound of magazines, as derived from the figures of the department—costs 6.4 cents; to haul and *handle* a pound of newspapers costs 8.75 cents. And the magazines make up—again according to Mr. Hitchcock—only about one-third of the total weight of the second class mail.

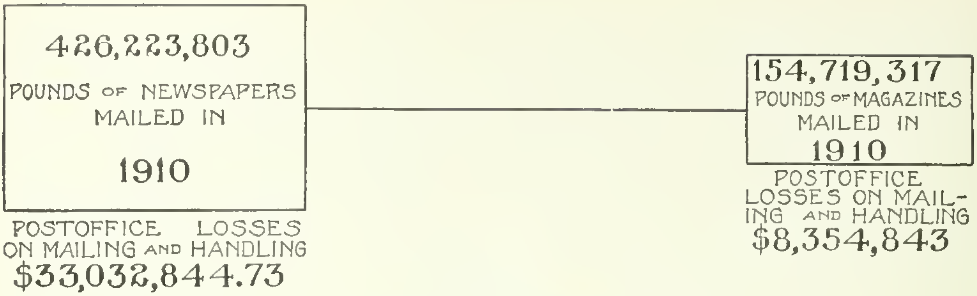
In other words the department's own figures show a loss in hauling and *handling* newspapers of more than $33,000,000, against a similar loss of $8,400,000 in hauling and *handling* magazines.

Why should this discrimination be shown in favor of the newspapers? A cynic, knowing the tremendous political



IS THE POSTAL DEFICIT DUE TO SECOND CLASS MAIL? THESE FIGURES SEEM TO DISPROVE THAT CONTENTION.

Note that, with one exception—1909—an increase in the quantity of second class mail produced a decrease in the deficit; a *loss* in weight of second class matter—1908—*increased the deficit.*



WHY RAISE THE RATE ON MAGAZINES AND LET NEWSPAPERS GO AT THE OLD FIGURE?

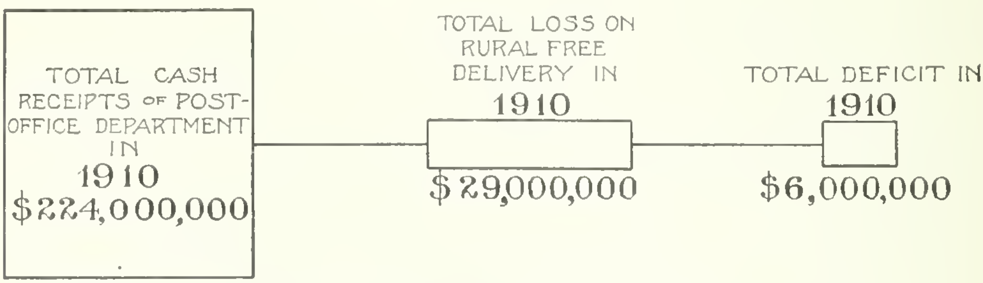
power of the newspaper press, might suggest an answer.

Again it may be stated, in passing, that under the present law all newspapers and other periodicals which are mailed for distribution to actual subscribers in the county of their publication are carried absolutely free, provided only that they are not mailed at a letter-carrier office. The object of this exemption is, of course, to provide for the circulation of the small country newspapers, chiefly weeklies. And this magazine, for one, thinks it a perfectly proper provision of the law.

Another reason which Mr. Hitchcock gives for putting the whole burden of the increased cost of postage on the magazines, is the alleged fact that they carry a greater percentage of advertising than the newspapers. This statement is not accurate. A comparison of the volume of advertising in newspapers and magazines is obviously hard to make. But, by careful measurements, it appears that the newspapers contain about four per cent more advertising than the magazines, in proportion to the amount of reading matter.

So far as the present business organization of the department is concerned, it is a matter of common knowledge that a large percentage of the postmasters appointed by every successive president are really nothing but the political agents of Congressmen and of other officeholders. In many cases—every man will be able to recall them in his own experience—these political postmasters practically turn over the management and operation of the postoffices to subordinates and devote almost all their own time and attention to their individual business or to political work. Certainly if every postmaster were compelled to give his individual attention to the postoffice, a considerable saving in clerk-hire and other expenses could be made.

Postmaster General Hitchcock and President Taft apparently recognize the fact that this great opportunity for saving exists, for they have recommended that first class postmasters be put under the protection of the civil service law. This will remove them from politics and insure to competent and honest public servants, permanent positions in the postoffice service.



THE PRESENT DEFICIT IS LESS THAN THREE PER CENT OF GROSS INCOME.
Could not a non-political post office department, organized and run on a business basis, save that per cent in the expenses of administration alone?

Once this great reform is put into effect it is believed that the present deficit will promptly disappear—unless, indeed, the department decides to make rural free delivery universal or institutes some other public convenience which cannot, and should not be expected to, pay its own way.

3. Any change in postal rates should be made by Congress on its own merits, with plenty of time for discussion and consideration.

The law increasing the postal rate on advertising pages of magazines was hitched onto the postal appropriation bill as a "rider" in the Senate Committee on Post Office, under the lash of the administration and after the bill had passed the house. This method of forcing legislation through a reluctant Congress by attaching it to an absolutely necessary appropriation bill is recognized as so unfair that in some of the states of the Union it is absolutely prohibited.

It is the method frequently adopted by shrewd and determined men, who desire to secure the passage of bills which would have no show if they stood by themselves.

So introduced in the closing days of a crowded and tumultuous session, it was made impossible for the magazines to get a fair statement of their case before Congress or before the public.

To attempt in this indirect and underground way to take "snap judgment" on the magazines is not worthy of a dignified and sincere statesman. It suggests, rather, the peevish and spiteful determination of an angry politician to punish and, possibly silence, certain of his critics.

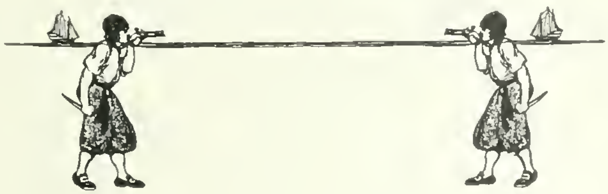
It is to be noted that the movement to increase the postal rate on magazines did not originate in Congress. It is the pet project of Postmaster General Hitchcock and has been endorsed by President Taft. And it is exceedingly unfortunate that the bill is so worded as to apply almost exclusively to those magazines of large circulation and influence which have taken a leading part in the discussion of public affairs and in criticism of certain policies of the administration.

One of the worst features connected with the increased rate on magazine advertising pages is the tremendous power which it puts in the hands of the Postmaster General. The increase applies only to magazines and not to newspapers. Now what is the difference between a magazine and a newspaper? Is Collier's Weekly, devoted almost entirely to the discussion, illustration and description of current events, a newspaper? Are the magazine sections of the great Sunday newspapers, printed in close imitation of recognized magazines, newspapers or are they magazines? These questions—and a thousand like them—only the Postmaster General is authorized to answer.

No one wishes for a moment to suggest that Postmaster General Hitchcock would be guilty of using such a tremendous power for any ulterior purpose. But suppose a case where a Postmaster General is an unscrupulous politician, devoting most of his attention to political manipulation and wire-pulling?

Suppose he is desirous of stopping adverse criticism of the administration with which he is connected or of recognizing the flattery of some complacent periodical? By a nod of the head, he might reward his political friends and punish his political enemies.

Are we ready in this country for the appointment of a press censor, with a lash and muzzle in one hand and a fat piece of meat in the other—to say nothing whatever of the absolutely crushing power of the post office department behind him?



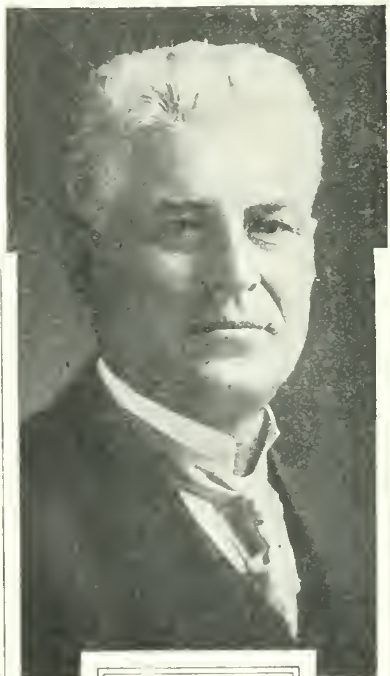
A POTATO AMBASSADOR

By

ARTHUR CHAPMAN

IN the endeavor to find out why the United States, with its immense area of arable land, cannot always raise enough potatoes to supply the home demand, the Department of Agriculture has had a "potato ambassador" abroad, studying potato conditions in Europe.

E. H. Grubb, of Carbondale, Colorado, known as the "Potato King" of the Centennial State, has been making official investigations for Uncle Sam, and he has found that American potato growers have much to learn of foreign farmers before the crop in this country becomes great enough to supply the demand from year to year. Mr. Grubb has specialized in potato culture for years, though he is also celebrated as a livestock raiser. It was on his suggestion that the government established a carriage horse-breeding station in Colorado, to develop a national type of carriage horse, and he put the need of better potato conditions so convincingly before Secretary of Agriculture Wilson that a scientific investigation of conditions at home and abroad was determined upon and Mr. Grubb was chosen to carry out the work.



E. H. Grubb.
Uncle Sam's "Potato Ambassador."

"I have found that the foreign farmers, in the great majority of cases," said Mr. Grubb, on his return, "are far ahead of our tillers of the soil. They are quick to take advantage of every scientific implement, and they put their land to the best use. That is why Lord Rosebery, on soil that has been cultivated for hundreds of years, can grow 2,000 bushels of potatoes to the acre while the best I can do on my irrigated farm in Colorado is 600 bushels. Foreign farmers are specially strong in saving their land, not making it barren by too frequent demands for bumper crops. The potatoes of Great Britain are not as large nor as firm as those grown under irrigation in our own West. That encourages me to believe that, when scientific culture becomes general, especially in the West, it will no longer be possible for Germany and Russia, and nearly every foreign country, to outstrip us in potato production. There is no reason why a small country like Germany can raise one-third of the potato crop of the world — nearly 1,700,000,000 bushels, while we can raise only about 300,000,000 bushels.

"With cheap potatoes to fall

SCENE ON AN IRRIGATED POTATO RANCH.

back on, there will be no cry about the high cost of living in this country. Germany is able to get along with little meat, because potatoes are used as a substitute. The Germans use potatoes to make alcohol for commercial purposes, and also put the tubers to other general uses, but in this country we seem to think the potato's field of usefulness is ended when it figures on the table. We ought to be able to raise potatoes enough in this country to enable us to use denatured alcohol as much as we use gasoline. In Germany potatoes are even dried and used for feed. In fact there is no end to the uses to which the potato can be put—but the first problem is to make the American farmer raise a better and larger potato crop.

For thirty years the consumption of potatoes in this country has been about three and one-half bushels per capita, but the supply has not always kept pace with the demand. It will surprise the average individual to learn that we import about one-quarter of the potatoes used in this country, but such is the fact. This lagging of the potato crop is one of the chief reasons why living expenses in America have climbed until the average wage-earner stands aghast at his household bills.

"Advancement in knowledge of soils, and how to preserve their richness—that is the solution of the potato problem in this country, and incidentally the solution of the cost of living problem," declares Mr. Grubb. "We have been wasteful of our soil, which was the best in the world. First we impoverished the soil of New England, and of late years we have wasted the soil of the West. Now there is no new soil to be taken up, and we are face to face with the problem of making the best use of the old acreage. Europe has faced that problem for centuries, and has solved it, if one is to judge by the immense crops European farmers grow on a restricted acreage. The potato is only one of the many things we must cultivate better—but it is one of the most important."

The government's "potato ambassador" is another Luther Burbank in many

SCIENTIFIC CULTURE AND IRRIGATION DID THIS.

respects. His highly developed ranch, at Carbondale, Colorado, under the shadow of Mount Sopris, is the scene of many interesting experiments, carried out by this man who is intensely interested in the problems that confront the American farmer. In the course of his potato experiments he has succeeded in developing potatoes that are of uniform size, consequently being ideal for baking purposes, and that have thin skins and shallow eyes—points that any housekeeper will appreciate. These potatoes will yield heavily under scientific cultivation. Mr. Grubb has made no secret of his methods, but has carried on an evangelical work in many Western states. Several railroads have engaged him to instruct settlers along their lines in the art of potato growing—for that it is an art anyone will admit after seeing the results achieved by this Colorado Burbank. A New York railroad recently engaged him to carry on the work of restoring the abandoned farms along its line. Always Mr. Grubb has given his services and the results of his investigations in a most unselfish spirit, though he could have made himself wealthy by keeping his potato knowledge to himself and supplying the demand that naturally arose for his products.

Mr. Grubb's commission to inquire into potato conditions abroad is considered one of the most important steps taken by the Department of Agriculture in recent years, and the final report of the "potato ambassador" will affect every potato raiser and consumer in the country.

A FUR TRADER COMING INTO PRINCE ALBERT.

A CONTINENTAL FUR FARM

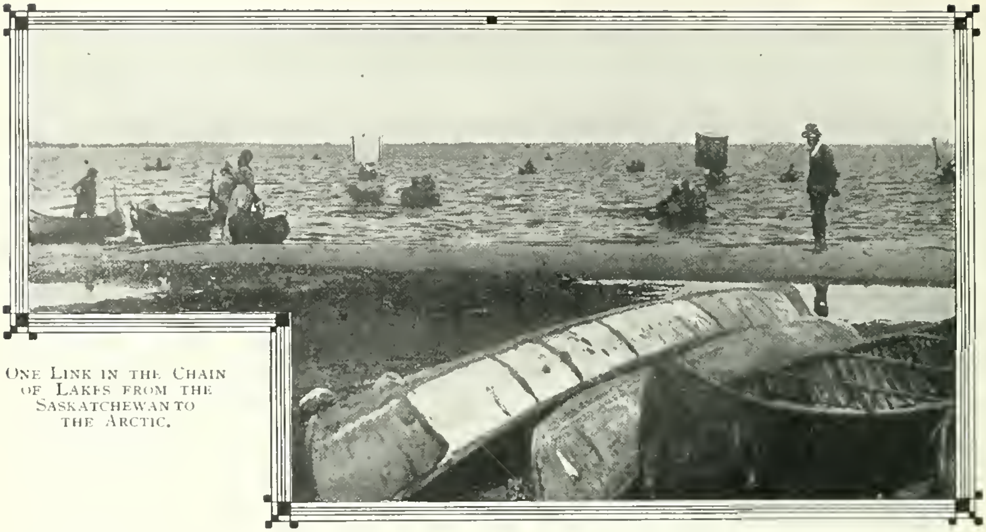
By

AGNES C. LAUT

IS the world facing a permanent shortage of fur supplies? Is the oldest industry of man coeval with cave life threatened with extinction?

Three times in the last few months the statement has been made to the public with show of first hand authority that the last chapter of the fur hunt is being written; that the oldest industry of man coeval with cave life is threatened with extinction; that another twenty years of fur hunting will mark the last of the precious furs; that another half century will witness the utter extinction of fur bearing animals in America.

The statement is a sweeping one, vitally significant to every denizen of snowy latitudes the world over. Is it true? When I was a child in the Canadian Northwest, you could buy a buffalo coat for $25 or a beaver from $70 to $100. You cannot buy a buffalo coat today at any price; and during the closed season established for beaver by the Canadian Government these past seven years, it has been almost as impossible to buy a beaver. I remember one summer in the Rockies years ago pricing mink skins from the Stoney Indians. I could have bought them at 80 and 90 cents apiece. Those skins today would cost from $10 to $15 each. I could have bought the most perfectly marked ermine from 4 to 10 cents a skin. Today those skins would cost from 40c to $1. I



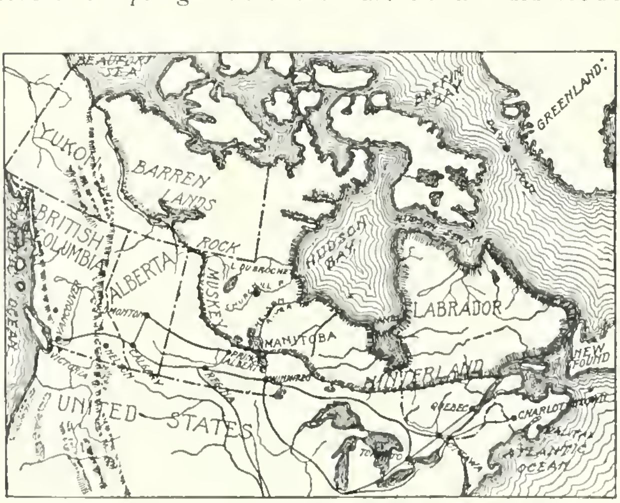
One Link in the Chain of Lakes from the Saskatchewan to the Arctic.

have in my work room as I write a lynx skin robe larger than the ordinary floor rug, for which I paid less than $30. Fur traders today tell me that lynx skin would bring its weight in gold—which is not so costly as it sounds; for lynx is the lightest of furs.

Does all this prove that we have reached the permanent world shortage of furs?

One does not need to prove the extinction of the buffalo. Buffalo, which roamed the prairies between the Missouri and the Saskatchewan so numerous that literally bridges of the dead spanned the rivers in spring where the vast herds crashed through the ice or over a cliff into an Indian pond—today exist only in half a dozen private and public parks. I have visited all of these parks in the last three years. I do not think the total number of buffalo from Missouri to Saskatchewan today exceeds 1,000. The largest herd I know does not exceed 400.

The case is almost as bad regarding fur seal. But a few years ago the population of the seal islands was five millions, and the yearly catch 150,000. Last fall, the greatest authority on seal fisheries in America today told me he did not believe there were more than 30,000 seals alive in the whole world; and not a seal would survive the next five years unless pelagic sealing ceased—the indiscriminate shooting outside the pelagic zone by Japanese, Canadian and Russian poachers of male and female and young swimming to the rookeries. The death of each female in spring costs besides the mother's life, the unborn pup's and the young seals' ashore which die of starvation when the mother's care is removed. Still a worse feature of this pelagic sealing occurs during fog. When the fog falls over Bering Sea



The Great Fur Country of the North.
The shaded line represents approximately the boundary of this territory.

thick as wool, the poachers venture in ashore to the rookeries. So great is the haste of their bloody work to escape before the fog lifts, that the raiders often skin the seals alive, not stopping to see that the blow of the gaff club has caused death.

As for sea otter, it has come so near extinction that it may almost be written down as one of the furs no longer obtainable. Four years ago when I made enquiries on the Pacific Coast as to the take of sea otter, I put down the decrease from 150,000 a year in a century to 400 a year; and those figures have been diligently copied ever since. They are no longer correct. The annual take is now nearer 200 than 400. Of the fur, itself, little need be said except that the pelt is the largest of the sea furs and finer in texture and depth than either seal or silver fox.

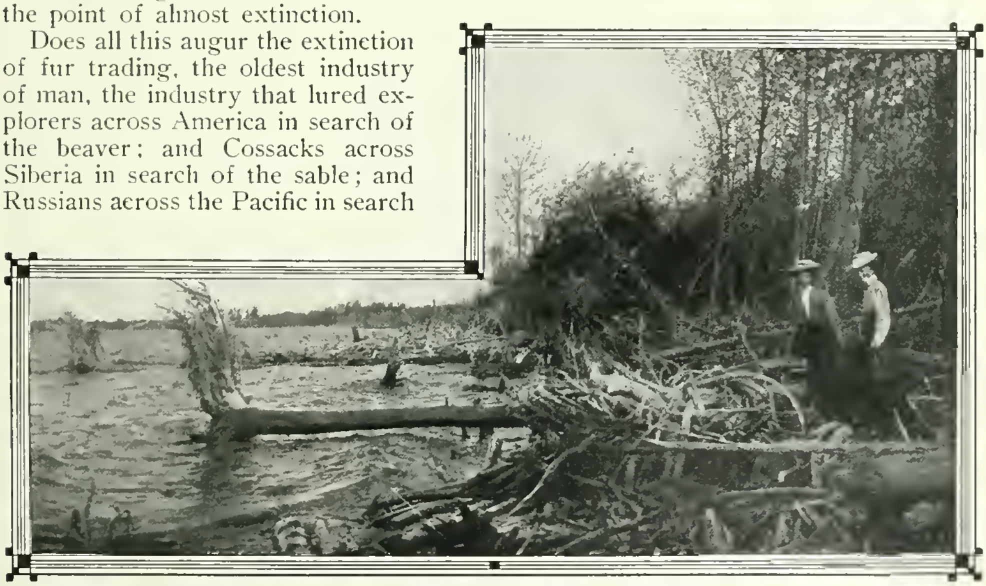
Beaver is today practically extinct in the United States, or almost so. Ten years ago, it became so scarce in Canada that the Dominion Government established a closed season for a term of years. This closed season has now expired; and once more the trapper will wage war on the beautiful rodent of marsh and woods. If he is permitted to wage war with dynamite and on male and female and young indiscriminately, beaver will again become scarce to the point of almost extinction.

Does all this augur the extinction of fur trading, the oldest industry of man, the industry that lured explorers across America in search of the beaver; and Cossacks across Siberia in search of the sable; and Russians across the Pacific in search of the sea otter? Have we reached the last chapter in fur?

Frankly and with the deepest respect for the prophets of evil, and from a life time in the Northwest, I do not think so. The oldest industry of mankind, the most heroic and protective against the elements—against Fenris and Loki and all those Spirits of Evil with which Northern myth has personified Cold—fur hunting, fur trading, will last long as man lasts.

We are entering, not on the extermination of fur, but on a new cycle of smaller furs. In the days when mink went begging at eighty cents, mink was not fashionable. Mink is fashionable today; hence the absurd and fabulous prices of $900 and $1,000 for a lady's opera cloak. Long ago, when ermine as minevir—the garb of nobility—was fashionable and exclusive, it commanded fabulous prices. Radicalism abolished the exclusive garb of royalty; and ermine fell to four cents a pelt, advanced to twenty-five cents and recently has sold at one dollar. Today, mink is the fashion, and the little mink is pursued; but tomorrow fashion will veer with the caprices of the wind. Some other fur will come into favor; and the little mink will have a chance to multiply as the ermine has multiplied.

Be it noted here—buffalo were ex-



DEBRIS BROUGHT DOWN BY FLOOD FROM THE BIG TIMBER COUNTRY.

terminated, not because of the pursuit of the fur—for the pelts rotted unsold in St. Louis warehouses in the 1830's and 40's or were used as leather—buffalo were exterminated because the buffalo pasture grounds were cut up into barb-wire fenced farms, by the transcontinental railways.

The seal and the sea otter have been reduced almost to extinction—not by the fur hunters; for the true fur hunter never destroys the female or the young—but by the poachers, by the fact that international law was involved and the nations of the United States, Canada, Japan and Russia could not sink their other hostilities long enough to come together and regulate fur hunting. The monopolist never destroys the source of his own prosperity. When competing monopolists come together on the same field, they destroy on the principle "if they don't, the other fellows will." Of this, I found a curious example when examining the documents of the Hudson's Bay Company in London five years ago. It was in the early 1820's. Peter Skene Ogden was scouring south of the Columbia with fur brigades of 200 men; Ross was leading his hunters on the Upper Missouri. The only section of the Hudson's Bay Company's field from California to the Arctic, where instructions were issued to clean out all beaver irrespective of age, size, sex, was south of the Saskatchewan; "for if we don't" declared Ogden, "the Americans under General Ashley will." The same spirit was exemplified last year. It was before the Canadian Club of Ottawa, Canada. I had been pointing out the fact that the seal was being exterminated, not by the true fur hunter but by the poacher—the Japanese and Russian and Canadian raider, who swooped down on the unprotected rookeries, or shot the mother seal swimming in and out of the pelagic zone. A man, who had been secretary to one of the sealing commissioners, came up to me after the lecture. "You are wrong," he said, "you are wrong I tell you in blaming Canadians. If Americans hog the whole thing, then I say, let the Canadians go in and kill every blamed cub. I'd shoot every last seal in the sea rather than let them beat us and hog it all."

"Meanwhile," I answered, "what becomes of the seal?"

"I don't care," he said. "We'll show them."

This spirit of international jealousy—shall I call it hoggery?—and not the spirit of the true hunter, is what has brought the seal and the sea otter almost to extermination.

As for the beaver, he is not an Arctic animal. He is a denizen of the temperate marshes. What has become of his marshes? Read the Congressional reports on reclamation and draining. Where beaver dams once lapped to wind and reed west of Lake Michigan, stands the city of Chicago. Like the buffalo, the little beaver has witnessed his habitat cut up into cities and farms; but where city and farm can never go—north of the Saskatchewan, in Labrador, down MacKenzie River, on the marshes of the hinterland of Ontario—the little beaver still plies his furtive calling of damming sluggish streams and converting marshes into meadows.

Some Thirty Thousand Dollars Worth of Gray and Silver Fox Skins.

In spite of the cry of the end of fur, more furs were marketed in the world last year than ever before in the

BRINGING THE FURS TO PRINCE ALBERT IN WINTER.

history of the race—forty million dollars worth; twenty million of which were handled in New York and Chicago and St. Louis and St. Paul; some five millions passing through Edmonton and Winnipeg and Montreal and Quebec, three millions for home consumption, two millions plus for export. Five years ago I went through all the Minutes of the Hudson's Bay Company in London from 1670 to 1824, and have transcripts of those Minutes now in my library. In not a single year did the fur record exceed half a million dollars worth. Compare that to the American traffic today of twenty millions; or to the three and four hundred thousand dollar cargoes that each of the Hudson's Bay Company and Revillons' ships bears to Europe from Canada yearly. The muskrat marshes of New Jersey and Delaware have been hunted diligently for half a century; yet they last year yielded between four and five million pelts of the little water rodent that lines fur coats.

There is another remoter but understandable cause for these cycles of seeming scarcity and higher prices for furs. "Once in seven years, regular as the years come round, from some cause that I have never heard any scientist explain, rabbits die off in the North of pestilence," said the Revillons' chief guide to me, as we canoed down Saskatchewan River two years ago.

"Yes," interjected the Hudson's Bay tripman, whom we had taken on as paddler for an especially long stretch of rapids, "and when waupoose is scarce, all the other fellows are going to go meat hungry."

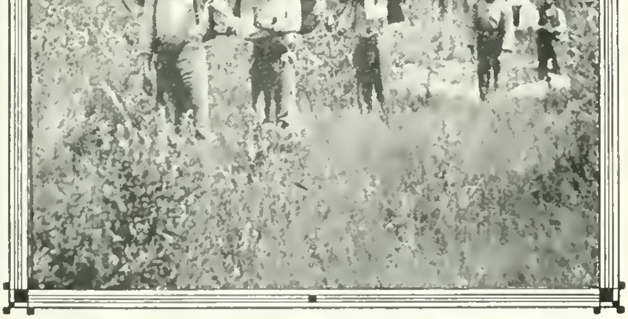
"It's like this," explained the head guide. "When rabbits fall off, lynx and wolverine and all the other meat eaters are not going to be in as good fur the *next* year—won't likely have as fine litters; and the kits may starve. That means scarce fur for a year. The rabbit plague is about due now. That means higher prices for the rabbit eaters next year."

"Do they always have this plague every seven years?" I asked.

"Always have since I have come to the country; and that is twenty-four years ago."

"And the fur is always better when the animals eat meat?"

"No—not of all animals. It is of lynx



INDIAN PACKERS PORTAGING PAST A RAPID.

A Trapper of the North.

always get the mink and the muskrat best in the small game marsh country; and the marten and the lynx in the wood and berry country where rabbit is plentiful. Otter are hard to get because at the season when they are in colonies, the fur is no good—a trapper won't take them. When the fur is in season, they are off solitary. You look out for them fishing round ice holes."

"How much can a good Indian hunter make in a season?" I asked this because in nearly all accounts written about furs, you read a wail of reproach at milady for wearing furs when trapping entails such hardship and poverty on the part of the hunter.

"A good hunter easily earns $600 or $700 a winter if he will go out and not hang round the minute he gets a little ahead. It takes from $3,000 to $4,000 to outfit a small free trader to go up North on his own account. This stock, he will turn over three or four times at a profit of one hundred per cent. on the supplies. For example, $10 cash will buy a good black otter up North [1908]. In trade, it will cost from $12 to $15. On the articles of trade, the profit will be fifty per cent. The otter will sell down at Edmonton from $20 to $30. It's the same of muskrat. At the beginning of the season when the kits are plentiful and small, the trader pays nine cents for them up North. Down at the fur market he will get from twenty-five to sixty cents for them according to size. There were 132,000 muskrat came to one firm of traders alone in Edmonton this year, which they will sell at an advance of fifty per cent."

and wolverine; but when the marten, or what the Russians call wood sable, eats mice, like a cat it grows poor and lean. You always find the marten in the berry country; and when it eats berries, it is fat and its fur is fine and beautifully glossy. Its pelt will command all the way from $8 to $32 according to quality. I tell you a few of those fellows will make you rich. The fur doesn't require any dyeing, just drying and tanning; and it doesn't spoil in sun or rain. We usually catch them in dead falls; and when they are meat hungry, they will eat each other's heads off in the traps. You

At the very next fur post, where we stopped—the big game country west of

THE TOWN OF FORT RESOLUTION ON GREAT SLAVE LAKE.

old Fort Pitt—it was easily estimated that the trader took in $40,000 of supplies a year, and sent out $125,000 of furs; but it is not all so profitable and easy as it sounds. Comes the hard year when the pest sweeps off the rabbits or drought dries out old marshes—which latter is very seldom owing to the supply of moisture from the winter's heavy snow—and the Indian hunters, who never save, demand advances on credit from the trader. If he refuses, they will never again bring him a pelt. To hold their good will he advances flour, tea and perhaps some clothes. When the good years come again, he finds that the Indian owes a prior debt to some other trader. If the banks will not carry him past this second into a third season, the free trader goes bankrupt. At the first post where we stopped in the swamp or muskrat country north east of the Saskatchewan, we met a free trader, who had bought 32,000 muskrat his first year and cleaned up a tidy profit; but his second year in order to hold trade, he extended too much credit. Winter set in early and lasted late. The muskrat hunt was poor. The Indians could not pay their debts and the trader sold out to The Company—The Company standing for only one firm in the Northwest—the H. B. C. which old-timers irreverently translate, "Here B. C."

"How much fur comes yearly to Edmonton?" I asked. If you look at the map you will see that Edmonton is the jumping off place to three of the greatest fur fields of North America—down MacKenzie River to the Arctic, up Peace River to the mountain hinterland between the Columbia and the Yukon, east through Athabasca Lake to the wild Barren Land inland from Churchill and Hudson Bay.

"Well, we can easily calculate that. I know about how much is brought in to each of the traders there."

I took pencil while he gave me the names. It totalled up to $600,000 worth for 1908. When you consider that in its palmiest old days of exclusive monopoly, The Company never sold more than half a million dollars worth of furs a year, $600,000 total for Edmonton alone does not sound like a scarcity of furs.

The question may be asked, do not these large figures presage the hunting to extinction of fur bearing animals? I do not think so; and my knowledge of the West is not gained from the windows of a Pullman car as much expert knowledge of the Northwest is. Two years ago a very flamboyant article came out accusing a circle of writers on the Northwest—myself among the number—of gross misstatement of facts. "Canadian fakirs," was I believe the phrase. Among other questions, it was asked with that mock indignation so comic with sparse

FUR BUYERS AT EDMONTON.

isn't. When you go seventy miles north of Saskatchewan River (barring Peace River in sections) you are in a climate that will grow wheat all right—splendid wheat, the hardest and finest in the world. That is, twenty hours of sunlight—not day light but sun light—force growth rapidly enough to escape late spring and early fall frosts; but the plain fact of the matter is, wheat land does not exist north of the Saskatchewan except in sections along Peace River. What does exist? Cataracts countless—Churchill River is one succession of cataracts; vast rivers; lakes unmapped, links and chains of lakes by which you can go from the Saskatchewan to the Arctic without once lifting your canoe; quaking muskegs—areas of amber stagnant water full of what the Indians call mermaid's hair, lined by ridges of moss and sand overgrown with coarse goose grass and "the reed that grows like a tree" muskrat reed, a tasseled corn-like tufted growth sixteen feet high—areas of such muskeg mile upon mile. I traversed one such region above Cumberland Lake seventy miles wide by three hundred long where you could not find solid ground to camp the size of your foot. What did we do? That is where the uses of a really expert guide came in: moored our canoe among the willows, cut willows enough to keep feet from sinking, spread oil cloth and rugs over this, erected the tents over all, tying the guy ropes to the canoe thwarts and willows, as the ground would not hold the tent pegs.

knowledge, how these writers dare refer to "blood-hounds" in a country where no dog exists but the husky; or call travel difficult in a land where "fur traders could as easily go from Edmonton to Klondike as a postman could go his daily rounds in an Eastern town." At the time that article appeared, I was camping in the fur country storm stead at Cumberland Lake, and had to hang my boots on my tent post to keep them from being eaten at night not by huskies—huskies have much better manners—but by the mongrel packs locally known as "the string band," half wolf-hound half bloodhound bred by the fur traders for length and speed of limb in the traces, which rove Northern woods in ravening hordes. My guide, camped down at the big beached canoe, happened to be the man whom the Government had selected to pilot a path from Edmonton to Klondike. Not a man alive ever went through to the gold field that way. He happened to be one of the men who came back alive. Most of the others didn't. So much for Pullman car expert knowledge on the West.

Take a map of the Northern fur country. Take a good look at it—not just a Pullman car glance. The Canadian Government, to whom I am proud to owe allegiance and have more than once contributed facts for their official publications, have again and again advertised thousands, hundreds of thousands, millions of acres of free land. Latitudinally, that is perfectly true. Wheat-wise, it

It doesn't sound as if such regions would ever be over-run by settlement—does it? Now look at your map, seventy miles north of Saskatchewan. From the north-west corner up by Klondike to the south-east corner down in Labrador is a distance of more than 3,000 miles. From the South to North is a distance of almost 2,000 miles. I once asked a guide with a truly city air—it might almost have been a Harvard air—if these distances were "as the crow flies." He gave me a look that I would not like to have a guide give me too often—he might maroon a fool on one of those swamp areas.

"There ain't no distances as the crow flies in this country," he answered. "You got to travel 'cording as the waters collect or the ice goes out."

Well, here is your country, 3,000 by 2,000 miles, a great fur preserve. What exists in it? Very little wood, and that small. Undoubtedly some minerals. I myself saw brought by an Indian from some unknown mine on Churchill River a piece of pure natural copper the size of a man's hand. What else exists? A very sparse population of Indians, whose census no man knows, for it has never been taken; but when the total Indian population of Canada is only 100,000, and you deduct from the total those on reserves and those on the Pacific Coast, it is a pretty safe guess to say there are not 20,000 Indians all told in the North fur country. I put this guess tentatively and should be glad of information from any one in a position to guess closer. I have asked the Hudson's Bay Company and I have asked Revillons how many white hunters and traders they think are in the fur country of the North. I have never met any one, who placed the number in the North at more than 2,000. Spread 2,000 white hunters with 10,000 Indians— for of the total Indian population half are women and children—over an area the size of two-thirds of Europe —I ask you frankly, do you think they are going to exterminate the game very fast? Remember the climate of the North takes care of her own. White men can stand only so many years of that lonely cold, and they have to come out; or they dwarf and degenerate.

Take a single section of this great Northern fur preserve—Labrador, which I visited some years ago. In area, Labrador is 530,000 square miles, two and a half times the size of France, twice the size of Germany, twice the size of Austria-Hungary. Statistical books set the population down at 4,000; but the Moravian missionaries there told me that including the Eskimo who come down the coast in summer and the fisherman who come up the coast in summer the total population was probably 17,000. Now Labrador is one of the finest game preserves in the world. On its rocky hills and watery upper barrens where settlement can never come are to be found silver fox—the finest in the world, so fine that the Revillons have established a fur trading post for silver fox on one of the islands—cross fox almost as fine as silver, black and red fox, the best otter in the world, the finest marten in America, bear of every variety, very fine Norway lynx, fine ermine, rabbit or hare galore, very fine wolverine, fisher, muskrat, coarse harp seal, wolf, cariboo, beaver, a few mink. Is it common sense to think the population of a few thousands can hunt out a fur empire here the size of two Germanies?

(Concluded in May number.)

IMMERSING THE MATCHES IN THE IGNITING COMPOSITION.
White phosphorus renders this occupation a deadly peril.

THE WHITE PHOSPHORUS HORROR

By

P. HARVEY MIDDLETON

"I invite attention to the very serious injury caused to all those who are engaged in the manufacture of phosphorus matches. The diseases incident to this are frightful, and as matches can be made from other materials entirely innocuous, I believe that the injurious manufacture could be discouraged and ought to be discouraged by the imposition of a heavy Federal tax. I recommend the adoption of this method of stamping out a very serious abuse".— *William Howard Taft, December 6th, 1910.*

THESE few lines in the President's message inspired this article. Mr. Taft is conservative. When he uses such words as "frightful" and "a very serious abuse" you may depend upon it that there is something wrong somewhere. And so the writer investigated, and the result is the startling discovery that several thousands of American men, women, and children are exposed to a loathsome disease—a disease so repulsive that even experienced physicians turn sick while examining the unhappy creatures who are afflicted with it, and dread the duty that calls them to attend such cases. Leprosy itself is no more horrible than phosphorus necrosis, popularly known as "phossy jaw."

In all American match factories the head of the ordinary parlor match is made by dipping the end of the wooden splint into a paste containing white phosphorus,—a most deadly poison. The fumes and particles of phosphorus attack the bones of the workers, but more especially their teeth. If the factory worker happens to have a decayed tooth, the poison enters the cavity, setting up an inflammation which, if not quickly arrested, extends along the jaw, killing the teeth and bones. The gums become swollen and purple, the teeth loosen and drop out, and the jaw-bones slowly decompose and pass away, the horrible product sometimes breaking through the neck in the form of an abscess, or if not almost continually cared for, finding its way to the stomach. Here is the brief history of one case among hundreds:

Nine years ago, at twenty-one years of age, Mary Wilson, tall, strong and full of the joy of life, married Henry Welsh. She had worked for several years as a "packer" in the match factory, and continued to work there after her marriage. But two months later she commenced to have trouble with her teeth. Dr. A—— first treated her, beginning with the first operation November 15th, 1901. He performed a second operation August 11th, 1903, removing several large splinters of bone from her jaw She grew no better, and through Dentist B—— she secured daily treatments at her home.

Finally, as the trouble continued, she went to Doctors C—— and D—— for further medical aid, and is receiving medical attention from them at the present time. Three years ago an abscess opened through the right side of her jaw, and one year ago another opened on the left. Both require constant bandaging. When seen recently she was scarcely able to open her lips enough to speak and could not separate her upper from her six remaining lower teeth. All of her lower teeth except the middle six have come out, and several inches of the jaw-bone is bare, and in indescribably horrible condition.

The physicians, in an effort to preserve the contour of her face and to avoid leaving unsightly scars, attempted to operate on the inside. In this case the dead bone does not form a sequestrum or separated portion which might easily be removed from the living bone beneath. It simply continues to die and to dispose of itself in the most nauseating and dangerous manner, poisoning the entire system.

The poison first manifested itself eight years ago, shortly after Mary Wilson's marriage. She has a boy six years old, a little girl of four, and a baby but two years old. She says that the two older children are well and strong, but that "the baby seems to have trouble in its blood."

"The doctors say perhaps they could cure me," she says, "by cutting out my

Splitting the Shavings into Match Sticks.

jaw, but I am young yet, and how would it look? I'd rather be dead, I think!"

The suppurating bone is more horrible than anything that can be imagined. Anyone who has once witnessed the condition of such a sufferer can readily understand why dentists and physicians alike shun patients who are afflicted with "phossy jaw."

Now the case of Mary Wilson is not extraordinary. It is typical of many. There is an old woman in Ohio—a former matchmaker—who, as a result of phosphorus poisoning, for twenty years has had no lower jaw, but masticates her food by pressing it against her upper jaw with her thumb. Then there is George K—— of Portland, Maine, who also had his entire lower jaw removed and for twenty-two years ate no solid food; and William J—— of Milwaukee, who lived in abject misery with necrosis of the bones of the ear.

A well-known case was that of Emil H——, who underwent treatment in Chicago in 1895 for necrosis of the jaw. According to the hospital records, when forty-six years old, and married, he was first admitted to the hospital on June 9th, 1896, and remained ten days. The following appears in the hospital record: "Phosphorus necrosis. Dr. B—— of Chicago removed both upper and lower maxillae." With both upper and lower jaws entirely removed, and with the poison still continuing its deadly work, this man lived month after month, suffering untold agonies, and taking nourishment through a tube.

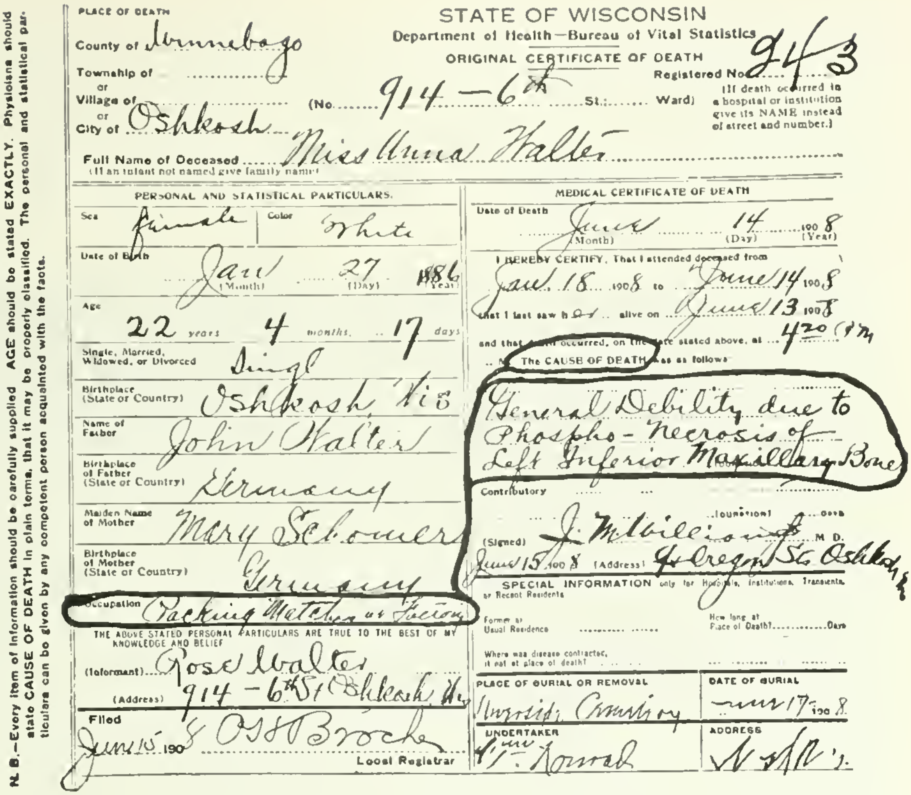
Dozens of cases could be quoted of strong vigorous young men and women who have gone to work in our match factories, and in a few years have become terribly disfigured, with teeth gone, and with necrosed bone exposed. When a man has his lower jaw removed he immediately grows a beard, a refuge denied to the women sufferers.

Now, incredible though it may sound, it is an absolutely established fact that this human misery, this blasting of the lives of men, women, and children, is absolutely unnecessary, and that a harmless substitute for the white phosphorus exists and has been successfully used in this and other countries. In other words, our match manufacturers permit their workpeople to run the risk of this peril by unnecessarily continuing the use of poisonous phosphorus, because the substitute costs a fraction more!

In order to understand the full meaning of the present situation we must review briefly the match industry as a whole. Know, then, that these insignificant little trifles of wood, paper, or wax, topped with latent flame, wherewith we kindle fires and light the soothing pipe or cigar, represent an industry involving an investment in Europe and America of hundreds of millions of dollars. The match does its work, and is cast contemptuously aside, yet it is an evolution representative of much human patience, ingenuity and skill,—one of the best gifts sought out and elaborated by genius for the benefaction of the human race.

In this country alone the largest producer cuts one hundred million feet of timber every year to be converted into match sticks. Every minute of the twenty-four hours throughout the day three million matches are struck. Fifteen hundred billion is the number for an entire year. The importance of the industry is only recognized when the average smoker tries to contemplate his predicament if he had to go back to the time when he had to coax a spark from a tinder box.

In the years succeeding the discovery of the phosphorus match the industry grew prodigiously. In Germany first, then in France, Belgium and England, and successively in all parts of Europe, factories were established, and as there was absolutely no control exercised over the manufacture, the most deplorable conditions prevailed. Matches were being made almost anywhere, in the workmen's cottages, in the homes, in cellars. Phosphorus was found in clothing, in the midst of food, within reach of children, and from this carelessness came fires and hundreds of deaths from poisoning. The workmen, recruited from anywhere, and uncared for, were crowded together in unventilated workrooms, where the atmosphere was stifling. In a brief period the hospital in Vienna had one hundred and twenty-six sufferers from phosphorus necrosis, and the hospitals of Berlin and Nuremberg were also crowded with cases.



MARGIN RESERVED FOR BINDING

WRITE PLAINLY WITH UNFADING INK—THIS IS A PERMANENT RECORD

No incomplete or mutilated certificates will be received.

N. B.—Every item of information should be carefully supplied. AGE should be stated EXACTLY. Physicians should state CAUSE OF DEATH in plain terms, that it may be properly classified. The personal and statistical particulars can be given by any competent person acquainted with the facts.

PLACE OF DEATH

STATE OF WISCONSIN

Department of Health—Bureau of Vital Statistics

ORIGINAL CERTIFICATE OF DEATH

County of Winnebago

Township of ....

or

Village of ....

or

City of Oshkosh (No. 914 — 6th St.; ..... Ward)

Registered No. 943

(If death occurred in a hospital or institution give its NAME instead of street and number.)

Full Name of Deceased Miss Anna Walter

(If an infant not named give family name)

PERSONAL AND STATISTICAL PARTICULARS.

Sex Female Color White

Date of Birth Jan 27 1886 (Month) (Day) (Year)

Age 22 years 4 months 17 days

Single, Married, Widowed, or Divorced Single

Birthplace (State or Country) Oshkosh, Wis

Name of Father John Walter

Birthplace of Father (State or Country) Germany

Maiden Name of Mother Mary Schoner

Birthplace of Mother (State or Country) Germany

Occupation Packing Matches in Factory

THE ABOVE STATED PERSONAL PARTICULARS ARE TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF

(Informant) Rose Walter

(Address) 914 - 6th St Oshkosh Wis

Filed June 15 1908 O. S. H. Brooks Local Registrar

MEDICAL CERTIFICATE OF DEATH

Date of Death June 14 1908 (Month) (Day) (Year)

I HEREBY CERTIFY, That I attended deceased from Jan 18 1908 to June 14 1908

that I last saw her alive on June 13 1908

and that death occurred, on the date stated above, at 4:20 P.M.

The CAUSE OF DEATH was as follows:

General Debility due to Phospho-Necrosis of Left Inferior Maxillary Bone

Contributory .... (Duration) .... days

(Signed) J. McWilliams M. D.

June 15 1908 (Address) 4 Oregon St. Oshkosh Wis

SPECIAL INFORMATION only for Hospitals, Institutions, Transients, or Recent Residents

Former or Usual Residence .... How long at Place of Death? .... Days

Where was disease contracted, if not at place of death? ....

PLACE OF BURIAL OR REMOVAL Riverside Cemetery

DATE OF BURIAL June 17 1908

UNDERTAKER Geo. F. Konrad

ADDRESS N. Side

DEATH CERTIFICATE OF ANNA WALTER.

A worker in a Wisconsin factory after the use of the harmless substitute for poison had been discontinued. She died in June, 1908, of "general debility due to phospho-necrosis of left inferior maxillary bone." Fifteen others in the same factory have lost one or both jaws.

About this time the various governments of Europe began to make rules and regulations for the manufacture of matches. The new industry was driven out of the cellars. Better ventilation and better opportunities for bathing in the factories were insisted on. But so long as white phosphorus continued to be used necrosis could not be eliminated, and so in 1872 Finland gave up attempts at regulation and prohibited the use of white phosphorus in her match factories. Denmark, in 1874, followed suit.

In France, where the manufacture of matches is a state monopoly, the disease spread with great rapidity, and the French Government, called upon to bear the expense of the many cases of poisoning, offered a reward of $10,000 for a substitute for white phosphorus, which was discovered in sesqui-sulphide of phosphorus, and the use of white phosphorus was prohibited in 1897. Switzerland decided upon prohibition in 1898, and the Netherlands in 1901. In 1906, on account of the difficulties of eliminating the use of phosphorus in countries with an important export trade, the International Association for Labor Legislation secured an International Conference at Berne, which resulted in an international treaty providing for the absolute prohibition of the manufacture, importation, or sale of matches made from white phosphorus. This treaty was signed by France, Denmark, Luxembourg, Italy, Switzerland, the Netherlands, and Germany. On January 1, 1910, Great Britain also signed the Berne treaty. In 1908 the Austrian House of Representatives passed a resolution requesting the Austrian Government to prohibit the use of the poison. Hungary is considering absolute prohibition. Sweden does not permit the use of poisonous matches at home but exports them to other countries. In 1905 the tax on white phosphorus matches in Russia was doubled.

Thus the leading countries of Europe have gone on record as favoring the absolute elimination of this terrible trade disease, and the United States has the unenviable distinction of being the only country that has made no adequate provision for the protection of the health of workers in her match factories, although for over half a century the dangers of working with white phosphorus have been well known

The best harmless substitute for the poisonous phosphorus, i. e., sesqui-sulphide of phosphorus, would make the manufacturers' cost of matches less than five per cent. more, but they declare that its voluntary use would place them at too great a disadvantage with business competitors. During 1909 and 1910, however, a quiet investigation was made of conditions in fifteen American match factories by agents of the Bureau of Labor. Their reports show that sixty-five per cent. of the labor force were working under conditions exposing them to the fumes of phosphorus and the dangers of phosphorus poisoning. The women and children were found to be much more exposed than the men, ninety-five per cent. of the women and eighty-three per cent. of the children under sixteen years of age being so exposed. Those fifteen factories, according to statements by the manufacturers, employed 3,591 persons, of whom 2,024 were men and 1,253 were women 16 years of age and over; children under 16 numbered 314—121 boys and 193 girls.

THE PEELING OR VENEERING ROOM OF A MATCH FACTORY.

Notwithstanding the dangers connected with employment in the match factories, 23.26 per cent. of the men are paid less than six dollars a week, and 33.52 per cent. earned ten dollars or more. Of the women, 53.75 per cent. earned under six dollars a week and only 4.47 per cent. earned ten dollars and over. In some instances the employees have been in ignorance of the serious dangers of match-factory employment. In several factories visited not a single notice was posted warning the employees of the peculiar dangers to which they were exposed by the character of their work.

In some instances the employers also have carried on the manufacture of matches entirely in ignorance of the dangers involved. The manager of one factory even declared to Dr. John B. Andrews, secretary of the American Association for Labor Legislation—who has made an extensive study of the effects of phosphorus poisoning in the United States—that they had gone on for five years in no way suspecting that there was anything dangerous about the material they were using. Their attention was first called to the dangers of the industry, so they said, by an epidemic of phosphorus necrosis which broke out almost simultaneously among their employees.

Ignorance of the dangers of the industry and of the practice of the most fundamental precautions exists to an extraordinary degree. A physician in one of the towns where a match factory is located had under treatment a very serious case of phosphorus necrosis, and when asked what kind of phosphorus was used in the factory where the disease was contracted, replied that he "did not know." Several dentists interviewed stated that they had been unable to find anything written on the subject of phosphorus poisoning, and several confessed that they had been "experimenting," and hoping in that way to learn what to do for their patients.

A searching investigation by Dr. Andrews in the homes of the workpeople of three match factories yielded a total of eighty-two cases of phosphorus poisoning. He quickly discovered the records of more than one hundred cases of the disease, though the belief has been fostered by the match manufacturers that the disease has not existed in a serious form for twenty years in this country.

Unfortunately for the investigators, the labor element in match factories is constantly changing, and it is difficult to find among the employees one whose memory goes back over many years to recall cases of necrosis that may have occurred several years ago. Girls who formerly worked in match factories are difficult to find because of change of name by marriage, or because of change of occupation and residence. And when finally located these older women often, from reasons of social pride, reluctantly admit that they ever worked in a match factory. Employees now at work in the match factories frequently express the greatest alarm, even when met at their homes, lest the giving of information cost them the loss of their miserably paid positions. Sometimes, however, starting with the statement that they never heard of more than one case, they are later able to recall, after some careful thinking, half a dozen or more specific instances, and to give names and even approximate dates, although it is a fact that employees leave the factory immediately upon learning the nature of their trouble, often without telling their most intimate friends at the bench the true cause of their leaving.

Although complicated by modern methods of machines, the fundamental processes in the manufacture of matches may be described in a few words. The wooden match splint is prepared, the phosphorus composition for the head of the match is mixed; one end of the splint is dipped into this paste; the "green" match is allowed to dry, and finally it is boxed and wrapped.

The processes which are especially dangerous in this industry are all those which bring the employee within range of the poisonous phosphorus. In the mixing, dipping, drying and packing room the danger from breathing the poisonous fumes and from contact with the phosphorus is always present, although it may be much diminished by thorough ventilation and by the rigid enforcement of preventive measures. Also, particles of phosphorus become attached to the hands and are later transferred to the mouth by the employees.

Two kinds of phosphorus are used in the manufacture of matches. One is the red or amorphous variety contained in the friction surface of safety match boxes. This, when pure, is entirely harmless. It is made by baking in a closed vessel the poisonous or white phosphorus—also called yellow phosphorus, because when exposed to the light it becomes yellowish—and is consequently more expensive. The poisonous phosphorus is made from bones, and when sold for commercial purposes is usually in the form of sticks, in appearance not unlike lemon candy. A very small amount of this poison is sufficient to cause death.

Broadly speaking, three kinds of matches are manufactured. One is the "safety" match, which must be struck on a prepared surface on the box. This match contains no phosphorus, and is harmless. The igniting composition is painted on the box, and contains red phosphorus, which, when pure, is nonpoisonous. Although used extensively in Europe, its manufacture in this country is limited.

The second kind of match can be struck on any ordinary rough surface, and is called the "strike-anywhere" phosphorus match. This is the familiar parlor match. As made in America, the paste for the head of this ordinary match contains poisonous phosphorus, the direct cause of "phossy jaw."

The third variety of match also possesses the desirable quality of striking anywhere, and is at the same time nonpoisonous. This is the strike-anywhere match now manufactured and used in those countries where public sentiment has been sufficiently aroused to prohibit the use of white phosphorus in matchmaking, and, as we have seen, it is made of sesqui-sulphide of phosphorus. For twelve years, in France, this substitute has been successfully employed, and its use has been extended to several other countries, which have absolutely prohibited the manufacture, importation and sale of matches made from white phosphorus.

Several years ago the Diamond Match Company, the biggest concern of its kind, with giant factories in Ohio, Wisconsin, Maine, Michigan, New York and California, demonstrated the practicability of manufacturing the nonpoisonous "strike-anywhere" match in this country, and put thousands of boxes upon the market labeled "These matches do not contain phosphorus. A new discovery."

It cost a little more to manufacture, however, and as the public, unaware of the perils of white phosphorus, did not demand it, it was abandoned. The writer was shown a box of these matches by Dr. John B. Andrews, who struck several of them on wood and cloth and other objects. Although they were manufactured four or five years ago they ignited perfectly, completely refuting the statement that has been made that while successful in Europe they cannot be manufactured and used in America "owing to climatic conditions."

Now the Diamond Match Company had acquired the American patent rights from the French chemists who discovered sesqui-sulphide. When the investigation conducted jointly by Dr. Andrews and the Bureau of Labor revealed the shocking nature of the disease caused by the white phosphorus, the American Association for Labor Legislation brought all its influence to bear on the Diamond Match Company to induce them, in the interests of humanity, to surrender their monopoly in the harmless match. The present president of the company, Mr. Edward R. Stettinius, happens to be an unusual type of trust president, with a distinctly philanthropic turn of mind. During the two years that he has been connected with the match industry he has made every effort to improve the working conditions of the employees.

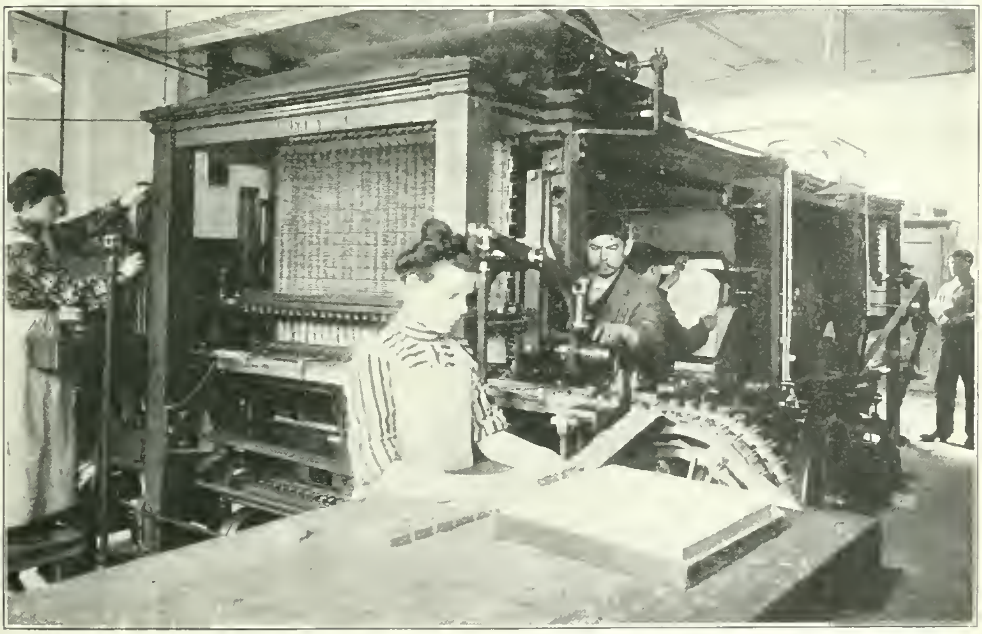
But the proposition which Dr. Andrews made on behalf of his Association meant the surrendering of rights which it had cost the match company about one hundred thousand dollars to acquire. Nevertheless, Mr. Stettinius laid the matter before his directors, and expressed his personal approval of the suggestion. The board was amazed and indignant. "What! Present our competitors with a patent worth $100,000! You must be crazy," they said, in effect. Stettinius pointed out the unenviable position in which the company stood. "Phossy jaw" could no longer be denied, and they possessed the only remedy. To cut a long story short, Stettinius eventually carried the day, and on January 6th, 1911, the patent rights of sesqui-sulphide of phosphorus were transferred to three trustees,—Professor E. R. A. Seligman of Columbia University, Charles P. Neill, Commissioner of the Bureau of Labor, and Jackson Ralston, Attorney for the American Federation

Box of Matches Made at Wisconsin Factory Six Years Ago.
These matches were made without poisonous phosphorus, and they strike perfectly on all rough surfaces. On account of slight increase in cost the manufacturers discontinued using the harmless substitute.

of Labor. These gentlemen were empowered to permit the use of this patented formula on whatever terms they might consider just. As even this extraordinary step was not sufficient to satisfy some people, the owners of the patent finally, on January 28th, cancelled their proprietary rights in order that "phossy jaw" might be abolished without delay.

The only excuse remaining, therefore, for the continuance of white phosphorus and the resultant "phossy jaw" is one of dollars and cents, the match companies using the poison having an unfair advantage over those using the slightly more expensive substitute. However, companies producing in the aggregate over ninety per cent. of the total product have promised to discontinue the use of the poison as soon as a uniform prohibitive regulation can be secured. The next move of the Association for Labor Legislation was therefore to prepare a bill securing national legislation on the subject, which was introduced in Congress by Representative John Esch of La Crosse, Wisconsin, on December 19th, 1910. This bill now in the hands of the Committee on Ways and Means provides for a tax upon all manufacturers of white phosphorus matches of one thousand dollars a year, and a further tax of one cent upon every hundred white phosphorus matches, which must be put up in special packages bearing Internal Revenue stamps.

The objectionable match would thus be taxed out of existence, and the harmless substitute, costing less than five per



MAKING THE MATCH BOXES.

cent. more than the present match, would come into general use.

One match superintendent, the father of a family, spoke feelingly to Dr. Andrews of the possibilities of the harmless match, and expressed great regret that it had been withdrawn. "There was a great satisfaction in working without a lot of poison around," he said, "and then it was worth a whole lot to know you were putting out a match with a head that a baby might suck and still not die."

And that brings to me to another phase of the poisonous match peril—one that vitally affects every mother and father in the United States. While the writer was chatting to Dr. Andrews the mail carrier brought him a letter. He read it and handed it to me. "There are many like it in my desk," he said, sadly. Here it is:

"Dr. John B. Andrews,
New York.

"Dear Sir:

It pleases me more than I can express myself to think someone in this world has taken an interest in this most awful match business. I and a good many others are ignorant of the fact that they are deadly poison, that is, I was until my little girl ate them, and also was my husband and so many people that I have spoken to about them. I do hope and pray that something can be done to prohibit the using of this deadly poison phosphorus. It seems that they can make matches without and I do hope you can do something about it. One other case just a few weeks before ours was a Dr. O'Connor's little girl, but I had not heard about it until after our case came up. Had I known I should have called a doctor at once. I was out calling on Saturday afternoon. She was left with her father and baby sister one year old, and of course was playing around the house, and spied the holder on the table that had the matches. She ate six or eight, so far as we can find out, but when she was taken sick to her stomach at night I did not think for one moment it was matches that had made her sick. I thought it was her supper and gave her something to settle her stomach. She seemed to be all right and slept the rest of the night and played as lively as could be all Monday, and slept well Monday night, except towards morning, when she got real fussy, so I took her in bed with me, and it seemed so hard to warm her, she was so cold, and when I did succeed in getting her warm I put her in her little bed again.

She then slept till nine Tuesday a. m. I dressed her and sat her on the kitchen table while I fixed her breakfast, and when I turned to feed her she was asleep again, but I thought nothing of it. She kept it up all morning, falling asleep whenever I left her, so I was alarmed and sent for the doctor. She wanted to be on my lap all the time, so I held her. I told the doctor about her eating matches, but not because I thought it was they that made her sick, but I just happened to mention it. It was then I was told of the other little one dying from eating them, but it was too late to do anything for our little one, the poison had a deadly hold of her. She got unconscious and slept away. The doctor did all in his power to save her. Metta, who was only two years old, died at seven on Thursday a. m. We took her to Ann Arbor to bury her. . . .

Yours truly,
Mrs. J. C. Morris,
579 Toledo Avenue, Detroit.

P. S.—Matches were pink with white tip. Dr. O'Connor lives on Dix Avenue, Detroit, Mich."

So, you see, it isn't only the poorly paid wage earner who must be protected from the deadly white phosphorus match, for it is also a menace to every American home. Almost daily the newspapers record the death of some helpless babe who, like little Metta Morris, has been attracted by the colored tips of the matches and has died a terrible death as a result. The O'Connor child referred to in Mrs. Morris' pathetic letter was Margaret E. O'Connor, the twenty-three months' old daughter of Dr. and Mrs. M. W. O'Connor, of 615 Dix Avenue, Detroit, who died in great agony as a result of having eaten the blue and red heads of a number of matches last September. Dr. O'Connor called in Dr. W. A. Harper, a neighbor, and they worked for several hours trying to save the child's life. Margaret, while unwatched for a short time, went into a bedroom, where she climbed upon a bed and reached from a bookcase a tin box containing the matches.

Then there was John Henry Acker, a boy of four, who ate the heads of twenty Black Diamond matches at Monroe, Michigan, in January, 1910, and died two days afterwards; Edwin K. Woods, Jr., two years old, son of Dr. E. K. Woods, of Indiana, Pennsylvania, and Raymond B. McGuire, eleven months old, of Depew, New York, who both met a similar fate in May, 1910, followed a week or so afterwards by Carl I. Stone, the two year old son of Frank Stone, 365 Hamblin Avenue, Battle Creek, Michigan, who died through eating the white tips of twenty match heads. On June 2, 1910, Dorothy Hartle, the two year old daughter of Mrs. Samuel Hartle, died at Fort Wayne, Indiana, through eating the heads of more than forty matches. Other cases have since been reported from Birmingham, Alabama; Sidell, Illinois; Bronx, New York; Buffalo, New York; Livonia, New York; Indianapolis, Indiana, and many other points.

While it is a decided shock to discover that our faithful friend the match is capable of causing such tragedies in our homes, it is comforting to realize that we have on hand a substitute that is in every way as efficient, and common sense as well as common humanity demands that we should insist on the banishment from our factories and homes of a poison which has already caused untold suffering through the efforts of a small body of men to save a few paltry dollars.

And all this applies with equal force to our Canadian friends, who have already gone us one better by putting forward a bill, which will undoubtedly pass the Parliament at Ottawa, absolutely to prohibit the manufacture and importation of matches made with white phosphorus. This bill had its first reading on November 24th, 1910, and the Act, by the terms of its framing, will come into force on the first day of January, 1912.

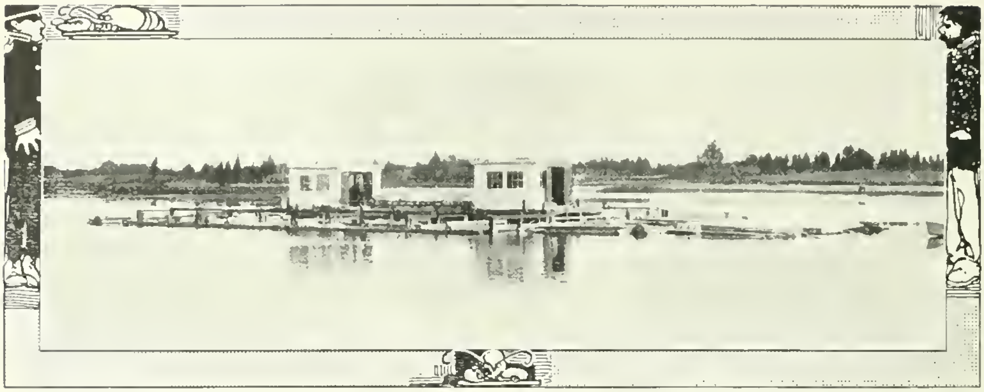
In Reverie

In the west, the weary Day
  Folds its amber wings and dies;
Night, the long delaying Night,
  Walks abroad in starry guise.

Rest more precious than a sleep,
  Silence sweeter than a dream,—
These enfold me as I float,
  Idle waif on idle stream.

Fainter, fainter, fainter still,
  By no breath of passion crossed,
With the tide I drift and glide
  Out to sea—and all is lost.

—Harriet McEwen Kimball.



THE LOBSTER HATCHERY ESTABLISHED AT WICKFORD, RHODE ISLAND.

FRESH LOBSTERS FOR THREE CENTS

By

C. B. EDWARDS

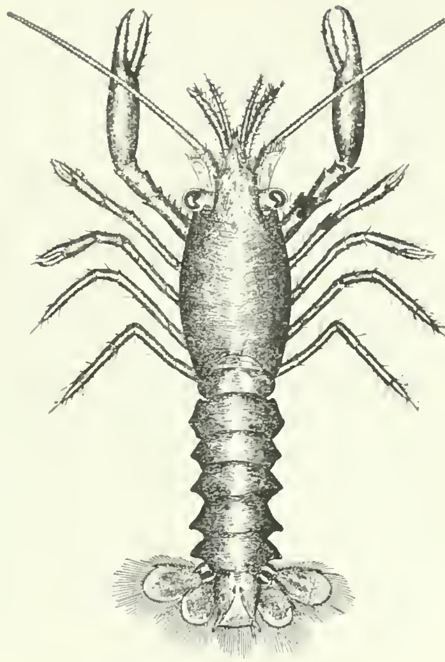
AFTER ten years of steady and continuous work on the part of the Commissioners of Inland Fisheries of the State of Rhode Island at their Experiment Station at Wickford, Rhode Island, a scheme has been devised and put in operation which promises not only to save the lobster from extinction but to revolutionize the methods employed in its artificial culture throughout the world, and lobsters for three cents will be no surprising result. The work accomplished, too, at the Wickford Station, gives a firm foundation for the future raising of the lobster from the egg state to maturity on a commercially practicable scale by artificial methods.

This being the final goal of Superintendent Earnest W. Barnes, who has been connected with the station for the past ten years, he regards the work done as simply a start in the right direction, although what has already been accomplished is without precedent in this or foreign countries, the efforts of biologists both abroad and in the domestic service of the United States Fish Commission failing to bring about anything like the results accruing from the patient work of the Wickford authorities.

Owing to the alarming decrease in the lobster along the Atlantic Coast, the matter of artificial culture has received much impetus and the fact that the traffic in the lobster fisheries of Rhode Island is of considerable financial import to the state caused an immediate interest in the work of the Wickford Experiment Station. It is not generally realized that the lobster requires very delicate handling in the early stages of growth, a pine shaving in a retaining jar, the presence of wire netting over a bottle of larvae, may cause the death of hordes of the young crustacea. In the early stages of development the lobster is at the mercy of every current of water and makes easy prey for even the smallest of fishes. Probably their greatest enemy is in the cannibalistic tendency of the larvae, for all periods of life, but especially during the first three stages of life a lobster is eager to seize upon a weaker relative and devour him.

It is thus apparent that if much result is to be expected from the planting of lobster fry they must be reared to a point of development which approaches in the nearest degree the property of self defense inherent in the adult crustacea. It is admitted that with the exception of the Wickford Hatchery the state and national lobster hatcheries fall far short of accomplishing the desired results. Indeed, in the latter mentioned hatcheries it is admitted that not over two per cent. ever live to reach the second larval stage. Furthermore, in the planting of first stage larvae in this helpless state they are poured in a cloud of countless thousands into the water and the fish, attracted by the superabundance of food, proceed to avail themselves of the young lobsters. Authorities state that it is extremely doubtful if one lobster out of every thousand liberated in this manner ever survives.

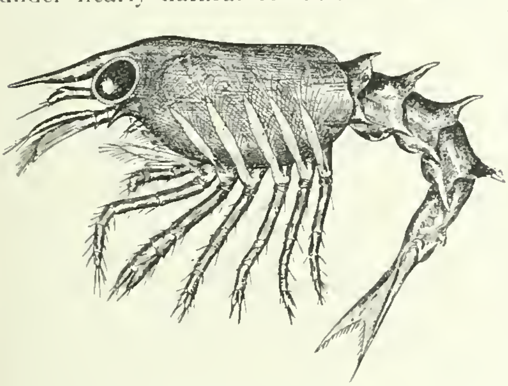
In the method employed at Wickford the egg lobsters are purchased in the spring and confined in covered cars, their claws being plugged to prevent fighting and the resultant scraping off of egg clusters which appear on the underside of the female adult. During the following May the lobsters that will hatch their eggs at approximately the same time are put in compartments together. As soon as the lobsters' eggs reach a point where they will hatch in two or three hours they are transferred to flat crates and allowed to float on this wooden structure in a large canvas bag or, as in the more recent method, the egg lobsters are placed in large wooden boxes which are subsequently used for rearing the larvae. The hatched larvae are allowed thus to roam around the bag or box under nearly natural conditions. When



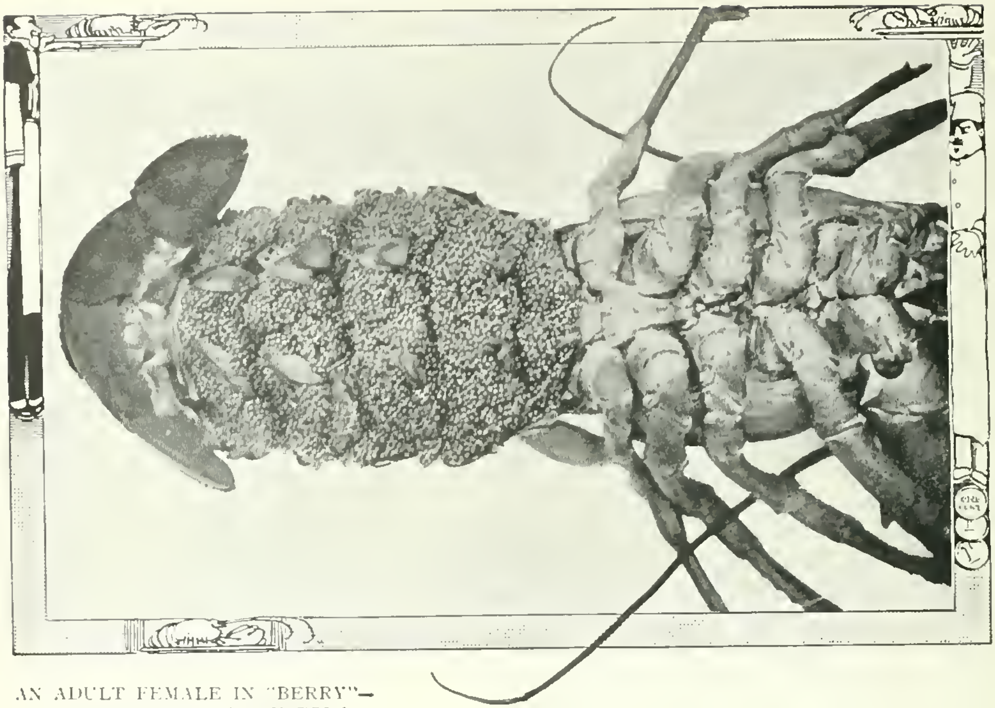
Fourth Stage Lobster.
Life size.

a sufficiently large number of eggs are hatched to fill the retaining bag with fry, the egg lobsters are removed to another bag. The main feature of successful lobster raising as practiced at Wickford is in keeping the hatched fry in constant circulation, thus protecting the fry from the fungous diseases which infest them and minimizing the danger of cannibalism. The circulation of water is accomplished by large, two-bladed, paddles, not unlike restaurant fans, which, by slow revolutions in a box or bag, keep the fry separated and at the same time fan the food within easy reach. The bags in which the lobsters are hatched are provided with screen windows, allowing the ingress of fresh water and the egress of the foul.

The most peculiar feature of the Wickford hatchery is the hatchery itself. It has no physical connection with the ground beneath it and is veritably built on water, for the hatchery looks like nothing so much as a large houseboat. Around it are grouped large raftlike structures supported by barrels. A main shaft running from the houseboat proper branches and ramifies in all directions



First Stage Lobster.
Several times enlarged.

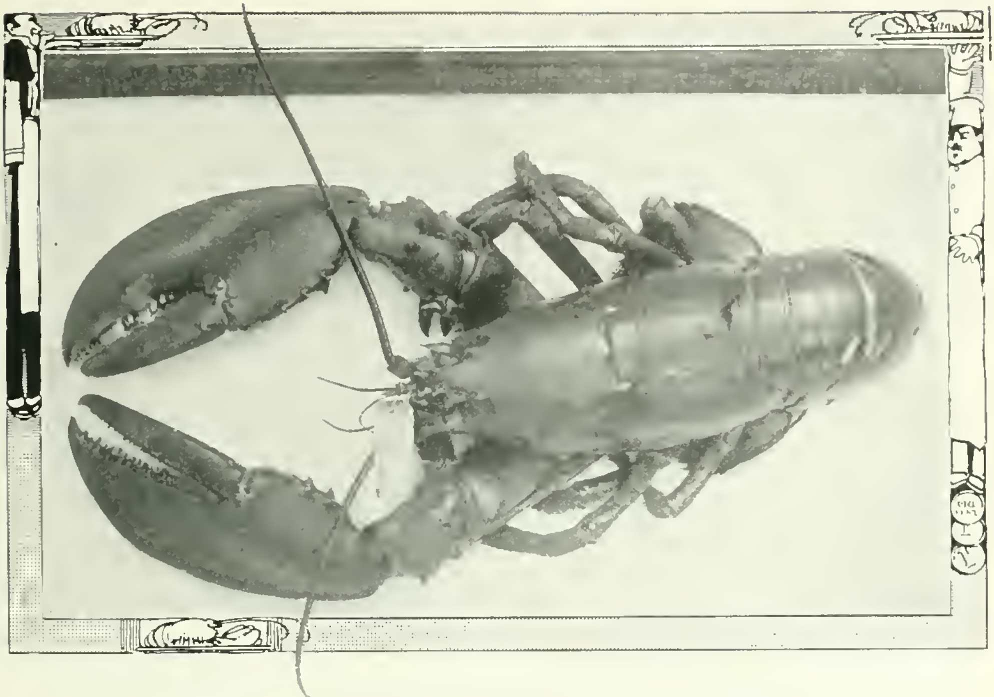


AN ADULT FEMALE IN "BERRY"—BEARING THE EGG-CLUSTERS UNDER THE TAIL.

over the rafts or floats. This system of shafting, deriving its power from a gasoline engine sheltered in the house-boat, transmits through bevel gears, the power necessary to drive the circulation propellers in each of the hatching bags. To conform to the undulating movement of the floats, the shaft from the engine house is connected to the floats by a flexible joint and the shafting used on the floats is of such small diameter that the motion of the water bends it without tearing off shaft hangers or breaking the shafting. Two floats are used, one on each side of the houseboat, and from these are suspended twenty-eight rearing bags ten feet square and four feet deep.

The engine gives a speed of 360 revolutions and this is reduced by belting to forty and finally, through gearing, to twenty and ten, the last named being the revolutions per minute that the "fans" run during the culture of the lobsters. The paddles are painted white, as the young lobsters tend to avoid all white surfaces, and the white sides and bottoms of the hatching receptacles protect the delicate larvae from injury by being thrown against the container or ventilating paddles. In the making of the ventilating paddles only by years of study was it possible to arrive at the proper angle for the blades of the paddles to impose against the water, it being found that an infinitesimal variation in this respect was the cause of total failures, resulting in the death of a large number of fry and poor larvae. The current given by the paddles must be just strong enough to keep the food in motion, prevent cannibalism by constant circulation, and keep the larvae from collecting at the bottom of the bag and rolling over with the food silt and diatoms that have collected there. The strength of current also affects molting, which is the process of growth in the crustacea, the growth being accomplished between the time of casting off the old shell and the hardening of the new coat.

The lobster fry eat ravenously in all stages and the feeding assumes great importance as the young lobsters molt three times in from ten to fourteen days. Under such conditions the feeding is



FEMALE LOBSTER TAGGED AND READY TO BE PUT BACK INTO THE WATER.

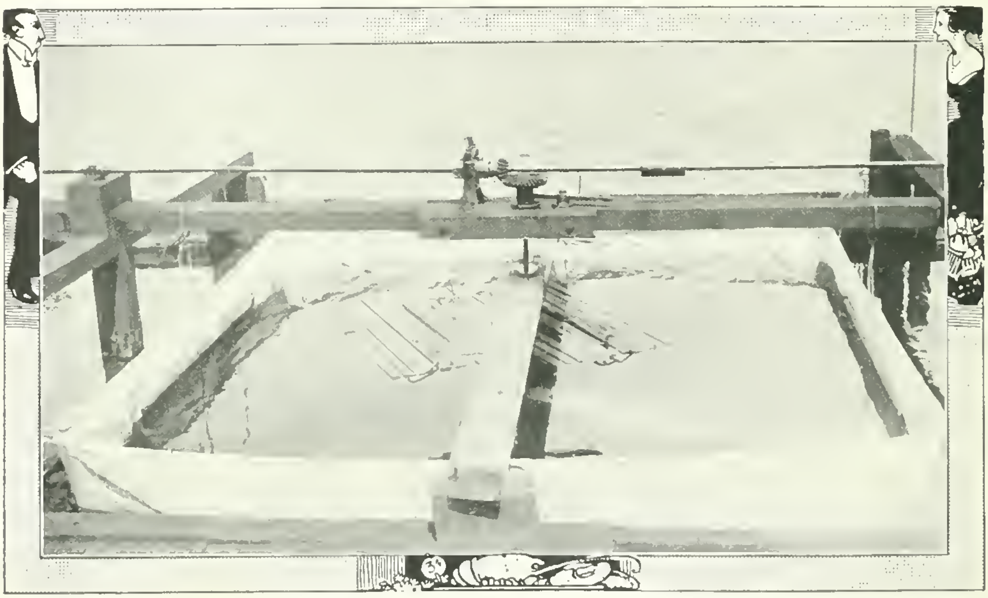
constant and regular. Scrambled hen's eggs, liver, and beef are used for food in a finely cut form to allow the gentle current of water to carry it within easy reach of the larvae, and the feeding is attended to every two hours throughout the full twenty-four of each day and night. To rear a lobster to the fourth stage for planting at the Wickford hatchery requires from ten to twenty-one days, depending mostly on the temperature of the water, and the young "lobsterlings" are planted after reaching this stage of maturity known as the first "ground" stage because of the fact that during the fourth stage the lobster takes up its abode among the rocks and grass at the bottom for the first time. As fast as the lobsters reach this latter stage of development they are dipped out, a few at a time, and counted. They are then put in a planting can and are due to be "planted" in the briny deep. To allow the fourth stage fry to take full advantage of their hiding instinct for protection after planting, they are poured out at the water's edge where an abundance of eel grass and rocks tend to make a natural harboring place for the young lobsters till they attain their full growth. With this method developed to the fine point it has been at the Wickford Station, it has been accurately calculated, not "estimated," that from forty per cent. to seventy per cent. of the eggs yielded by the egg lobster reach the fourth stage of development. As their most precarious period of existence is during the first three stages, the fourth stage lobsters have an infinitely greater chance to survive against the natural enemies around them than would be possible under any circumstances with the first stage larvae as still liberated by the other state and government establishments.

After hatching is over the female lobsters are again consigned to the waters from which they came and are put back in pre-determined localities with copper tags fastened to them giving a recorded number. The fishermen are requested to return the tag to the station with information as to the locality of the trap it was caught in. By this method the egg bearing lobsters have furnished valuable data regarding their movements, after their period of usefulness at the station has expired.

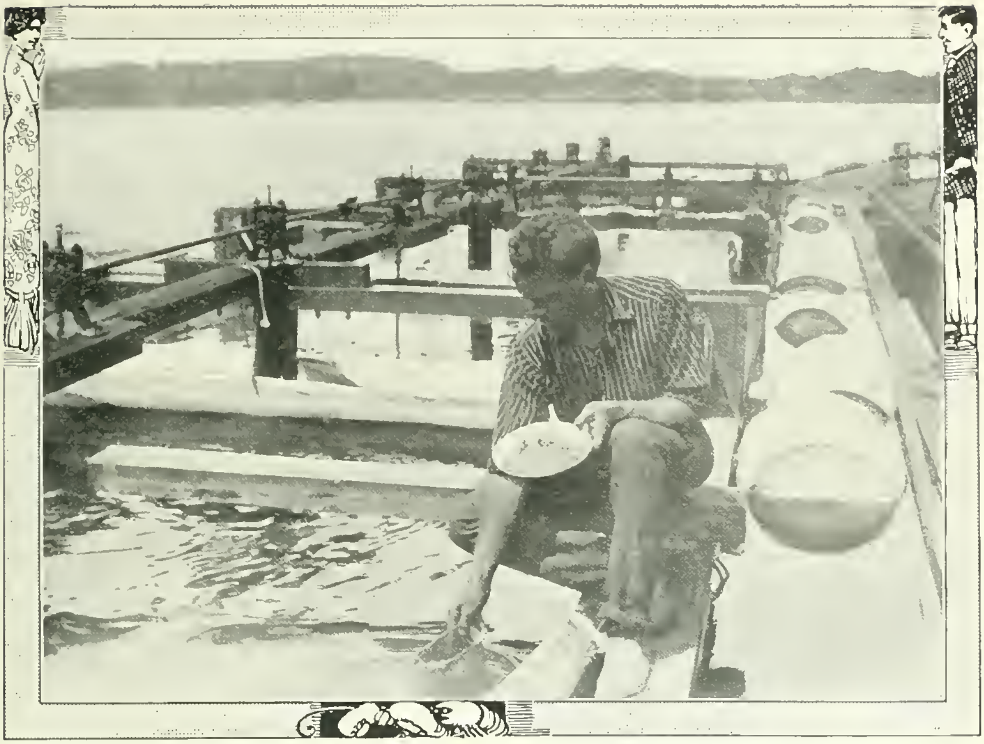
The unique plant which this new process of culture has successfully dem-

PLANTING FOURTH STAGE LOBSTERS.

onstrated cost only $2,500 and has a capacity of 500,000 young lobsters each season. Allowing for running expenses and labor the process produces fourth stage lobsters for about $2.00 per thousand or five for a cent. During the year of 1910 over half a million were reared to the fourth stage and from one egg lobster 8,000 fourth stage lobsters were produced. The probability of reducing the cost of this highly prized sea-food to a nominal amount is therefore excellent.



METHOD OF SCATTERING LOBSTER EGGS.
The eggs are placed on the floating slats of the fan.



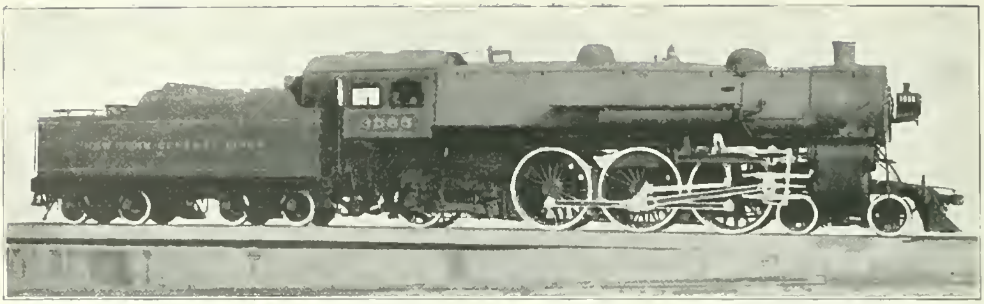
FEEDING YOUNG LOBSTERS AT THE WICKFORD STATION.

It is not too much to say then, that the luxuries of the rich and of the well-to-do may soon be served on the workingman's table. Though of course lobster will never be cheap at the best restaurants, where service as well as actual ingredients must be paid for. That need not trouble us. A good cook in the home—in reality equal to any French chef—will readily obviate that difficulty.

Dreams and Books

Dreams, books, are each a world; and books, we know,
Are a substantial world, both pure and good.
Round these, with tendrils strong as flesh and blood,
Our pastime and our happiness will grow.

—WORDSWORTH.



THE CHAMPION COAL EATER.
An engine of this type consumed 4.25 tons of coal per hour in a test run with seven coaches, making sixty-five miles per hour.

MACHINES TO FIRE LOCOMOTIVES

By

CHARLES FREDERICK CARTER

IF official prophecies are entitled to credence the next great evolution in railroad operation will be the general introduction of automatic stokers to relieve locomotive firemen of a task that has grown beyond the powers of human muscles. For three consecutive years the standing committee on stokers of the American Railway Master Mechanics Association has predicted the early advent of the automatic, or mechanical, stoker; and according to popular belief, "three times is the charm."

In 1908 the committee said in its report to the annual convention, "Mechanical stokers used on locomotives in this country up to the present time have at least demonstrated the fact that freight and passenger engines in road service can be successfully fired by mechanical means. Mechanical stoking, however, has not made much progress abroad."

In its 1909 report the committee grew more bold, saying, "Results hold out great hopes for the future, particularly as the question has been taken up seriously by a number of railroads. . .

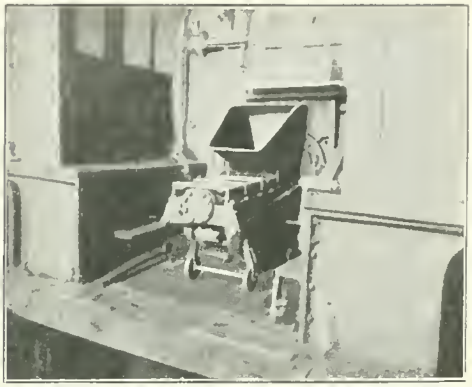
"It is reasonable to assume that the average tractive power of locomotives will increase. It is within the possibilities, therefore, that the increased fuel consumed per mile will render it advisable to provide mechanical means for firing locomotives in order that they may develop high sustained tractive effort and render the service attractive to men who possess the qualifications to become successful locomotive engineers. A successful automatic stoker should render locomotive firing more attractive, raise the standard of the service, permit close attention to the economic handling of fuel and the reduction of black smoke, enable firemen to become better acquainted with the general duties of a locomotive engineer and reduce tube and firebox troubles."

By the time the 1910 convention had assembled the stoker committee had become fully converted, as may be gathered from its report which contained this declaration: "The committee is convinced that the mechanical stoker is destined to be a very important factor in the operation of heavy locomotives in the not very distant future."

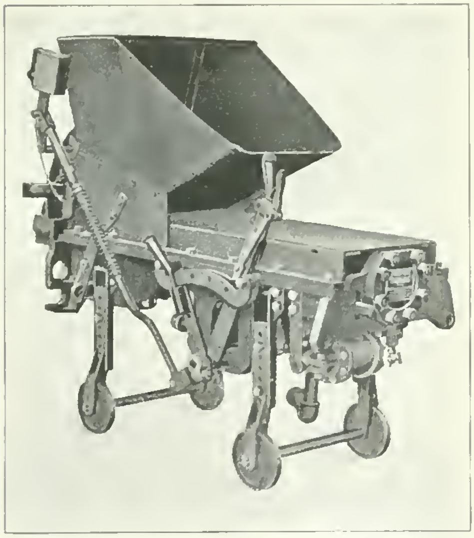
Railroad men have no occasion to read the unemotional reports of the committee to be convinced of the urgent need of a satisfactory automatic stoker; but since it is not the privilege of everybody to be railroad men it may be well to give some idea of what firing a locomotive means before discussing the subject of stokers. To the country boy who sees the fireman lolling on his cushioned seat box while his train stands on the siding waiting for the limited, it means a life of indolent ease at good pay with abundant opportunities for long range flirtations with the girls along a stretch of a hundred and fifty miles of steel highway. Consequently he loses no time in applying at the nearest division headquarters for a job. He is received with dissembled, but none the less sincere, joy; for the demand for firemen is great, and the best ones are farm bred.

But the "cornfield sailor" who has the strength of mind, character and muscle to struggle through all the preliminaries required to reach the left side of the cab immediately discovers that in addition to anticipating the coming of the pay car and throwing kisses to the prettiest girls along the road he is also expected to shovel from fourteen to twenty tons, or even more, of coal a day; and that this coal shoveling occupies his attention so fully that by the time he gets to the end of his run he doesn't care a hang if he never sees a paymaster or a rural coquette for the rest of his natural life.

To a husky young man, shoveling twenty tons of coal a day may not sound like a terrific undertaking; but that is because he fails to appreciate the difference between shoveling that quantity in the course of a ten hour day, standing on a steady footing and pausing for a moment whenever he feels like it to gaze at the scenery or light a cigarette, and trying to keep his balance on a jolting, jerking, plunging steel deck which tries ceaselessly to pitch him head first into the side of the cab, while with legs spread wide apart he humps over a scoop shovel, working with frantic energy to get coal into the firebox fast enough to keep steam up. While the engine is running the fireman must be straddled out on the deck working continually to the limit of his strength, for ordinarily he will have to get from two and a half to three

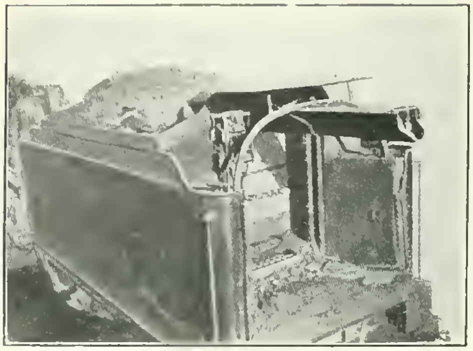


Strouse Automatic Stoker in Use on Heavy Consolidation Locomotive, Iowa Central Railroad.

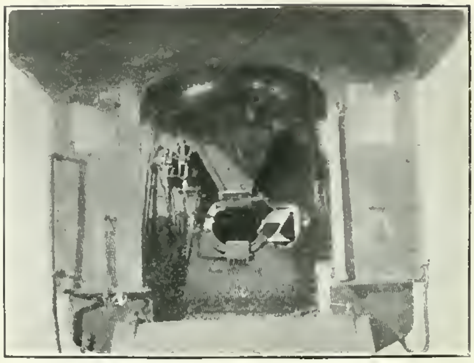


Side and End View of the Strouse Stoker

The Transfer of Coal from Tender to Fire Door Is Accomplished by the Use of a Screw Conveyor.
The Crosby Stoker.



THE HAYDEN STOKER IN USE ON THE ERIE RAILROAD.
Tender conveyor, driving engine, grating and trough.



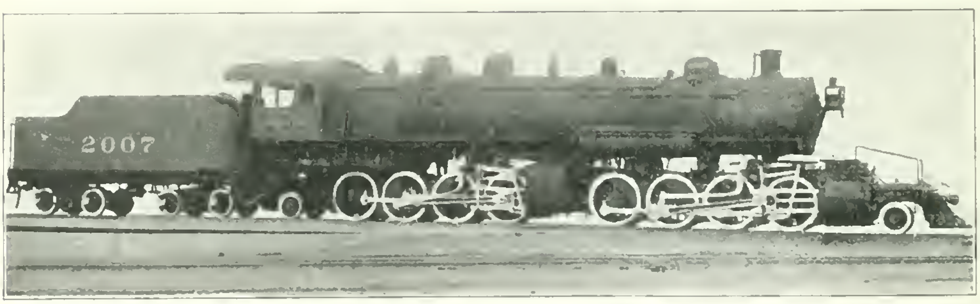
FIRE DOOR OPEN.
The Hayden Stoker.

tons of coal into the firebox every hour. Three and a half tons is generally regarded as the limit of a fireman's capacity, but this has been greatly exceeded on the fastest trains.

To turn from the general to the particular, one of the Lake Shore's monster Pacific type locomotives, weighing 266,000 pounds, hauling the west bound Twentieth Century Limited with seven cars in the train on a test run December 5, 1909, made the run between Toledo and Elkhart in 2 hours and 4 minutes at an average speed of 65 miles per hour. In this short time 8¾ tons of coal were shoveled into the firebox. The average scoop used on a locomotive holds 14 to 15 pounds of coal. Taking the latter figure as the average scoop load the fireman had to reach out into the tender, a long stretch, get a shovel full of coal, swing it around and throw it into the firebox, not anywhere, but on the particular spot on the 56½ square feet of grates that happened to need it most at that instant, every 6.3 seconds from start to finish. This is the most remarkable feat of firing for which authoritative figures are available, and it may also be submitted as a marvelous feat of physical endurance.

But this is not all the story. The heat from the open fire door is so intense that it not infrequently blisters the fireman's side, while the white hot glare sears his eyes until seventeen per cent. of firemen are disqualified for further service in the first three years on account of defective vision.

So much for the fireman's side of the stoker problem. For the railroad company the question is even more serious. Already there are many locomotives in service which never do anywhere near what they are capable of doing, for the simple reason that the man never lived who could keep one of them hot while working at maximum capacity. Take,

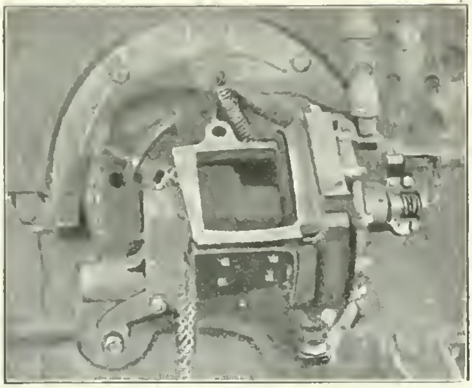


A MALLET COMPOUND LIKE THIS COULD BURN 12,000 TO 15,000 POUNDS OF COAL PER HOUR IF DESIRABLE OR NECESSARY
There is no way, however, of getting it into the firebox.

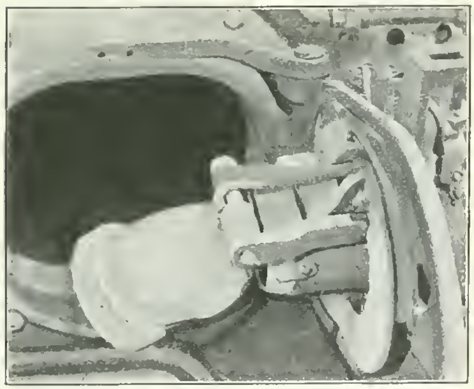
for example, a Mallet articulated compound locomotive weighing 445,000 pounds and having a grate area of 99.85 square feet. In the series of tests on the Lake Shore already referred to, the average consumption of coal was 129.6 pounds of coal per square foot of grate area per hour; the maximum, 150 pounds. Some locomotives crowded to the limit have been found capable of burning 200 pounds per square foot of grate area per hour. At the average consumption for the Lake Shore test the big Mallet would burn 6½ tons per hour or one-half more than the Pacific type locomotive burned. At the maximum for the Lake Shore tests the consumption would be 7½ tons, while at the highest recorded rate of consumption it would eat up 10 tons of coal per hour. It is hardly necessary to point out the utter impossibility of any mortal getting even the smallest of these quantities into the firebox in an hour. As a matter of fact a Mallet locomotive of the size mentioned in a test run in pusher service on the Delaware and Hudson burned 5,781 pounds of coal per hour. This was not the measure of the engine's possibilities but of the fireman's capacity under the circumstances.

It is not possible for two firemen to work at once because there is barely room for one man to swing himself on the narrow deck. The C., N. O. & T. Railroad tried the experiment of putting two firemen on one of its Mallet locomotives on a Kentucky division with heavy grades. The men relieved each other at short intervals, each working with his utmost speed when his turn came, but they could not keep up steam. Besides, the constant blasts of cold air through the open fire door caused the flues to leak so badly that they had to be caulked at the end of every trip. Then the company put on a Hanna mechanical stoker and invited the University of Kentucky to send some of its young men to make a forty days test. The first effect noticed was that the flues did not have to be touched during the forty days. The other results when figured out and tabulated were so favorable that twelve more stokers were ordered.

From all this it may be gathered that the call for an automatic stoker that will meet the requirements of all the varying conditions of road service in America is urgent. In Europe where the locomotives are small and the trains light the necessity for an automatic stoker is not so apparent and so practically nothing has been done to develop one.



THE DISCHARGING HOPPER OF THE CROSBY STOKER.



THE CROSBY STOKER WITH THE DEFLECTOR.
The deflector regulates the feeding of coal.

In the United States a number of automatic stokers have been tried out with varying degrees of success; but with possibly a single exception none is yet regarded as entirely satisfactory. As in the case of every other important device used on a railroad, there has been a weary road to travel between the first conception of the idea and its practical working out.

Locomotive mechanical stokers are of two general types, the overfeed and the underfeed. Of the former, which was the first developed, the greatest number

The Firemen on the Twentieth Century Have to Do Some Hustling.

have been tried out. Of the latter, but two have been attempted and but one of these developed.

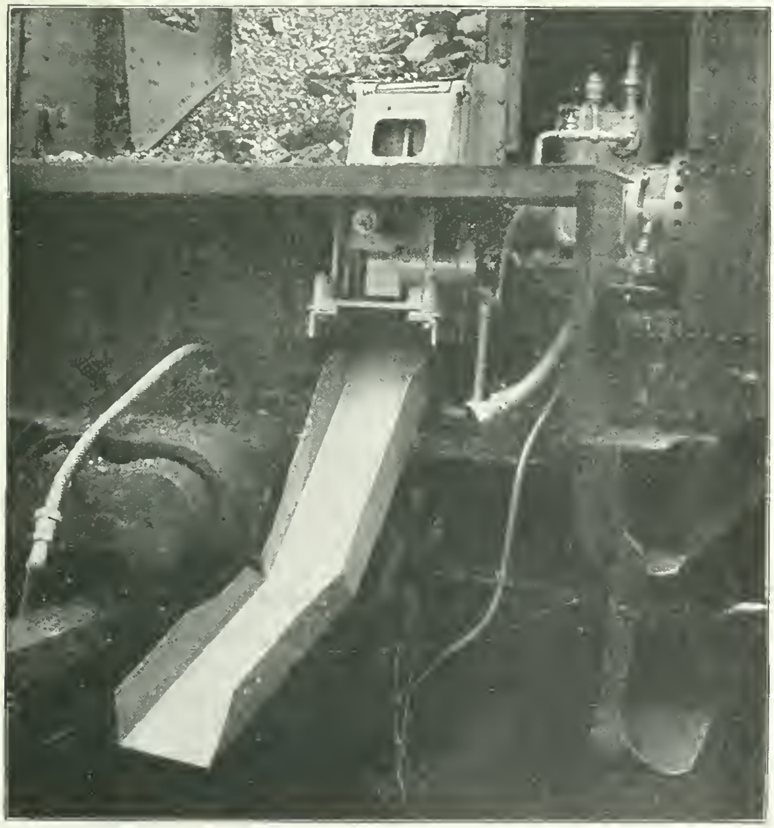
The first automatic stoker was invented a dozen years ago by J. W. Kincaid, an engineer on the Chesapeake and Ohio, where it had been found next to impossible to keep up steam in the hundred-ton locomotives to enable them to haul their full tonnage over long divisions. The original stoker was worked by hand at first, then a steam motor was applied. It did very well but was unpopular with the firemen, just as the injector, the air brake, sight feed lubricator and all other improvements were at first.

This original stoker, developed under the name of the "Victor," consisted of a hopper standing on a frame attached to the boiler head and supported on three wheels. Two conveyor screws in the bottom of this hopper worked the coal forward on to a stoking plate in front of a plunger. This plunger, which was wedge shaped, forced the coal over an upward sloping deflector, thus spreading the coal. By means of three valves operated in rotation the plunger made a rapid, a medium, and a slow stroke, to throw coal to the forward end of the firebox, the middle and the back end. The apparatus was worked by a steam engine beneath the hopper.

At first coal was thrown into the hopper by hand so that the only thing it did was to protect the fireman from the heat, and the flues from the cold draughts.

The Crosby stoker, which originated on the Chicago and Northwestern, had a screw conveyor in a trough in the floor of the tender to convey coal to the firedoor where it dropped into a small receiving hopper at the bottom of which were steel blades revolving horizontally at high speed forcing the coal through a nozzle into the firebox. This nozzle was jointed so that it distributed coal down the left side of the firebox from front to back, then up the middle and down the right side, completing the cycle every thirty seconds. The spreader could be stopped anywhere to build up a thin spot in the fire. The stoker was operated by a small steam turbine disk upon which four small steam jets impinged. The other end of the shaft drove the conveyor through a cone gear by which the speed could be varied. The attempt to develop the Crosby and the Victor stokers to an efficient working basis has been abandoned.

The Strouse stoker has a conveyor to deliver coal from the tender to a hopper above the firedoor from whence it is distributed by means of a plunger much like that of the Victor. The firebox door is replaced by a special door hinged at the top and opening inward which can be taken off and replaced by the regular door for firing by hand. This seems to be the most advanced of the plunger type of stoker, for it is in use on twenty-two locomotives on the Chicago, Burlington and Quincy and two on the Iowa Central. On one trip on the Burlington a locomotive equipped with a Strouse stoker hauled five hundred tons more than its rated capacity at an average speed of seventeen miles per hour over the division. The steam pressure did not vary more than four pounds and there

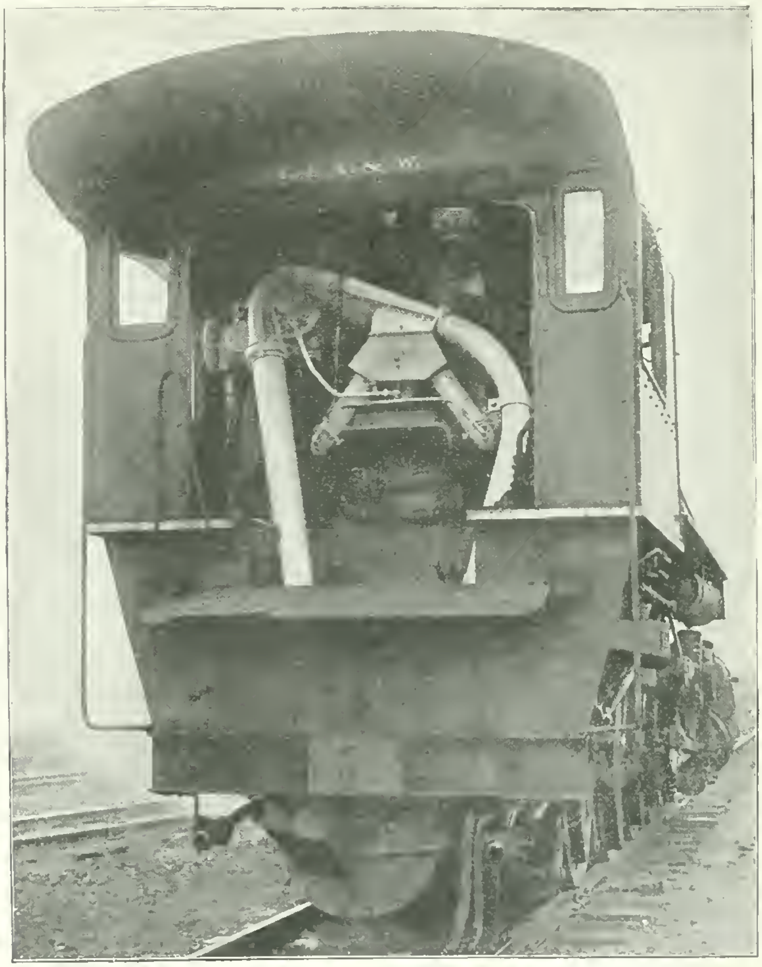


A RECENT AUTOMATIC STOKER—THE STREET
The coal crusher is located on the tender.

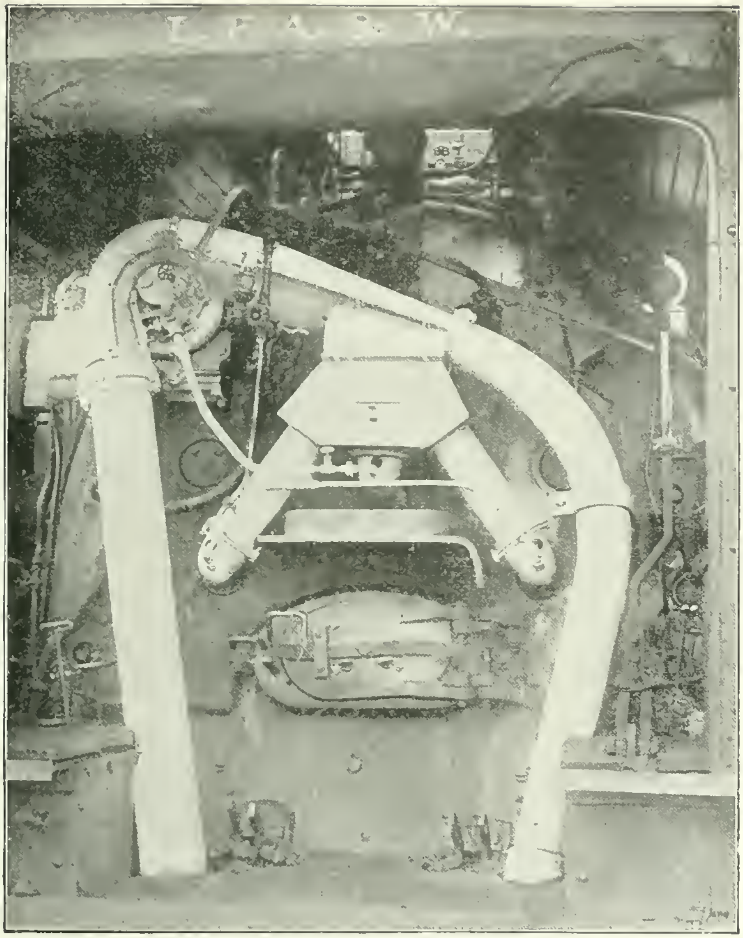
was very little blowing off. At the end of the trip the fire was in such good condition that the engine could have gone back over the division without having the fire cleaned.

The Erie Railroad has been experimenting with two stokers, the Black and the Hayden. The former delivers coal from the tender by means of a worm conveyor into a hopper above the firebox door from which it falls on a shelf. Two four-bladed wheels running at 250 revolutions per minute spray the coal over the fire over a tilting shelf which directs the spray of coal to any part of the grate.

The Hayden stoker, which has been tried on six Erie locomotives, is in two separate parts, each driven by its own engine. The first part is a mechanical coal heaver on the tender which by means of bucket on endless chains elevates the coal from the tender to a trough six feet above the floor. A worm conveyor in this trough delivers the coal into a hopper on the stoker proper. A slide operated by hand lets the coal from the hopper on to a shelf 5 inches wide and 2 feet long inside the firebox. Intermittent steam blasts from five radially directed nozzles blow the coal off the shelf into all parts of the firebox. The intermittent blasts are regulated by twin engines with cylinders 1.5 by 1.5 inches turning a small gear wheel on which is a striking pin with beveled head which strikes the end of a bell crank lever



REAR VIEW OF LOCOMOTIVE WITH THE STREET STOKER.
This stoker is of the scatter type, in which crushed coal is driven into the firebox by steam jets.



INTERIOR OF THE CAB.
Street Stoker.

which lifts an auxiliary valve, which in turn admits steam to a piston valve opening a passage to the nozzles. There is a peephole through which the fireman can watch his fire, and if everything is not going right he can help out with the scoop, as the stoker does not interfere with the regular fire door. This stoker has often fired eighteen or twenty tons of coal on a division 140 miles long, though it uses more coal than a good fireman would.

The Street stoker, which has been used experimentally on the Lake Shore since May, 1909, consists of crusher, with swinging jaws to break up the larger lumps of coal, an elevator consisting of a double endless chain with buckets traveling in pipes and driven by a small engine. The coal falls through a hopper into three distributors, one in the center and one on each side above the door from which it is blown over the grate by intermittent steam jets. A discharge regulator enables any part of the fire to be built up at the discretion of the fireman. Complete round trips over a division of a hundred miles have been made without opening the door.

D. F. Crawford, Superintendent of Motive Power of the Pennsylvania Lines West of Pittsburg, has developed an underfeed stoker which promises to produce great results when all the minor details have been perfected through tests in service. He started out with the proposition that the stoker must do all the work all the time, that it must be a part of the locomotive and not an attachment to be thrown aside at will, that it must be saving of coal and that it must produce no smoke. These requirements seemed to bar all forms of overfeed stokers.

All the various styles of underfeed stokers for stationary plants were tried and failed. Then, after a series of experiments extending through years, an underfeed stoker that would work on a locomotive was produced. There is nothing in the cab and nothing visible anywhere except a large cylinder bolted to the back end of the frames on the fireman's side, which might be mistaken for a brake cylinder. The apparatus in the tender includes a plunger which breaks up the larger lumps of coal before it drops into a trough in the floor of the tender. Two bars on each side of the trough are connected at intervals by cross bars on each of which are six fingers. These longitudinal bars have a reciprocating motion. As they move back they rise so the fingers drag back over the top of the coal. On the forward stroke they dig into the coal and drag it forward. The coal falls out of the front end of the trough into two troughs 9 inches wide placed 27 inches apart from center to center and at equal distances on either side of the firebox. These troughs extend the length of the grates, sloping up from a depth of 18 inches at the back to nothing at the front. In the bottom of the troughs are three plungers in succession working in square recesses. The back plunger is the largest, the next is smaller and the front one is the smallest. This arrangement of plungers distributes the coal evenly under the grates. As it is worked forward by the plungers the coal rises and falls over on to the grates, which occupy the areas between the troughs and between the troughs and the sides of the firebox. A nearly uniform bed is maintained over the whole area and the whole upper surface is kept aglow. As the green coal comes up under the glowing coal the gases are consumed so that the engine is practically smokeless. The whole apparatus is worked by rocker arms and rods driven by the steam cylinder mentioned. Each stroke of the plungers delivers about twenty-eight pounds of coal to the fire. The speed is regulated by a valve so that the fireman has entire control. There is a peep hole protected by blue glass so that he can watch the fire. In a series of 81 trips between Columbus and Denison there were but 18 trips in which the stoker failed to do all the work and but 3 in which it did less than 90 per cent of the firing. In case of accident, however, the engine can be immediately fired by hand without any changes being made, for there is no obstruction in the cab. This experimental stoker has fired 5,200 pounds of coal per hour.

From all this it may be gathered that the automatic stoker is far advanced on the way toward the practicable stage. With the automatic stoker in general use it will be possible to introduce locomotives of the largest type wherever traffic is heavy enough to require them and to work them to the limit of their capacity. By this means the capacity of existing lines can be very greatly increased, for the big engines working at their maximum power will not only haul much heavier trains, but they will be able to make better speed. While the fuel bill of the railroads, already $337,000,000 a year, will be increased, other economies made possible will wipe out this increase and leave a handsome margin of saving besides.

REAR VIEW OF CALIFORNIA'S STATE INSECTARY.

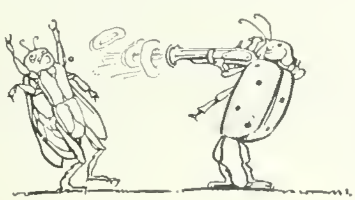
BATTLE OF THE BUGS

By

JOHN L. COWAN

IT is quite possible that anyone who might happen to be stranded in the canyons of the High Sierras of California, any time between Christmas and Easter, might stumble upon two or three young men whose actions in those almost inaccessible solitudes would look very mysterious. He would see them gather up great masses of dead leaves and rubbish in places where the snow had melted, sift the finer material into burlap sacks, throw the leaves and sticks away, and then hasten on to a new location. If he were curious enough to follow the mysterious strangers, he would find that as soon as the bags were filled they were loaded upon the back of a patient mule, taken to the nearest railroad station, and shipped to Sacramento.

Inquiry would probably elicit the statement that the young men were from the "State Bug-House," but the inference that they were escaped lunatics, if natural under the circumstances, would be altogether wrong. The "Bug House" is the name commonly applied to the California State Insectary at Sacramento; and the methods described are those employed by the field agents of the Insectary on expeditions for the collection of ladybird beetles. These breed in the canyons of the Sierras, where they are collected while still dormant in the winter time. Tens of millions of them are shipped to the Insectary, where they are kept in cold storage until the melon aphis makes its appearance in the cantaloupe and cucumber fields of the Imperial Valley, or until the peach and apple aphids are reported in the orchards. Then they are shipped to the endangered region, in whatever quantities may be required to meet the emergency; and when this has been done,



the doom of the aphid pests is considered sealed.

These ladybird cohorts, directed and controlled by the parasitologists of the State Insectary, probably saved the extensive melon growing industry of the Imperial Valley from entire destruction, and have prevented the loss of orchard fruits worth millions of dollars in many widely separated districts throughout the State. This, however, is simply an illustration of the sort of work the parasitologists of the Insectary are doing. As an institution, the State "Bug House," as it is usually called—for of course anything in the nature of an insect is a "bug" in the popular mind—is absolutely unique, and without a peer in the world. Superintendent Carnes, and his coadjutor, Acting Superintendent Maskew, do not antagonize spraying, dipping, washing, and fumigating as methods of ridding fields, orchards and gardens of insect pests; but they keep up an unceasing search for something better—in other words for natural checks that will render these makeshift expedients unnecessary. Never since men began to practice agriculture and horticulture have mechanical means brought under permanent subjection and control a single pest of this nature. The orchard that has been sprayed or fumigated, and the field that has been treated with Paris green or other insecticide, this year, must be similarly treated next season, and so on for all time to come. These operations are expensive, and never result in more than a temporary victory for the horticulturist. The basic idea of the new science of parasitology, then, is to employ bugs to fight bugs: to pit predaceous or parasitic insects against those that destroy the crops, in the absolute certainty that nature never created a pest without an efficient check. The Insectary, then, was established for the purpose of collecting, propagating and distributing beneficial insects in sufficient numbers to be of commercial value. It is in charge of scientists of exceptional attainments, and of more than national reputation, upon whom is laid the task of translating pure science into a commercial commodity, for the benefit of California agriculturists and horticulturists. It is a subdivision of the State Horticultural Commission, which keeps an explorer in the field, who traverses every country on the globe in search of beneficial insects, sending such as he thinks likely to prove serviceable to the Insectary. There they are bred, studied and observed, and, if proved to be valuable, an effort is made to breed them in sufficient numbers to meet all legitimate demands. Insects whose good offices have been conclusively demonstrated are for free distribution in the State, to persons having need of their services; and demonstrations are given in the orchards, gardens and truck farms, showing the farmer just what sort of help he is justified in expecting from his insect allies, and just how he must co-operate with them in order to secure the best results. "Larger crops of cleaner fruit at a less cost of production," is the slogan of the department, as stated epigrammatically to the writer, by Acting Superintendent Maskew.


A Sackful—and a "Few Extras."
Ladybirds collected in the Sierras.

One statement made to the writer by Mr. Maskew, at first thought appears startling. It is this: "In all the world there is a permanent surplus of but one thing: that is life itself." So superabundant is life that nature takes almost as elaborate precautions to insure its destruction as to secure its reproduction; so that for every form of life there is one or more other forms to prey upon it, and prevent it from becoming redundant."

By this interminable

series of natural checks upon the endless number and variety of forms of life, a fairly even balance is maintained. But man, in providing for the wants of a complex and highly artificial civilization seriously disturbs this nattural balance or equilibrium—to his own undoing, unless that equilibrium can be restored. This equilibrium may be disturbed in various ways. For example, in the Imperial Valley the natural life-balance has been upset by irrigation, bringing vegetation to luxuriant growth at a season when the whole region, in a state of nature, was a parched and burning desert. The ladybird beetle is native to the valley, but it issues in January, when the various aphids indigenous to the same region also issued, when natural conditions prevailed. But by irrigation and cultivation the melon vines are made to grow in April and May, supplying an abundance of food to the aphids, and causing them to multiply with the rapidity characteristic of that order of insect life, at a season when their natural check in that life-zone is inactive. To restore the equilibrium, ladybirds must be imported from the snowy canyons of the Sierras into the tropic fields of the valley.

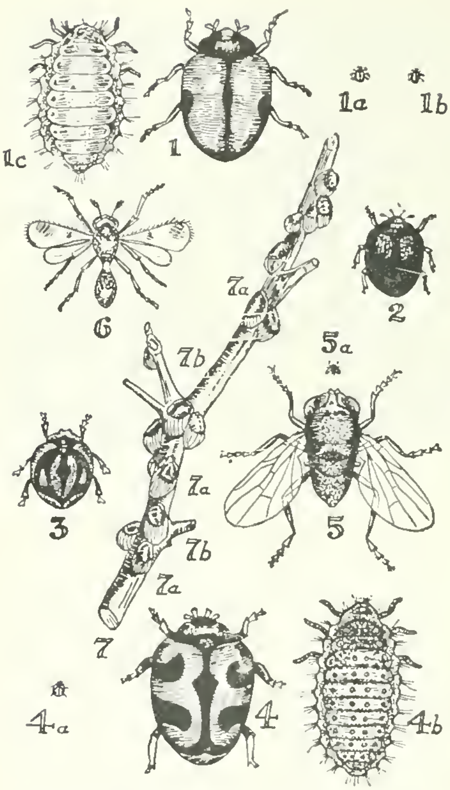
A TRAVELING "BUG HUNTER.
George Compere, of California.

E. K. CARNES.
Superintendent of California's State Insectary.

FREDERICK MASKEW.
Parasitologist of the California State Insectary.

But a more common, and usually more serious, disturbance of the natural life-equilibrium is due to the importation of foreign insects. A new variety of fruit, for example, is imported from Australia, or Japan, or South America; and it is quite likely that the almost microscopic eggs of some insect that thrives upon that fruit are brought along unnoticed. In its natural habitat that particular insect probably did no noticeable damage, because its natural check kept it within bounds; but in its new environment, with an abundant food supply, and with no predaceous or parasitic enemies to limit its increase, it propagates with inconceivable rapidity, develops into a pest, and causes widespread destruction. When a pest of this kind makes its appearance in California, war is immediately begun upon it by means of insecticides, dips, sprays or poisonous gases, in an effort to prevent its spread and to limit its ravages. But while these crude and inefficient mechanical checks are not neglected, the parisitologists of the State Insectary are exhausting every resource at their command to find its natural check, introduce it into the State, breed it in sufficient numbers to be of use, and distribute it where needed. Nature never makes a mistake, and never does things by halves; and it is just as sure as fate that for every insect pest there is a natural check. To put it in another way; the Intelligence that created the universe is quite capable of running it, and never gave to any form of life the power to destroy without placing a definite limit upon its powers of destruction. The mistakes in the distribution of insect species that bring widespread destruction are man's mistakes: not nature's. And when man makes a mistake of that kind it is up to him to correct it by finding nature's remedy. That is precisely what the parisitologists of the State Insectary are doing for California.

The inception of California's plan of campaign, to fight bugs with bugs, dates



VARIOUS SPECIES OF LADYBIRD AND THE PARASITES FROM WHICH THEY SAVED CALIFORNIA'S $20,000,000 CITRUS FRUIT CROP.

1—4b inclusive represent ladybirds and larvae; 5—7b, cottony cushion scale parasite; 7, twig infested with cottony cushion scale.

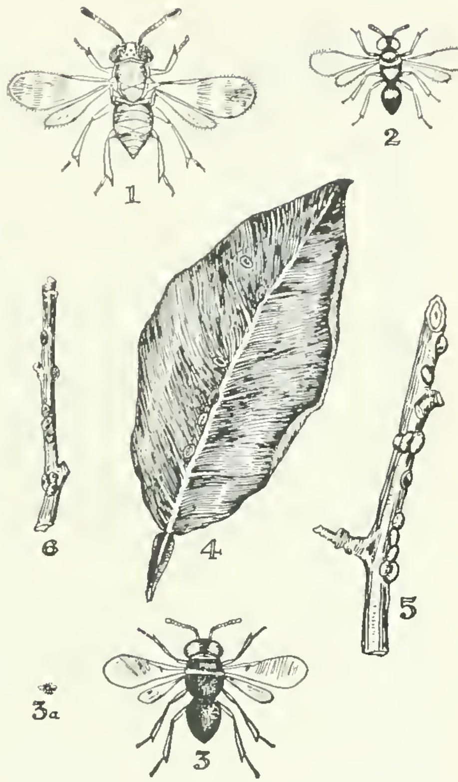
from 1888, the occasion being the ravages of an Australian pest introduced twenty years before. This was the cottony cushion scale, which for a time threatened the very existence of the orange growing industry. Groves that were badly infested presented the appearance of having been exposed to a severe snowstorm. From the orange trees the pest spread to hedges, shade trees, wild shrubbery and forests, until it was feared that vast areas of the State would revert to desert conditions. Shipments of oranges dropped from eight thousand car loads in one year to six hundred the next. Thousands of trees were cut down and burned, but the pest had been so widely scattered and had obtained so firm a footing upon wild vegetation that attempts to check its ravages, even by these heroic measures, were hopeless.

Prof. Albert Koebele, of the entomological division of the Federal Department of the Interior—the Bureau of Entomology not yet having been established—was sent to Australia, to try to find a check for the pest in the country from which it had come. He discovered a natural foe of the cottony cushion scale in the *Vedalia cardinalis*, a beautiful little red and black ladybird; collected it in quantities, and forwarded it to California, where it was distributed wherever the pest had made its appearance. A little later he introduced another species, *Novius koebelei;* and some time afterwards Mr. George Compere, explorer for the California State Board of Horticulture, discovered and introduced *Novius bellus* and the Black Vedalia. These ladybirds, like all others of the numerous species—numbering perhaps two thousand—of the great family of Coccinelidæ, are predaceous in their habits, both the larvæ and the matured

THE TRUE PARASITE AND ENEMY OF THE BLACK SCALE—SCUTELLISTA CYANEA AND RHIZOBIUS VENTRALIS.

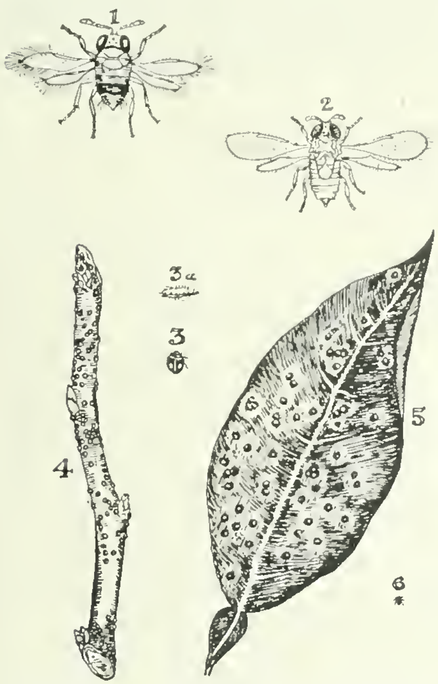
1—2, scutellista cyanea; 3—3b, rhizobius ventralis and larva; 4—6, black scale; 5, black smut.

insects pouncing upon and devouring the scale insects and plant lice that form their natural food. Other foes of the cottony cushion scale, also introduced from Australia, are a dipterous parasite, known as *Lestophonus icerya*, and a hymenopterous parasite, *Ophilosia crawfordi*. These deposit their eggs in the grub of the injurious insect; and when the young develop they feed upon the tissues of the host, killing it in embryo. Through the operations of these predaceous ladybirds and internal parasites, the cottony cushion scale was brought under complete subjection. It is no longer feared as a pest or regarded as a source of danger, so that in describing these species as the "beneficial insects that saved the citrus fruit industry of California, the State Commission of Horticulture indulges in no hyperbole or exaggeration. If anyone doubts whether it was worth while, it is sufficient to say that the citrus fruit crop of the State amounts to something like 35,000 carloads annually, worth $40,000,000 in the Eastern markets, or half that when



THE INTERNAL PARASITES—1, 2, AND 3—THAT HOLD IN CHECK THE SOFT BROWN SCALE—4—AND THE BROWN APRICOT SCALE—5, 6.

1. encyrtus flavus; 2. coccophagus lecani; 3, 3a, comys fusca.



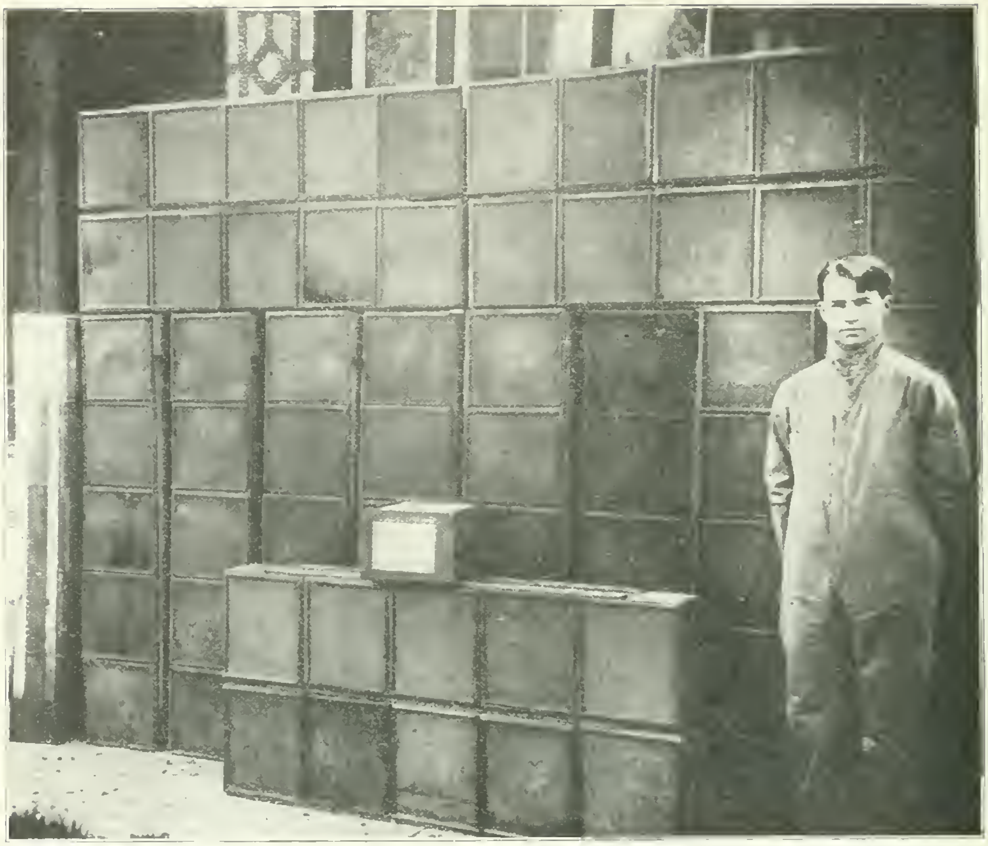
FOUR SPECIES OF INSECTS—1, 2, 3, AND 6—THAT SUBDUED THE SAN JOSE SCALE—4—AND THE YELLOW SCALE—5.

1. aspidiotophagus citrinus; 2. aphelinus fuscipennis; 3. chilocorus bivulnerus; 3a. larva of same; 6. rhizobius lophantha.

packed ready for shipment to those markets.

The successful fight waged by imported insect allies against this terrible menace to the citrus fruit industry convinced Californians that the scientific method of combating insect pests was to pit one form of insect life against another—to employ bugs for fighting bugs; and to that end the State Insectary was established. In 1891, the state legislature made its first appropriation of funds for a systematic search for beneficial insects—a search that Mr. George Compere, explorer for the California State Commission of Horticulture and for the entomological department of West Australia, has prosecuted in every quarter of the globe.

It is conservatively estimated that the minimum tribute annually levied by insect hosts upon American farmers is not less than ten per cent. of everything pro-



BUGS BY THE MILLIONS.
Shipment of 2,000,000 ladybirds from California's State Insectary to the melon fields of the Imperial Valley.

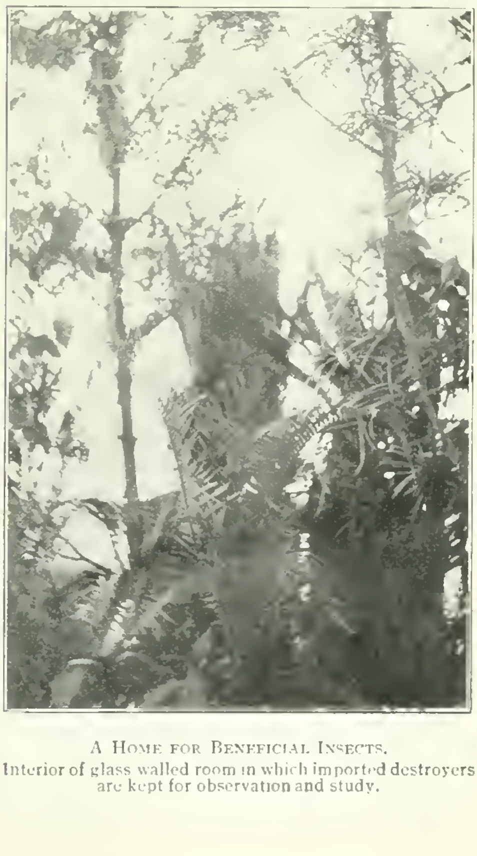
duced from the soil, and that the annual havoc wrought by forest fires is less than the damage to forest growth for which insects are responsible. The checking of insect depredations, then, constitutes a problem in national conservation of far greater moment than many of the local conservation issues that have occupied the attention of legislators and of the public. Secretary James Wilson, of the Department of Agriculture, estimated the value of the farm crops of the United States for the year 1909 at $8,876,000,000. But before the farmer gathered his harvest, the insect armies exacted a toll that reduced the total by at least $900,000,000!

California's elaborate and efficient organization for fighting insect foes is under the supervision of State Commissioner of Horticulture, J. W. Jeffrey. It is plainly as important to prevent the introduction of new pests as it is to find means of suppressing the old. So a Quarantine Division is maintained, in charge of Deputy Commissioner Dudley Moulton, with headquarters at San Francisco. Ironclad horticultural quarantine laws require that transportation companies, corporations and individuals bringing fruits, plants or bulbs into the State give notice to the quarantine officials, so that an inspection may be made. No vessel is permitted to enter any port in the State without having its cargo, even to the passengers' baggage, rigidly examined by the horticultural quarantine inspectors. Every tree, plant, bulb and package of fruit is taken possession of by these officials and carefully examined. Those found free from the suspicion of insect pests are promptly passed, and others are either fumigated or burned, as circumstances make necessary. Even an orange in the hands of a sick baby is likely to be taken from it, and the floral tributes on the casket of a citizen who has died abroad, and is being taken home for interment, are ruthlessly confiscated and destroyed. Of course occurrences like these do not tend to make the horticultural quarantine officials popular; but California has suffered too much from pests that came in accidentally and unnoticed to run any avoidable risks.

Horticultural regulations in the various counties are equally strict. Each county has a horticultural board, composed of three members. This board appoints local inspectors to any number that conditions appear to require; and has authority to order an inspection of any orchard, nursery, trees, plants, vegetables, fruit, packing house, storehouse, salesroom, or any other place or article that may be suspected of being affected with injurious insects, and to take steps to abate any pest found. It is required that all orchards be inspected at least once a year; that all horticultural inspectors shall be versed in entomology, and that they be instructed in the duties of their office by a competent teacher. As Superintendent Carnes, of the State Insectary, was conceded by all to be best fitted by temperament and attainments for such a task, he was detached from the Insectary many months ago, by appointment of Governor Gillette, to membership on the Board of Horticultural Examiners. This made it necessary for him to devote his time exclusively to the preparation of an extended series of questions for each county, and to conduct a separate examination in each county, of candidates for the position of horticultural inspectors. During his absence the responsible head of the State Insectary is Frederick Maskew, Acting Superintendent, to whose courtesy the writer is largely indebted for material used in the preparation of this article.

Mr. James Lick, of San Jose, California, was a plant lover, and introduced many foreign plants, shrubs and trees for the ornamentation of his grounds. In the early seventies, the pest that became known as the San Jose scale, appeared on trees belonging to him, rapidly spreading to other orchards in the neighborhood, and later to all deciduous fruit regions on the Pacific Coast, proving most injurious to pear, apple and peach trees. In 1893, it made its appearance near Charlottesville, Virginia, and investigation showed that Eastern nurserymen had scattered it broadcast over the Eastern and Southern States, through the sale of plum trees obtained in the San Jose district.

Before investigation was begun to determine from what country the San Jose scale had been introduced, Mr. Lick died. It being impossible to ascertain whence he had secured his plants, extensive explorations were made by Mr. Marlatt, of the Department of Agriculture, in order to find the natural habitat of the pest, as it was anticipated that its natural check would be discovered there also. Its true home was at last found, in the neighborhood of Pekin and Tientsin, China, where its enemy was discovered in the Asiatic ladybird—*Chilocorus similis*. A number of these ladybirds were imported, and the species has been bred to a considerable extent for the purpose



A Home for Beneficial Insects.
Interior of glass walled room in which imported destroyers are kept for observation and study.

of checking, if possible, the pest in the Eastern United States.

However, in California a native parasitic insect, the *Aphelinus fuscipennis*, adapted its taste to the San Jose scale; and, finding the food supply so abundant, increased with extraordinary rapidity, so that it has brought the dreaded pest well under control. It still breaks out from time to time in unexpected places, but the shipment of a few colonies of its parasitic foe from the Insectary suffices to check it before it becomes a menace, so that it is no longer feared. This is one of the rather rare instances in which a native beneficial insect has adapted its taste to an imported pest.

A Hunting the Ladybird.

Among other once serious pests that are now completely controlled by insect checks may be mentioned the soft brown scale on citrus fruits and the brown scale of the apricot, of which the natural checks are the two internal parasites, *Encyrtus flavus* and *Comys fusca*. In May of the present year, Mr. Maskew collected in the breeding cages of the Insectary, and shipped to endangered orchards, an average of no less than 12,000 flies of the last named species daily for a considerable period. The black scale that once appeared to threaten the very existence of the olive orchards, and that constituted a serious pest on citrus and many varieties of deciduous fruit trees, is fairly well controlled by an Australian ladybird, and a small internal parasite introduced through Charles P. Lounsbury, from South Africa.

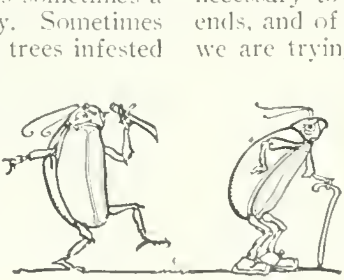
It may be inferred that to import live beneficial insects from China, Australia or other remote countries is sometimes a matter of no small difficulty. Sometimes it is necessary to pot small trees infested with a scale pest, box them carefully, and ship them to the distant country in which the enemy of the pest is found. There they are unpacked and exposed to the action of the parasite, which deposits its eggs in those of the scales. Then the trees are boxed up again, conveyed to the seacoast, shipped across the ocean in cold storage, and taken to the State Insectary. There the trees are unboxed and placed in a breeding room, where development is rapid, owing to favorable conditions of light, heat and ventilation. In this manner the parasite of the purple scale on citrus fruit trees was introduced from the interior of China.

One of the first points for determination at the Insectary, when a new beneficial insect is received from abroad, is whether or not it is affected by a secondary parasite. That every form of life has its natural check is just as true of beneficial insects as it is of pests, so that, while there is little poetry, there is a great deal of truth in the screed:

"Big fleas have little fleas
Upon their backs to bite 'em;
And little fleas have lesser fleas,
And so ad infinitum."

It is evident that if a secondary parasite were introduced along with the beneficial insect, to prey upon it and limit is increase, the very object in view in its introduction would be defeated. The breeding of insects in any quantities desired is a much less difficult undertaking than might be supposed. It is mainly a question of food supply, temperature, light and ventilation.

"It is a conservative estimate," said Mr. Maskew recently, "that one half of all the children now in California will some day be fruit growers, or the wives of fruit growers. If some of these can be given a fair idea of what we are trying to accomplish here, of the means necessary to the accomplishment of our ends, and of the importance of the work we are trying to do, to the agricultural and horticultural interests of the State, there will be fewer obstacles in the way of the parasitologists who come after us." So, perhaps, not the least important work of the Insectary is educational.



THE "TROUBLE MEN" IN ALASKA HAVE ARDUOUS WORK BEFORE THEM.
Repair party starting from a station.

WIRING AN OCEAN AND A WILDERNESS

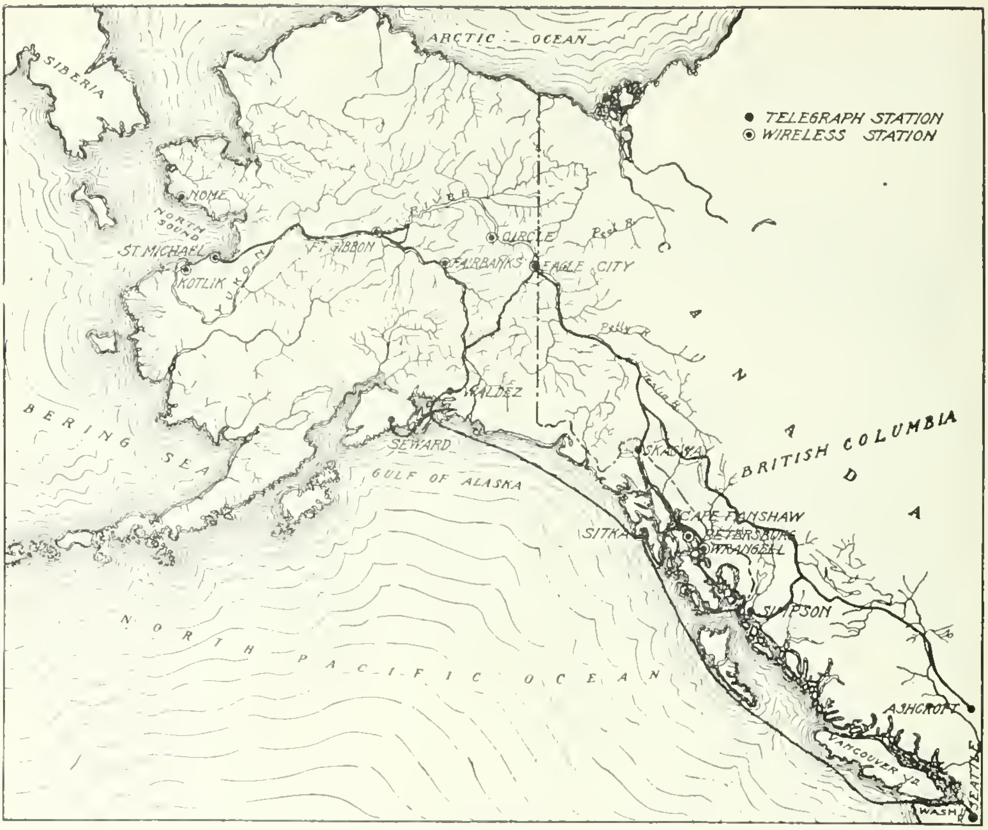
By

EDWARD B. CLARK

AN enlisted man of the Signal Corps of the United States Army, snowshoe shod, is harnessing his dogs to a sled outside a close chinked log hut in the Alaskan wilderness. He is making ready for a hard driving dash to the rescue of a prospector who, native report has it, is starving and freezing to death in a hut in the Valley of the Kinnoko.

The soldier is waiting the order to start, waiting for it to come from Washington, the Capital of the United States, five thousand miles away. Thirty minutes before he had asked the War Department for the word of authority to leave his post on a humane errand, and now momentarily he expects the reply that will give him permission to risk his own life to save that of another. The word comes and the relief expedition starts.

Thirty minutes to Washington and back, five thousand miles! Ten years ago how long would the soldier have waited on the edge of the Kinnoko Valley for an answer to his hurry-up message sent to the Potomac Valley? Before it came he would have counted the days and the weeks and the months, and in the meantime what would the cold and hunger have done to the blizzard-besieged prospector in the wilderness hut?



THE SYSTEM OF OCEAN CABLES AND TELEGRAPH AND WIRELESS STATIONS THAT KEEP ALASKA IN COMMUNICATION WITH THE WORLD.

The picture in part is fancy, for no American soldier would wait thirty minutes or thirty seconds for an order to save life. It is drawn only to show that today the military authorities in Washington are in telegraphic touch with the remotest points in Alaska, and that orders can be transmitted to Nome with virtually the same rapidity that they can be sent to Fort Myer, which lies close to Arlington within sight of the Washington Monument.

The Signal Corps of the United States Army has made this instant communication possible. There are only a few hundred members of the service, but they have completed in the face of forbidding conditions a cable and land line system which army officers of other countries have said, "is unique in the annals of telegraphic engineering." If plotted on the map of the United States this system would reach from Wyoming to the Bahamas, off the Coast of Florida. The cables used would reach from Newfoundland to Ireland, and the land lines from Washington to Texas.

This achievement of General James Allen, Chief Signal Officer of the Army and the officers and men under his control, won the admiration of Congress, and it was to be supposed naturally that in view of it, the lawmakers would have been willing that the Service should be given opportunity to seek results in other fields in no way foreign to those in which the corps is employed, and yet for two years there was refusal to give the signalmen the modest sum that they asked in order that they might keep abreast of the armies of the world in the science of aviation. Recently by dint of pleas from the service and from the country Congress consented to open its purse.

The United States has brought southeastern Alaska, the Valley of the Yukon and the region of the Behring Straits into instant communications with the entire civilized world. General Adolphus W. Greeley, formerly Chief Signal Officer of the Army, not long ago said, "There yet lacks to complete the dream of half a century ago of telegraphically uniting America and Asia via Behring Strait, a cable to the Asiatic shore and a Russian line of about 1,500 miles to Nikolaevisk." The dream may find realization much more quickly than any man not charged with the electric enthusiasm can believe.

The main Alaska cable and land lines laid and strung by the men of the Signal Corps run under the sea and through the air from Seattle in the State of Washington, to St. Michael. From St. Michael across Norton Sound to Nome the communication is by wireless. This is the route: Cable, Seattle to Sitka, Sitka to Valdez, 1,684 miles. Main land lines from Valdez to Fairbanks, to Fort Gibbon, to St. Michael, 1,068 miles. There are branch cables from Sitka to Juneau and to Skagway, and from Valdez to Fort Liscum, Seward and Cape Whitshed. Branch land lines run from Gulkana to Eagle City, which is on the boundary line between the British and the American Alaskan possessions.

Within a few weeks a wireless station has been put into commission at Kotlik at the mouth of the Yukon River. The new station is eighty miles from Fort St. Michael with which it is intended to communicate. The Kotlik office will be used to exchange messages with vessels entering Norton Sound from the sea. General Allen in his last report says that the operation of the wireless telegraph stations in Alaska has been of such a character as to warrant consideration being given ultimately to the abandonment of a portion of the land telegraph lines over the routes now covered by wireless, "thus relying on these as the sole means of communication instead of as an auxiliary to the land lines as originally intended."

During the past year there have been 213 men of the Signal Corps on duty in

THE CABLE STATION AT CORDOVA, ON THE COAST DIRECTLY SOUTH OF VALDEZ.

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BRIGADIER GENERAL JAMES ALLEN, CHIEF OF SIGNAL CORPS, UNITED STATES ARMY.

Alaska, enough to make a battalion of infantry of ordinary peace time strength. A few soldiers of the line, mainly infantrymen, have been detached for service with the Signal Corps in the Alaskan work. These men in little squads, barely enough in many cases to complete a set of fours, are stationed at long intervals on the rude roads and the blazed trails above which the wires of the telegraph are strung. Nine months of winter each year these soldiers remain cut off from anything save a humming wire to remind them that somewhere men live in cities and go to their work in the companionship of multitudes.

The soldiers of the Signal Corps in Alaska must fight the elements. For two years during the construction of a part of the land lines a little squad of service men made their headquarters in a log hut as primitive in building fashion as any ever thrown up by a pioneer forefather when the tide of migration flowed over the Alleghenies in the New West. Two years, eighteen months of winter, working daily with the thermometer marking degrees way below the zero point, these soldiers stayed there, apparently happy with their hardships. They are there today, some of them in log huts, and others in better quarters but with no other change in their surroundings to make lighter the load of isolation which they bear. Danger comes to these men frequently and difficulties daily, and it is theirs to test the truth of Byron's line, "There is society where none intrudes."

The cable line from Seattle to Sitka and thence to Valdez, with the branches now established, was laid under the direction of General James Allen and Major Edgar Russel, who were chosen for the work because of their cable laying experiences in the Philippines and of their high knowledge of electric engineering. The cableship, *Burnside*, was brought from China where it was undergoing repairs. The cable was manufactured in New Jersey and transported around Cape Horn, a distance of 12,000 miles. The work of laying was prosecuted in large part under the most unfavorable circumstances, gales and bad weather generally delaying operations and frequently endangering not only the success of the work but the safety of the

TYPICAL MOUNTAIN COUNTRY THROUGH WHICH THE LINESMEN MUST LAY AND MAINTAIN WIRES.

BUOYING THE END OF A BROKEN CABLE.
In the upper corner is shown the laying of the shore end of the cable at Cordova.

ship and the lives of the men engaged in the duty. Success finally came and Seattle talked to Sitka, and Sitka talked to Valdez.

In the service of cable laying a detachment of the Signal Service did the more arduous and technical work "with such success as to reflect new credit on the resourcefulness of the American soldier."

In writing of the cable laying an officer of the Signal Service has said: "The celerity with which the Valdez-Sitka cable of over five hundred miles in length was put under contract, manufactured, transported, and laid, illustrates American possibilities. Congress appropriated the money on April 24, the contract was awarded, the cable was manufactured in New Jersey, transported by rail and sea, installed between Valdez and Sitka and thrown open to commercial business in five months and twelve days."

The crew of the *Burnside* was composed of Filipinos, and there also was a detachment of "Little Brown Brothers" who were used as cablemen. General Allen has commended them "for activity, willingness, thoroughness and reliability," and he has added, "the previously expressed good opinion of the services of the Filipinos as crew and cable men has been strengthened by late experiences."

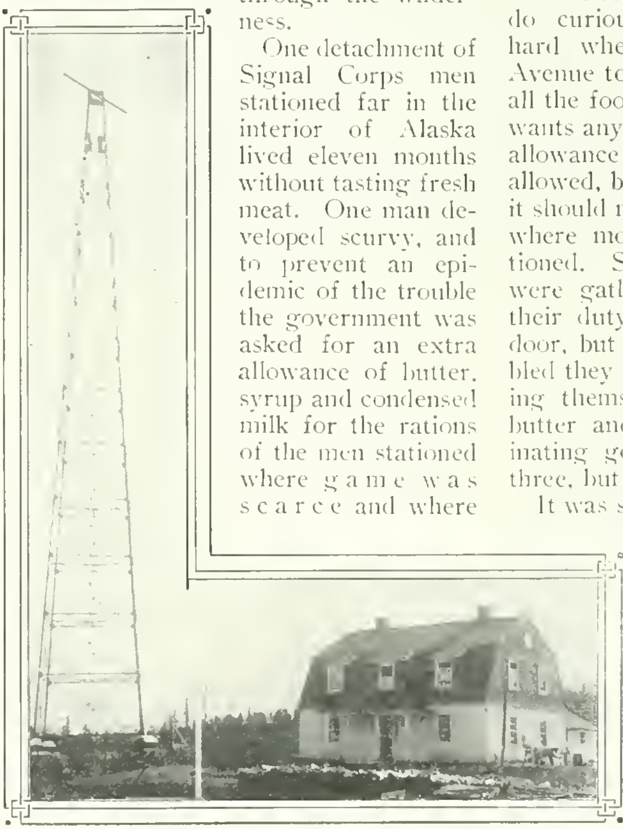
The cable lines of the Alaskan system are "safe down under the water." The land lines are exposed to the storms of every season, to landslides, to snowslides, to freshets and to forest fires. Over their safety the sentinel chain of Signal Service Corps men keeps watch day and night. Repair parties are ready to start at any moment from any station when word or sign of trouble comes. It is necessary frequently in the heart of the Alaskan winter for the men to make long sledge journeys while the mercury in the thermometer keeps company with the bulb.

Stringing a Wire.

The officers and enlisted men on Alaskan duty keep Washington in touch with Nome, and if communication is broken experience has told the headquarters authorities that at the first signal of trouble a detachment is starting on its way over the mountain or through the valley or down the ice of the river to make the repairs which will put the Capital once more in touch with the remotest point of the military line far flung through the wilderness.

One detachment of Signal Corps men stationed far in the interior of Alaska lived eleven months without tasting fresh meat. One man developed scurvy, and to prevent an epidemic of the trouble the government was asked for an extra allowance of butter, syrup and condensed milk for the rations of the men stationed where game was scarce and where there was no butcher shop on the convenient corner. The government officials do curious things occasionally. It is hard when stationed on Pennsylvania Avenue to realize that a man cannot get all the food and any kind of food that he wants anywhere in the world. The extra allowance of milk, syrup and butter was allowed, but the condition was made that it should not be issued at any Alaska post where more than three men were stationed. So it was that where four men were gathered together bent on doing their duty the scurvy wolf was at the door, but where three men were assembled they sent him hungry away by feeding themselves with the milk and the butter and the syrup which a discriminating government said was good for three, but not for four.

It was said in one of the opening paragraphs of this article that, "no American soldier would wait thirty minutes or thirty seconds for an order to save life." Congress recently gave to Sergeant Roy F. Cox of the Signal Service a certificate of merit for not waiting on orders to go on an errand of mercy. A few words hidden away in the army records tell what the Ser-



"Farthest North" Wireless Station at Nome.

geant did to secure Congressional recognition. His certificate of merit was granted "for highly meritorious service in traveling thirty miles in a severe blizzard, rescuing a civilian from freezing and dragging him by sled sixty-five miles to Fairbanks."

Word came in to a little detachment of the Signal Corps that a prospector, a man seventy years old, was perishing in his hut at a point thirty miles distant. The cold was as severe as any that the Alaskan winter knows, and a blizzard was raging. The conditions were such that no one was asked to volunteer to go to the rescue, for it was thought certain that death awaited the man who would try to hit the trail that day. In fact there was no trail. Sergeant Cox said he was going and he went. He made the thirty miles with a dog sled and found the prospector apparently almost at the point of death. He gave him food and medicine and then knowing that the services of a surgeon were necessary at once if the man's life was to be saved, he started on the journey of sixty-five miles to Fairbanks. He arrived there with the prospector still living and he lives today, altough it was necessary to amputate both his legs. Sergeant Cox was an inmate of a hospital for a long time, because of illness due to exposure, but he recovered and the experience in no wise weakened his love for the service. He is a Signal Corps man today and he has his certificate of merit, a thing which is prized above all other things by the American soldier, for it is the equivalent of the English Victoria Cross which is given only "For Valor."

Sergeant James E. Hogan did a deed which was almost the counterpart of that of Sergeant Cox. He also won his certificate of merit. The records of telegraph line construction and maintenance in the Alaskan territory contain many stories of courage and of self-sacrifice of the officers, commissioned and non-commissioned, and by the privates of the Signal Corps of the United States Army.

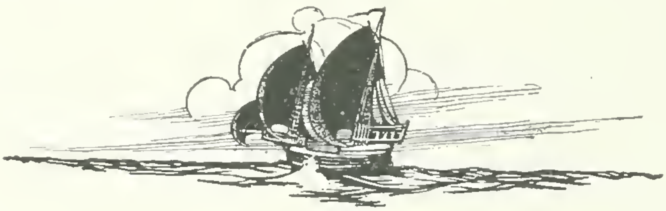
In appreciation of the service in Alaska of the men of the Signal Corps of the United States Army it does not

THE CABLE SHIP *BURNSIDE* APPROACHING THE PORT OF VALDEZ.

TYPICAL ALASKA TELEGRAPH STATION AND SIGNAL CORPS DETACHMENT QUARTERS, WITH STOREHOUSE FOR SUPPLIES.

seem that one can do better than to use the words of an official "who has seen and who knows." He says:

"These soldiers stand ready at all times 'to hit the trail' the instant that a wire goes down or a call for help comes. They are willing. They risk life and limb, asking no questions and doubting nothing. The extreme conditions of the service and the necessity of the continued maintenance of communication have demonstrated the spirit of the American soldier who has sacrificed himself to the work."



Decision

Once to every man and nation comes the moment to decide,
In the strife of Truth with Falsehood, for the good or evil side;
Some great cause, God's new Messiah, offering each the bloom or blight,
Parts the goats upon the left hand, and the sheep upon the right;
And the choice goes by forever, 'twixt that darkness and that light.

—Lowell.

CENSUS OF THE SALMON

By

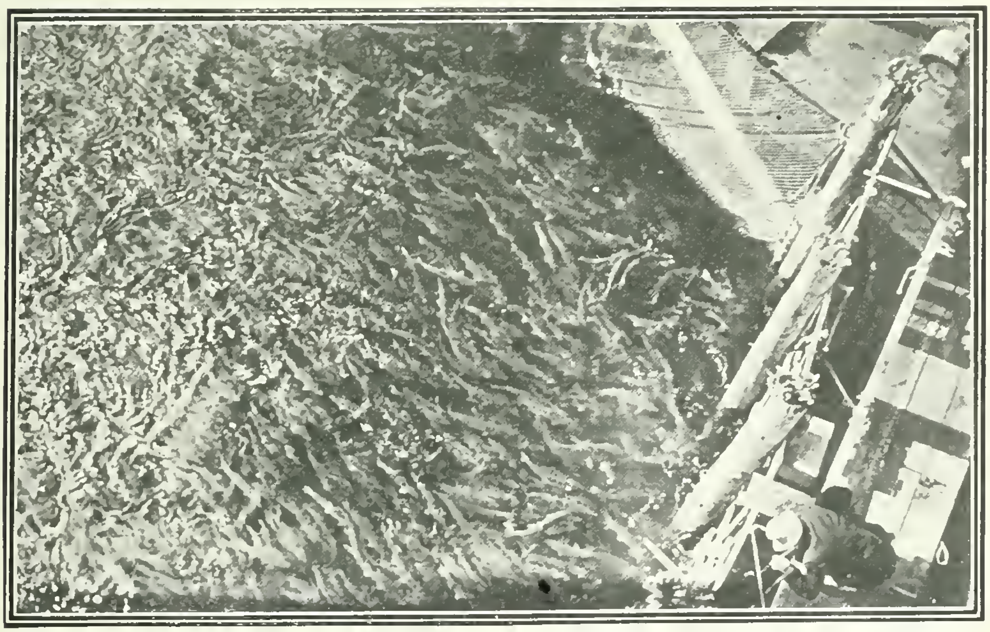
RENÉ BACHE

TO count the salmon in Alaskan rivers would seem to be a task not merely stupendous but impossible. Yet it is being accomplished in a very systematic way by the government Fisheries Bureau, and for a purpose of utmost practical importance to the future of the commercial salmon fishery in that part of the world.

So far is this true, indeed, that the cost of taking the salmon census is being defrayed, up to date, by two of the biggest canning companies—the Fisheries Bureau having no funds to meet the expense involved, which amounts to about $6,000 a year. This, however, it should be understood, covers the cost only of counting of salmon in one large river, which was picked out for an initial experiment to determine the possibility and merit of the plan.

The stream in question is the Wood River, which, for the purpose of census-taking, was closed for the time being to the commercial fishery. There was no trouble about arranging this, because the Fisheries Bureau, under authority bestowed upon it by Congress, has absolute control over all the salmon streams of Alaska. It tells the canning concerns where and when they may catch fish, and when and where they will not be allowed to catch them. If it chose, it could suspend the salmon fishery altogether for an indefinite period in Uncle Sam's Arctic province.

What it wants to do, however, is to keep the fishery going, and to make sure that the supply of salmon shall be main-



LOOKING DOWN ON THE GATES THROUGH WHICH THE SALMON PASS TO BE COUNTED.

RACK ACROSS WOOD RIVER, TO ASSIST IN COUNTING THE SALMON.

tained. Hence the undertaking here described, which, as will presently be seen, has a direct bearing upon the commercial problem. Thus, for example, now that it has been ascertained how many salmon run up Wood River to spawn, the experts are able to judge with accuracy of the number of fish required to maintain the supply in that particular stream.

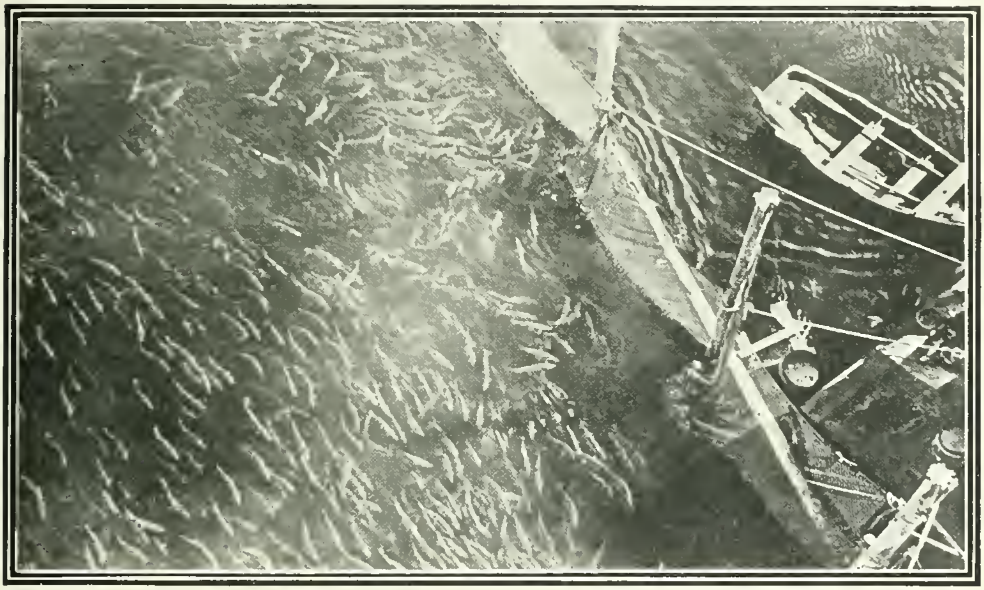
Suppose that the requirement for Wood River is 500,000 spawning salmon per annum. The Fisheries Bureau, then, will prohibit fishing in that stream each season until the necessary half million have passed up the river to the spawning grounds—this matter being easily determined by extending a species of barricade, called a "rack," across the stream, allowing the fishes to pass only through narrow gates, and counting them as they go by. When the 500,000 breeding salmon are thus assured of safety, the canning companies will be told to go ahead and catch all the salmon they choose in the waters below the "rack."

The rack and gate method is the one that has been employed by the government agents to count the salmon in Wood River. Tally was kept of them as they passed through with the aid of an automatic click counter, held in the hand. Such contrivances are sometimes used nowadays to make a record of the number of people who visit a museum or other public building. On July 14 over 402,000 salmon went through the gates, on their way up, and the total count for the season was 2,603,651. Reckoning was only made, however, of the red, or "sockeye" salmon, this being by far the most important species commercially.

Now, it should be explained that each salmon river has what is called a "value" of so many fish per annum—which means simply that it can produce just about that number, and no more. The number is always limited, each stream having a definite capacity, which depends upon its area of suitable spawning grounds and the amount of food available for the young "fry."

To make this clear, it is necessary to explain that no river produces salmon unless it takes its rise in lakes. For the fish go up to the lakes to lay their eggs—though, as a matter of fact, they do not deposit their spawn in the lakes, but in small streams flowing into the latter. When they are big enough to take care of themselves, the young fishes find their way into the lakes. But, if there are too many young ones, there will not be enough food to go around, and they will perish in multitudes.

It will be seen that in this way the number of salmon in any river regulates itself—or did so before greedy man appeared on the scene, to interfere with things. Recent study of the subject has proved that salmon, though their proper home is the sea, never—while in the ocean—go far away from the mouth of the stream in which they were hatched. At four years of age, or thereabout, they go up the river of their birth to spawn. Accordingly, the number of intending parents thus returning to the old spawning grounds in any given season is directly proportionate to the number of intending parents—hatched originally from the first salmon's eggs—enter the river from the sea four years later. This applies to all salmon streams. But no two rivers are alike in respect to the conditions governing their annual fish output; so that it is necessary to make a special investigation of each one. Speaking generally, however, it may be said,



PART OF THE RACK, OR BARRIER, CLOSE TO THE GATES THROUGH WHICH THE SALMON PASS.

"fry" that survived out of the brood of four years previous.

The government experts say that there is no longer any danger that the supply of salmon in Alaska will be exhausted, or even seriously diminished. So long as the Bureau is allowed to continue in control, and to prevent destructive methods of fishing, it can maintain the output to the end of time, without curtailing the commercial fishery, and without artificial hatching, except in places where fishing is extraordinarily active, or where the area of spawning grounds is curtailed by such salmon-killing agencies as sawmills, mining industries, etc.

A very painstaking and comprehensive study of the whole subject has been made, and one of the conclusions drawn is that for every salmon which reaches the spawning grounds, from two to five on the basis of the above figures, that from fifty to eighty per cent. of the total number of salmon may be taken annually without injuring the fishery.

Controlling the matter so absolutely as it now does, the Fisheries Bureau will be able not only to keep as many salmon in the Alaskan rivers as there are now, but to restore the fish in multitudes to many streams which have been depleted by reckless commercial operations — the most destructive of these consisting in putting up dams, or stretching nets across the streams, in such a way as to make it impossible for any fish to reach the spawning grounds. Obviously, the adoption of a plan of this kind meant that the river, however productive at the start, would cease to contain any salmon after four or five years.

It seems amazing that any human

being gifted with ordinary intelligence should adopt so short-sighted a policy. But experience has shown that people generally, when they have a chance to make money rapidly by exploiting a great natural resource, have not the slightest hesitation in destroying it utterly and for all time to come. It has been the practice of the canning companies, when they had wiped out all the salmon in one river, simply to move the scene of their operations to another stream; and, if this had been allowed to go on, the salmon fishery of Alaska, which yields $10,000,000 worth of products per annum, would have ceased to exist within a generation.

Under present circumstances, fortunately, it is not a very difficult matter to repopulate with salmon the depleted rivers. Unlimited numbers of eggs of the finest and most desirable species are easily obtained, and these are already being hatched by the hundreds of millions at two stations which the Fisheries Bureau has established for the purpose. One of these hatcheries is at Yes Bay, in southeast Alaska, and the other is on Afognak Island, south of the Aleutian Chain. The island is a government preserve, on which no game or fish is allowed to be killed or taken. Natural conditions make it one of the best localities in all Alaska for salmon-culture, and the spawning grounds are so situated as to be at all times under observation and control.

Last season there were hatched at these two stations 96,397,000 salmon eggs, mainly of the redfish, or "sockeye." No special difficulty is involved in the work, although salmon eggs require an extraordinarily long time, eight or nine months, for their incubation.

When the salmon reach their spawning grounds, they pair off, and excavate nests in the bottom by plowing up the sand and gravel with their noses and sweeping it out with their tails, until at length a bowl-shaped hollow is dug, perhaps three feet in diameter and from a foot to a foot and a half deep. In this the female lays her eggs, which are carefully covered up. It then remains for the parents to stand by the nest and fight off enemies, among the worst of which are the Dolly Varden and "cutthroat" trout. These trout follow the salmon to the spawning beds for no other purpose than to steal their eggs, of which they devour immense numbers.

While thus defending their nests, the parent salmon become thinner and thinner until at length they die. Not one out of all the multitudes that have reached the spawning beds survives to go back to the sea. Sometimes the streams that flow into headwater lakes are literally choked with their decaying bodies—a pitiful sight to see. Thus, however, it will be understood how and why it is that the maintenance of the supply of fish in any given river depends upon the annual crop of young "fry."

Early in the following spring these can be found on the spawning grounds by taking up handfuls of gravel from the bottom. They are not yet able to swim, but, when released, wriggle away and burrow into the bottom again, hiding themselves. Meanwhile they derive what sustenance they need from yolk-sacs attached to their bellies. When they are able to look out for themselves, they pass out of the affluent streams into the lakes, and remain there, feeding, until they are four or five inches long. The call of the sea now summons them, and they wend their way down the river to the ocean, where they dwell in deep water off the coast until, at the end of about four years, they are ready to swim up the river, to spawn, and in their turn to give up their lives for the perpetuation of their species.

During the fishing season of 1909-10 there were taken in Alaskan rivers 34,692,608 salmon, or a total of 175,028,594 pounds. The annual pack is about 2,500,000 cases of forty-eight one-pound cans each; but the catch varies a good deal from year to year, and every fourth year it is relatively huge. Thus the catch for the season of 1908-9 was 43,304,979 salmon, with a total weight of 213,378,570 pounds.

It is interesting to reflect that during the last ten years Alaska has produced, in salmon alone, fourteen times as much money as Mr. Seward paid for the territory when he bought it from Russia half a century ago.

THE ROWELL-POTTER TRAIN STOP—ONE OF THE TWO APPROVED BY THE GOVERNMENT BOARD.
The illustrations respectively show the signals set for safety, the track trip mechanism, and the signal set for danger.

MECHANICAL BRAINS SAVE LIVES

By

ROBERT FRANKLIN

TOO many railroad wrecks! How shall they be made less frequent?

During the last fiscal year, in this country, no fewer than nine hundred and thirty-two people were killed, and fourteen thousand, three hundred and seven persons maimed or otherwise seriously hurt, by smashups on the rail. It was a frightful carnage. A considerable battle, indeed, might have been fought without greater loss. But there is good reason for supposing that the number of slain and wounded in the present year will be at least as great, and so on for every subsequent twelvemonth.

That is to say, unless something is done to alter radically the conditions which give rise to mishaps of the kind. It is a very serious problem, and the government is trying hard to find at least a partial solution for it. Congress, not long ago, handed the matter over to the Interstate Commerce Commission, with authority to appoint a board to investigate the whole subject.

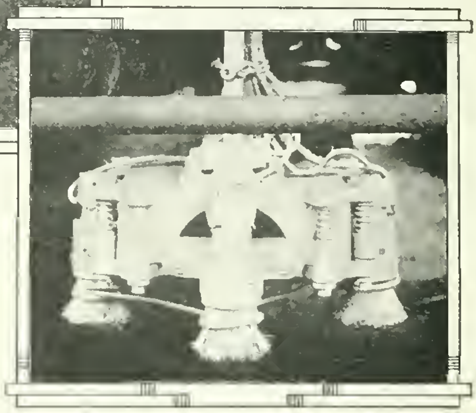
This board, in a report newly prepared, declares that the fundamental cause of the trouble is to be found in the American tendency to hurry. People in this country are so anxious to do things quickly that, to a great extent, they ignore caution. Here is the principal reason why railroad wrecks, which are rare occurrences in England and on the continent of Europe, are so frightfully frequent in the United States. Nevertheless, taking conditions as they are, much

Contact Rail, Which Toots the Whistle of the Passing Locomotive When Danger Threatens.

may be done to lessen the number of such accidents by the adoption of certain mechanical measures of precaution—most important of all, the automatic train-stop.

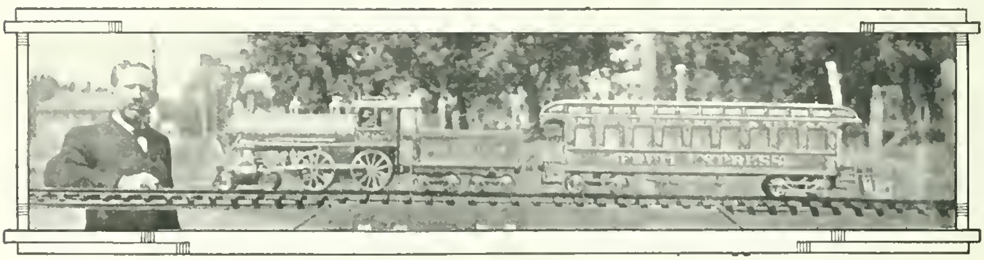
Such a stop provides for automatic train control. It is a device to prevent the over-running of stop signals by trainmen. Often it happens that the engineer of a locomotive fails to notice the fact that a signal is set for danger. It warns him to bring his train to a halt; but, failing to recognize it, he runs past, and in many instances a disaster is the consequence.

The ingenuity of inventors has been taxed to devise a means by which this sort of mistake may be avoided. They have contrived a number of expedients by which an over-run danger signal gives warning in the cab of the locomotive, automatically. These, which are called "cab signals" are already in use to a considerable extent abroad. Other devices, which not only give warning, but actually stop the train, are still more effective, reducing the human factor in the railroad equation to a minimum.

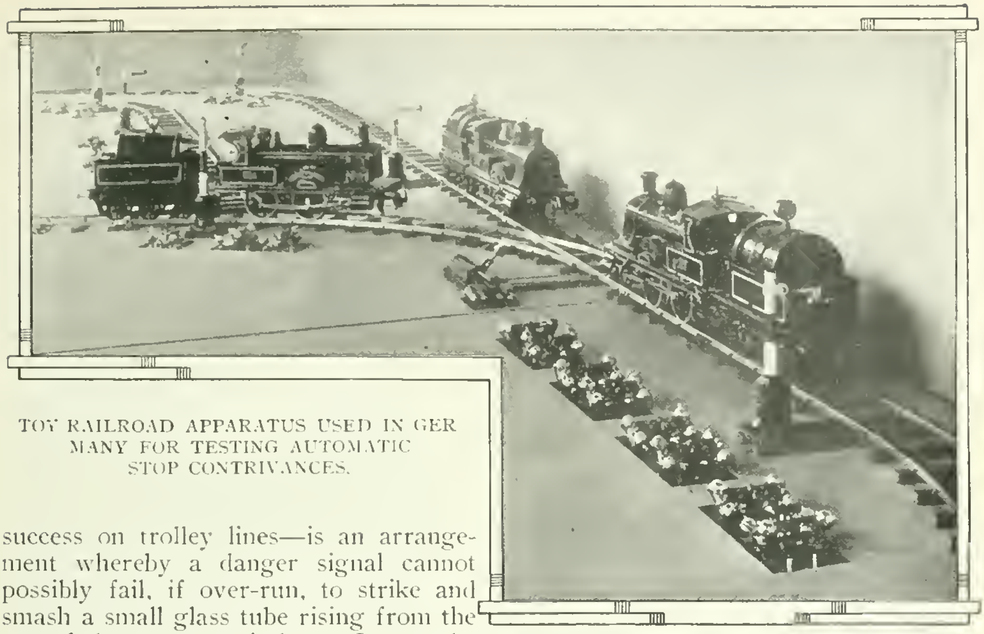


The Device for Contact with the Rail, Carried Beneath the Locomotive.

Many such automatic train-stops have been to a greater or less extent perfected. In most instances they are electrical contrivances, and operate by setting the brakes of the train. Thus, for example, one of them—already tried with some



J. E. PAGE, OF KANSAS CITY, AND HIS PATENT COACH.
This car has an anti-telescoping device, the steel floor at each end terminating at an angle, so that cars in collision may slide by each other.



TOY RAILROAD APPARATUS USED IN GERMANY FOR TESTING AUTOMATIC STOP CONTRIVANCES.

success on trolley lines—is an arrangement whereby a danger signal cannot possibly fail, if over-run, to strike and smash a small glass tube rising from the top of the motorman's box. In case he does not see, or neglects to obey, the warning, the breaking of the tube opens the air-brake valve and sets the brakes.

Up to the present date, no fewer than nine hundred and thirty-seven devices of various kinds, to promote the safety of railway operation, have been submitted to the board, and a majority of these have been examined and reported upon. In all, one hundred and forty-nine automatic train-stop inventions have been inspected, and of this number sixteen have appeared to possess sufficient merit to warrant formal tests. Two of these sixteen have already undergone such tests, and having been found to work

THE OLD AND DANGEROUS METHOD OF GOING BETWEEN CARS TO UNCOUPLE THEM.
Compare with cut in next column.

THIS COUPLER RENDERS IT UNNECESSARY TO GO BETWEEN THE CARS.
A contrivance that saves hundreds of lives annually.

satisfactorily have received the final approval of the board.

These two, which have been tested under actual traffic conditions, are both of the mechanical trip type. One of them, known as the Rowell-Potter train-stop, is an arrangement by which a bar lying parallel and close to one of the rails of the track is lifted a short distance above the rail whenever the visual signal is set for danger. Under such circumstances, the bar, coming into contact with an air-brake valve, suspended from one of the trucks of the tender, opens the valve and applies the brake.

THE S. H. HARRINGTON MECHANICAL TRIP AUTO-STOP.
One of the two approved by the government board.

MECHANICAL TRIP STOP WHICH OPERATES FROM THE GROUND.

Bars at the side of the track are provided in duplicate at each signal point, one of them 180 feet in advance of the other, so that, if the first one should by any accident fail to operate, the second would bring the train to a halt. Power to operate the stop, as well as to work the semaphore signals of the system, is derived from the pressure of the wheels of passing trains on levers fixed close to the rails, these levers serving to wind up a coil spring.

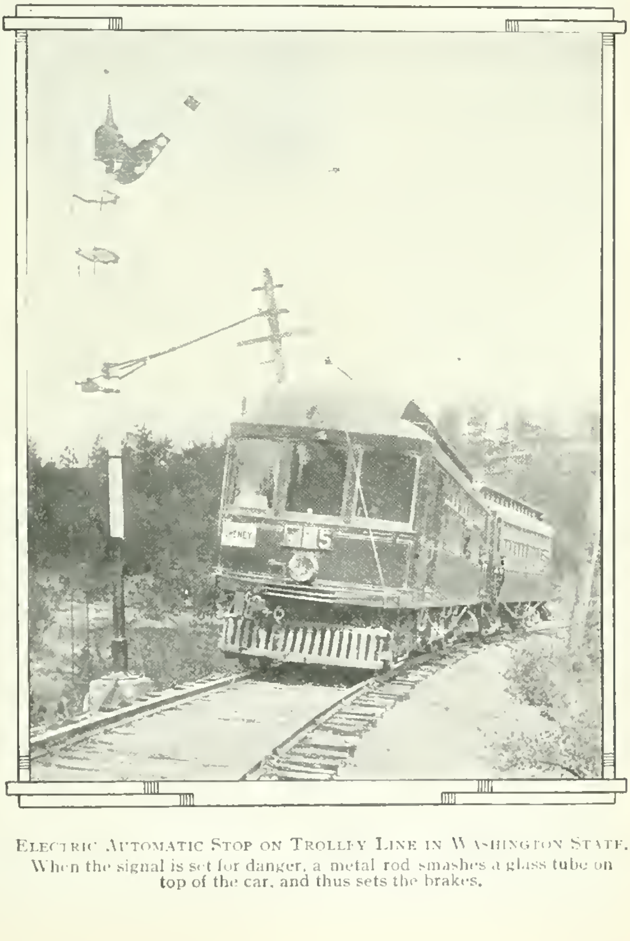
The other automatic stop approved by the board is the invention of S. H. Harrington, and has been in experimental and successful use for over two years on the Northern Railroad of New Jersey. It works "overhead"—that is to say, the device fixed at the roadside is suspended, fifteen feet above the track, in such a way as to come into contact with a projecting arm of an air-brake valve on the top of the cab in the locomotive, the opening of which valve applies the brake. The roadside contrivance consists of a weight suspended on the end of a chain, which, hanging free, operates the engine valve by its mere inertia, when it strikes. At the same time, it has the great advantage of *failing to work* when a train is going very slowly—say, five miles an hour or less. Under such circumstances—when a precaution of the kind is not wanted—the weight simply drags over the operating rod on the locomotive, producing no effect.

It will be observed that the automatic stop does not in any way insure the correctness of signals. Its only function is to correct the error of the engineman who runs past a danger warning. This, however, is of utmost importance, inasmuch as many bad accidents are caused by the failure of locomotive engineers to observe, understand, and obey signals. Failure to observe them may be due to fog, snow, extinction of signal lights, or smoke from other trains. The engineman may fail to understand signals because of their complexity, or for the reason that his attention is distracted. Intentional failure to obey them is rare. The automatic stop, however, eliminates almost entirely the element of human fallibility. Furthermore, experience has shown that engineers are much more careful to heed danger signals when it is certain that disobedience of such signals will be detected.

The board confidently expects that the automatic stop will be developed to a point where, like the block signal, the car-coupler, and the train-brake, it will be available to railroads generally, and will greatly contribute to the safety of train operation. Already such contrivances are in actual use to some extent—for example, on the Boston Elevated, the New York City Subway, the Philadelphia Subway, and the underground lines in London, England. Mechanical trip train-stops of similar design, worked by electric motors, are also in use in the tunnels under the Hudson River between New York and Hoboken. Officers of these roads are unanimous in testifying to their satisfactory operation, and on a number of occasions they have been the means of preventing collisions.

The board has likewise offered to make practical tests of two kinds of cab signals, to which an automatic train-stop can be attached if desired. One of these is the invention of E. F. Clement, of Philadelphia. The other is owned by the Railway Audible Signal Company, of London, and is now in use on the Great Western Railroad in England. Its essential feature is a short contact rail in the middle of the track at the signal point. This rail engages with a device beneath the engine, showing a danger signal in the cab and blowing the whistle of the locomotive.

The board has found itself called upon to give a good deal of consideration to the question of locomotive headlights. In seven States of the Union, Arkansas, Montana, North Carolina, Oklahoma,



ELECTRIC AUTOMATIC STOP ON TROLLEY LINE IN WASHINGTON STATE. When the signal is set for danger, a metal rod smashes a glass tube on top of the car, and thus sets the brakes.

South Dakota, Texas, and Washington, headlights of 1,500 candle-power or over are required by law. The State railroad commission of Indiana compels the use of equally powerful headlights, and in Georgia the law demands electric headlights of great luminous efficiency, with reflectors twenty-three inches in diameter.

The trouble with the ordinary oil-burning headlight, commonly employed on locomotives is that it is seldom powerful enough to make it more than a marker to indicate to persons at stations or railways crossings, or to trains on other tracks, that an engine is approaching. For discovering or identifying distant objects on the track ahead, it is of almost no use at all. Hence the argument in favor of the high-power headlight, gas or electric, by which persons or obstructions may be seen at a sufficient distance to enable the train to be stopped before reaching them.

TRAPPED THUS, MANY A PERSON HAS BEEN KILLED BY TRAINS.
All frogs are now required to be blocked with metal or wood.

On the other hand, there are some serious objections to the high-power headlight, chief among which is the fact that its rays are so intense as fairly to blind, for the moment, persons who may look into the beam. This effect, when experienced by enginemen of trains running in an opposite direction on parallel tracks, is likely to give rise to accidents. Furthermore, it is often difficult to read the colors of signal lamps correctly in the beam of an electric headlight, the spectrum of the arc being very rich in blue and green rays, and containing a relatively small proportion of the red and yellow. On this account particularly the railroads have made strenuous objection to such headlights.

On double-track roads, and particularly on roads having three or four tracks and equipped with signals placed at frequent intervals, the prevailing opinion seems to be that electric headlights are not only unnecessary, but are likely to cause serious errors on the part of engineers in reading colored signal lights.

An incidental problem which the board is trying to solve is that of the headlight which shall continue to throw its beam upon the track while the engine is rounding a curve. Inasmuch as such lights are usually fixed in position, their rays are projected in the direction of the axis of the locomotive, and hence on curves do not illuminate the track ahead. Various devices have been submitted for imparting to the headlight, while the engine is rounding a curve, such motion as will turn the beam so as to make it fall on the track. Most of these contrivances, however, are very crude, attempting to use the slewing of the front truck of the engine to rotate the headlight, and not one of them has been found satisfactory.

The board strongly recommends that railroads all over the country be compelled by law to adopt and maintain the block system for running their trains. At the present time only about sixty-six thousand miles of railroads, out of a total of approximately two hundred and forty thousand miles in this country, are operated under this system, notwithstanding a superabundance of evidence that, wherever used, it has added immeasurably to safety of transportation. The situation is not unlike that which existed at the time when the adoption of car couplers and power brakes was compelled by Federal enactment, against a most determined opposition on the part of the companies, desirous of avoiding the expense involved in the acquisition of such improvements.

As a matter of fact, the adoption of the block system everywhere would cost the railroads very little money. Not much apparatus is required. In July of last year, the Baltimore & Ohio line from Storr's, Ohio, west to Vincennes, Ind., and from North Vernon, Ind., to New Albany, over one hundred and eighty miles, was equipped with all the necessary outfit for the operation of the simple manual block system in less than one week.

It is the opinion of the board that the compulsory introduction of the block system on all railway lines will tend greatly to reduce the number of collisions and the incidental mortality record that results therefrom.

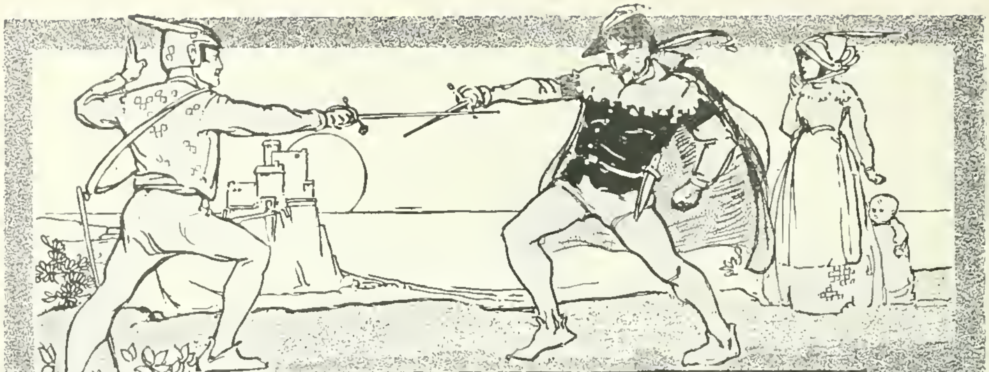
Keep Your Grit

Hang on! Cling on! No matter what they say.
Push on! Sing on! Things will come your way.
Sitting down and whining never helps a bit;
Best way to get there is by keeping up your grit.

Don't give up hoping when the ship goes down;
Grab a spar or something — just refuse to drown.
Don't think you're dying just because you're hit.
Smile in face of danger and hang to your grit.

Folks die too easy — they sort of fade away;
Make a little error, and give up in dismay.
Kind of man that's needed is the man of ready wit,
To laugh at pain and trouble and keep his grit.

—L. E. Thayer in *New York Times.*



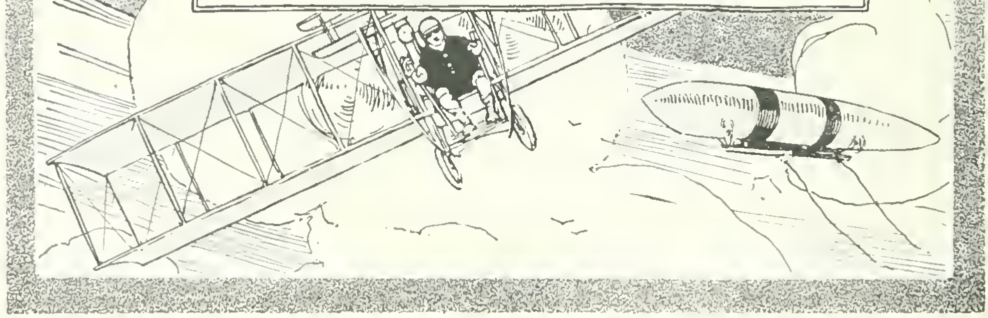
A.D. 1999

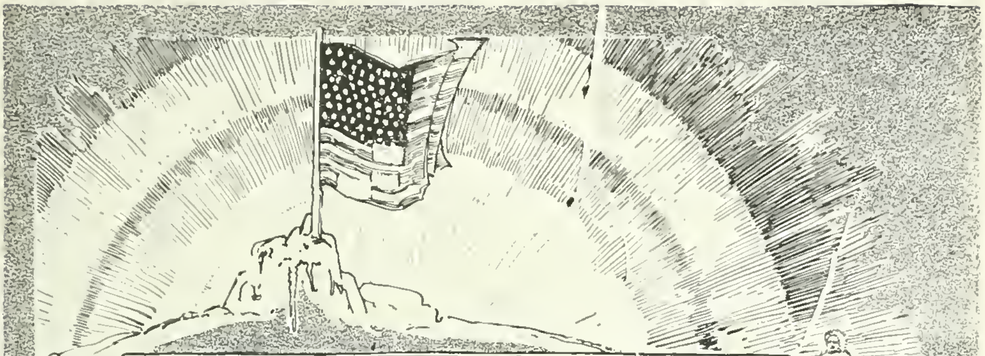
Soliloquy of a Minor Poet

By C. L. EDHOLM

This bloodless Age!
  So placid, cool, encompassed by the laws
  Of states and nations in a perfect round,
  Just as the perfect circle of the rim
  Encompasses a bowl of pale blue milk.
  Oh God, how irksome is our skim milk age!

The good old days!
  Our century was young then, (now so gray,
  It seems as if it never had been young).
  Ah, for the boisterous times when men were men,
  Not cogs in one vast, complex world-machine,
  But soldiers, captains,— yes, free lances, too,
  There were a plenty in those reckless days!
  One gripped his fellow's throat, the other stabbed;
  Spoils to the victor; to the weakling death!
  Why now-a-days a man can hardly die
  Outside the formulae prescribed by law.
  No breadline now; for who lacks bread and meat?
  No plots nor brawls for gold! What's gold to us?
  And even woman is no more man's own,
  To work for, kill for! She, too, is a cog.
  Does cog fight cog to win another cog?
  Our blood is turned to lubricating oil
  And poet's voices have a steely click
  When e'er they hymn the praises of our age.





Oh, for the good old times!
The first years of our ash gray century,
Comparable alone to those bright days
Of England's brave Queen Bess,— a man's queen that!
To think that not one hundred years ago
The flush of barbarism yet remained,
A sunset flaunting in a flaming sky
That's twilight now! Had I lived then,
What epics I'd have wrought in blood and fire!
What wonder tales, for Wonder was not dead!
Think of the thrill to him who first took flight,
When all the vast familiar continent
Of air was unexplored: the madcap search
To find the axis of our mudball earth.
The Commonplace of now was Wonder then:
The submarine; the word far-flung in air
And caught again, like pigeons shot in flight;
The rays that pierce, what men once called opaque,
(Today we know there's no such word!) Alas,
That I was born a century too late,
There's nothing left to sing of but the past.

And thereupon the minor poet flung
The lever of his Microphonograph
And settled back to hear the record, caught
(You know the late invention of Herr Schulz)
From Homer's lips when centuries had lapsed.

WHERE ONE HUNDRED PERSONS LOST THEIR LIVES.
Building concrete sheds to protect from snow slides at Wellington, Washington.

GUARDING AGAINST THE AVALANCHE

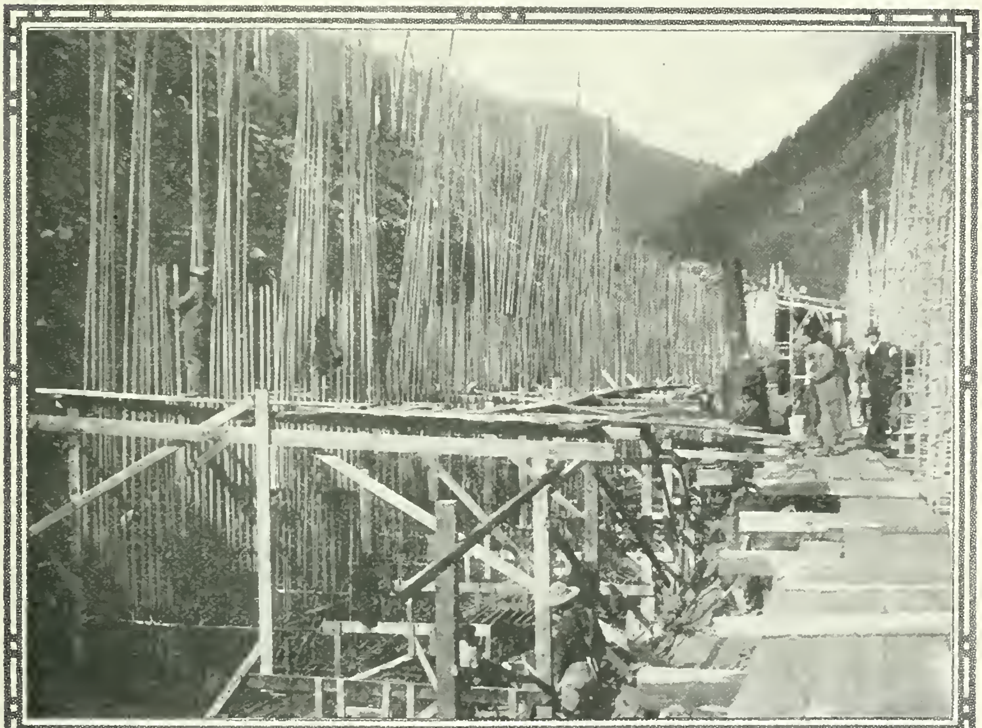
By

WILLIAM THORNTON PROSSER

IN June 1910 the TECHNICAL WORLD MAGAZINE told of one of the most tragic and remarkable railway disasters ever recorded in the United States; how an avalanche swept down the precipitous sides of the Cascade mountains at the little town of Wellington, Washington, and carried a Great Northern passenger train with almost one hundred passengers aboard, to a terrible fate in the depths of the canyon below. To prevent the recurrence of such a catastrophe was the problem that confronted the Great Northern's engineers, and spurred on by James J. Hill, who declared that the tracks must be rendered absolutely safe no matter what the cost, they finally determined upon the erection of reinforced concrete snowsheds protecting all the Wellington danger zone. These have just been finished at a cost of $500,000.

Construction of these solid masonry structures for a distance of 3,300 feet is regarded as a great accomplishment in the engineering world, for they are not merely coverings built over the tracks—they are indestructible hoods set into the mountain side. Future avalanches may thunder into the canyon, far below, all

MIXING GRAVEL AND CEMENT FOR THE CONCRETE SNOWSHEDS IN THE CASCADE MOUNTAINS.



SETTING THE FRAMES TO SHAPE THE CONCRETE COVERING.

THE STEEL RODS READY FOR THEIR CONCRETE COVERING

they please, but they will slide right over the concrete tubes, and trains may pass back and forth within them as safely as passenger traffic is carried on beneath the Hudson river in the McAdoo tunnels, or beneath the Detroit river.

It was a west bound passenger train stalled at Wellington by snow-blockades that was swept to destruction at the beginning of last March, together with four electric locomotives used in the Cascade tunnel, which had been recently electrified, and a part of the town of Wellington. For weeks and weeks workingmen continued to take out the bodies of the victims, some buried under fifty feet of snow and debris. Soon after traffic was resumed Mr. Hill, chairman of the Great Northern board of directors, with L. W. Hill, his son, president of the road, L. C. Gilman, assistant to the president, and A. H. Hogeland, chief engineer of the system, visited the mountain division, and studied the problem from all angles.

Observation convinced the officials that the only way to render the tracks immune from such disaster was to set the rails back into the mountain, and erect coverings that no avalanche could budge.

"We must make the mountain district impregnable against snowslides, even if an outlay of millions of dollars is necessary," declared Mr. Hill emphatically, and aside from the concrete sheds the railway magnate ordered more than $1,000,000 spent in an effort to prevent blockades and delays to through trains during the winter months. Two miles of the main line near Berne, east of Wellington, are in process of rebuilding, new buildings were erected at Wellington, a water supply system is being installed between Wellington and Scenic, and at Wellington a rendezvous has been made for the scores of men that each winter fight the snow king in the Cascades. From this point men may be rushed down the west side of the mountains or through the Cascade tunnel to the eastern slope.

Not before in the world have reinforced concrete snowsheds been constructed to protect a long stretch of track, as in the Cascades. Preparatory to the building of them and the erection of some wooden sheds the Great Northern placed orders for 11,000,000 feet of lumber. In the concrete work 30,000 barrels of cement were used, with 2,400 tons of steel as reinforcement. Relays of men worked night and day rushing the construction, as haste was necessary if the great task was to be completed before the winter snows again brought danger.

The mountain side of solid rock was excavated for fifty feet back from the old tracks. For most of the 3,300 feet the concrete construction rests against the mountain wall. The concrete roof, ten inches thick and sloping one foot in five, is twenty-two feet above the double tracks of the main line. Reinforced concrete pillars set ten feet apart in the walls give additional support.

Great Northern engineers declare that these so-called sheds will last for all time to come, and that danger is virtually eliminated. Each year snows and blockades made traffic extremely difficult to maintain through the Cascade district, but next winter with the improvements that have been made the operating officials expect less trouble than ever before.

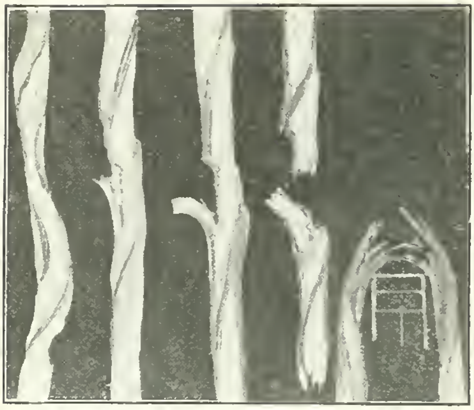
ROLLER COTTON GIN AT LAST

By

C. E. HAYES

FOR years all cotton men, whether growers, ginners or manufacturers, have recognized that a radical improvement was necessary in the present method of ginning cotton. The enormous loss in wasteful ginning methods, estimated as amounting to $40,000,000 on each year's crop, could be saved for the mills of this country, with the use of a perfect gin. Roller gins have been recognized for years as the proper gins to use, delivering the cotton fiber in its full length, uncut and unbroken, while the saw gins materially damage the fiber. But the roller gins in use, working by reciprocating motion, have a very small capacity, about 40 to 50 pounds per hour as compared with the saw gins which turn out from 400 to 500 pounds of lint per hour. Also the roller gins in use have only been adapted to the ginning of the very longest varieties of cotton, like Sea Island and Egyptians, and not much success was achieved with them in the ginning of short staple or upland cotton which comprises ninety-nine per cent. of the cotton crop in this country.

THE NEW ROTARY GIN WHICH HAS AN ENORMOUS CAPACITY FOR COMBING COTTON.



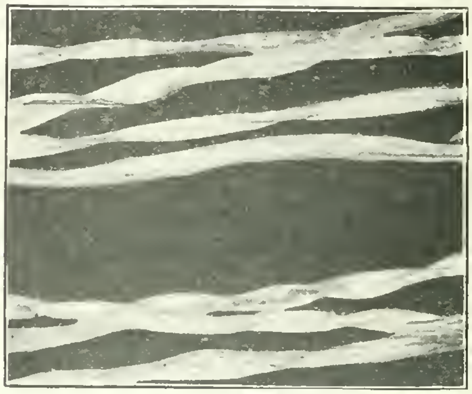
MAGNIFIED COTTON FIBERS SHOWING CUTS AND INJURY FROM SAW GINNING.

For years inventors have been working to improve the capacity of the roller gin, knowing that when the quantity of output would equal the saw gin, the latter would die out.

Some years ago Charles J. McPherson of South Framingham, Mass., became interested in the improvement of cotton ginning and as a result of his experiments invented what he calls the rotary comb roller gin. This gin will soon be in the market in competition with the saw gin.

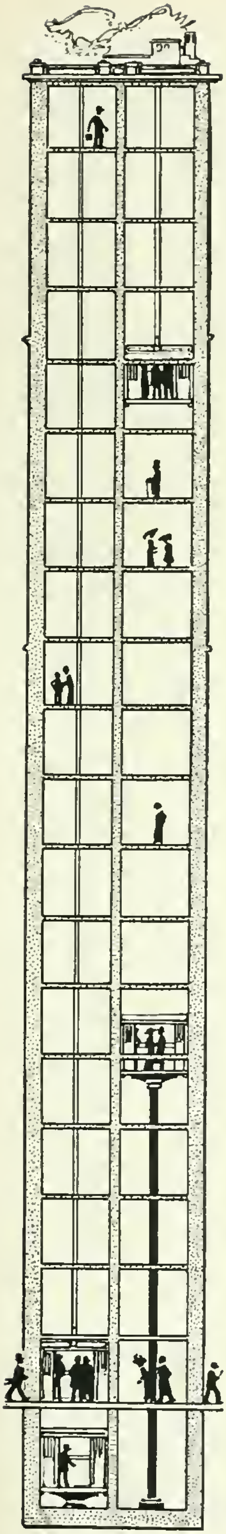
The new gin uses a rotary process which gives it a rapid ginning action and a great capacity, turning out from 400 to 500 pounds of short staple cotton per hour while the fiber is uninjured and the quality of the lint perfect. Many points of superiority are claimed for this new gin over the saw gin. Among them is the saving in fire losses which now occur in saw ginneries through the action of the rapidly revolving saws encountering pebbles or small particles of hard metals which are frequently brought to the ginneries in the seed cotton. Sparks are flashed as a result and fires ensue, thus causing insurance rates on ginneries to be very high. The action of the rolls in the rotary gin is to smother the fire should one start in the gin. Repeated tests having been made to demonstrate this fact. There is no danger whatever to operators of the new roller gin. Thousands of employes in Southern ginneries are maimed or less seriously injured each year by saw gins.

The new gin has ginned wet cotton perfectly and no saw gin will do it without mangling and tearing the lint. In competition with saw gins in the South it saved from twenty to twenty-five pounds of waste per bale, as it delivered the line full length from the seed. Perfect lint to the manufacturer means a great saving to him in the preliminary processes in the mill, besides making a stronger yarn. As a result roller gin cotton sells from one-half to three cents per pound more than saw gin cotton.



PERFECT COTTON FIBERS FROM ROLLER GIN.

The gin consists of two sets of double rolls, the rolls of each set revolving in opposite directions. One of these is a ginning roll, and is covered with some soft material having a gentle friction—usually walrus hide—which will thus not only not injure the fiber, but likewise should be free from the danger of heating excessively. The other roll is a combing roll and consists of a shaft on which are set spirally two pointed soft metal disks. The lint on the seed is caught by the ginning roll and drawn inside a polished steel plate or blade against which the ginning roll revolves. This action holds the seed firmly against the dull edge of the blade and it is combed from the lint by the points of the rapidly revolving disks. After being detached by the comb roll, the seeds are forced through a grate underneath by the rotary action of the comb roll, and the lint, now free, is blown by means of a suction fan to a condenser in the rear of the gin. The simplicity and efficiency of the process are apparent at a glance.



TWO ELEVATORS IN ONE SHAFT

By

H. G. HUNTING

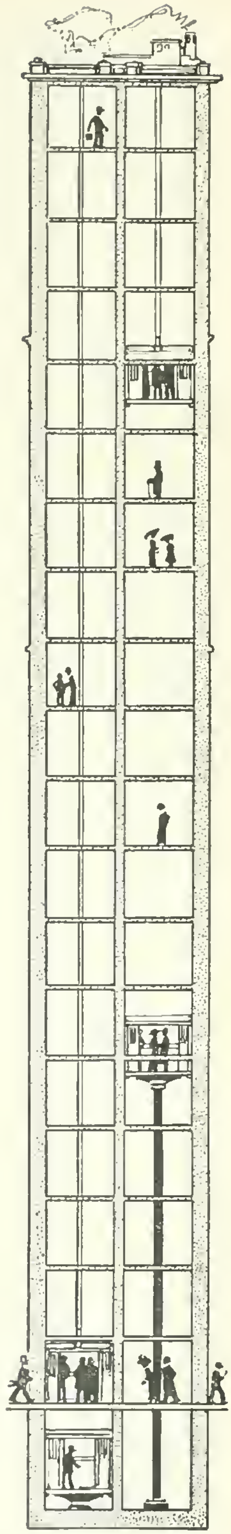
IF you have ridden up and down in the elevators of the big buildings of Chicago, you are more likely to feel that too little, rather than too much, space is given to elevators. Usually they are used to capacity. With this fact perfectly clear in his view, however, Jarvis Hunt, designer of big buildings, has made the astonishing announcement that twice too much space is used by the lifts, because—now, don't laugh—because two elevators can just as well run in one shaft as not.

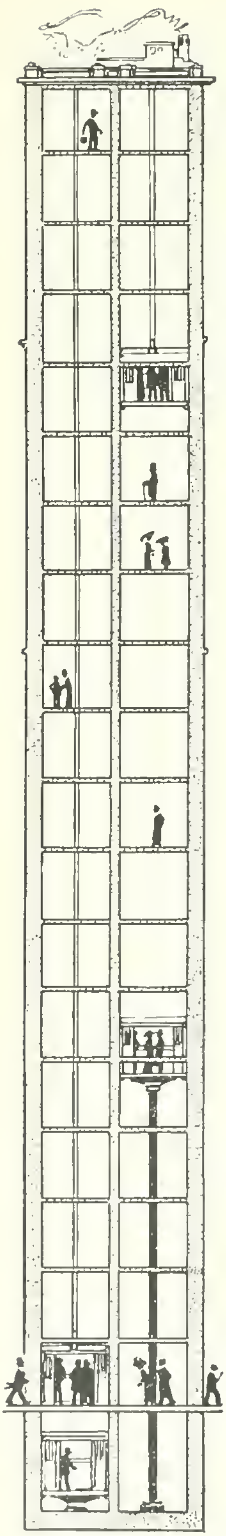
A few days ago, a group of Chicago capitalists paid $85,000 a front foot for a piece of State Street real estate. That means that, for a strip of ground one foot wide and running back one hundred feet to the alley, they gave cheerfully, not to say with alacrity, a sum that would make a snug little competence, at least, for most men.

Of course, they did not buy one strip alone. They bought several, side by side. Then they dug still deeper into their capacious pockets and brought forth a million or so and put up a building of magnitude and figured the value of floor-space as a basis for rentals. And the floor-space was valuable. It was worth enough to pay up-keep, interest and profit on that $85,000 per front foot and on the million or so invested in the building.

Floor space in that building rents for about five dollars a square foot per month, or say eighty dollars for an office twelve by sixteen feet. With twenty floors, each one hundred by one hundred feet inside measure, such a building would have two hundred thousand feet of floor space. And two hundred thousand feet at five dollars a foot per month, would make a very pretty income on investment. But ——

The space doesn't all rent. There must be halls and walls. There must be stairways. There must be closets, janitors' rooms, rooms for control-stations for various apparatus, washrooms. There must be a light-shaft.





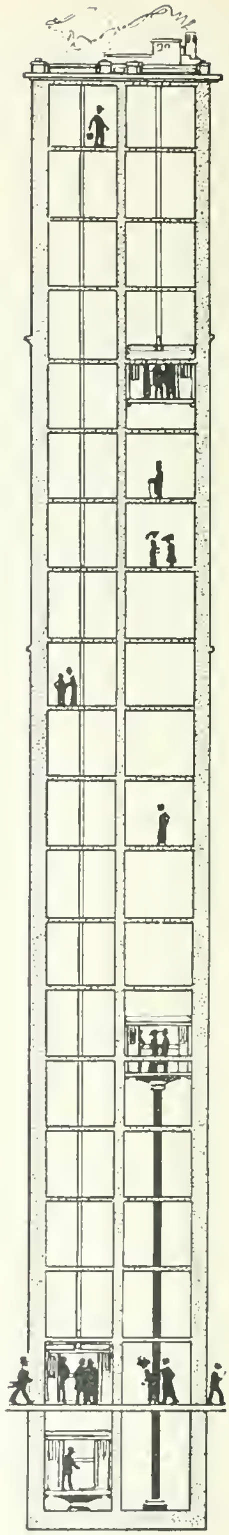
There must be air spaces and space for pipings for water and sewer and steam, and wiring for electric service. Lastly—but not least, by any means—there must be space for elevators.

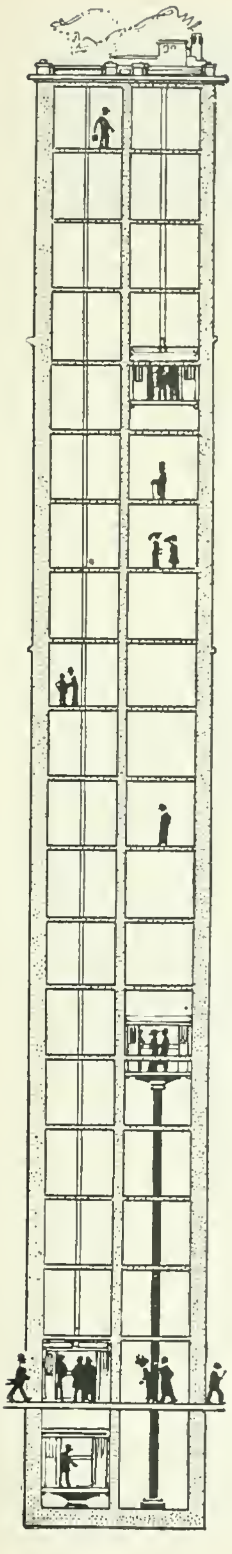
When you come to count it all up, it is costly space that is given to all these things. It keeps the profits down—somewhat, though it is still popularly believed to be a profitable investment, this building and renting of big skyscrapers. But suppose that each elevator in such a building takes a space six by seven feet, including its running space. That's forty-two square feet out of each floor for each elevator. Suppose it requires ten elevators to serve the building. Ten elevators would subtract ten times forty-two feet for each of twenty floors, or 8,400 square feet, in all, from the rentable floor space of the building. At five dollars—oh, well, it is easy enough to figure it. That's $504,000 a year in floor space given up to elevators. That's quite a sum.

The builders of the big skyscraper on State Street are giving up $504,000 every year for the purpose of lifting people in and out of the rentable floor-space. You may be quite sure that they have figured rather carefully about the necessities of the case before they have consented to any such thing. But a certain Chicago architect has come forward and proclaims that they are throwing away just one-half of that big sum. Literally they are throwing it away—for it isn't going to anybody—it isn't doing anybody any good. It simply isn't coming in when it should be. Why? Because too much space is given to elevators.

Two elevators in one shaft! How? Well, of course, they can't be side by side, so they must be one over the other. And the plan is "so simple that it's a wonder nobody thought of it before," just as is every other useful idea that crops into man's head after years of blundering blindness.

There are two types of elevators in common use now in the great buildings. One is the kind that is lifted by cables—the other is the sort that is pushed up by a plunger. Mr. Hunt means to put a cable-lift elevator in the shaft, to start at the first floor and run "express," without a stop below the tenth floor, serving the floors above the latter point. Beneath that elevator, he will put another to start at the basement and be pushed up by its plunger and run "local" to the tenth floor and back, serving all floors below the tenth. Between the two cars he puts a safety device to prevent possibility of collision and—there you are. It is simple to arrange the schedule so that the two

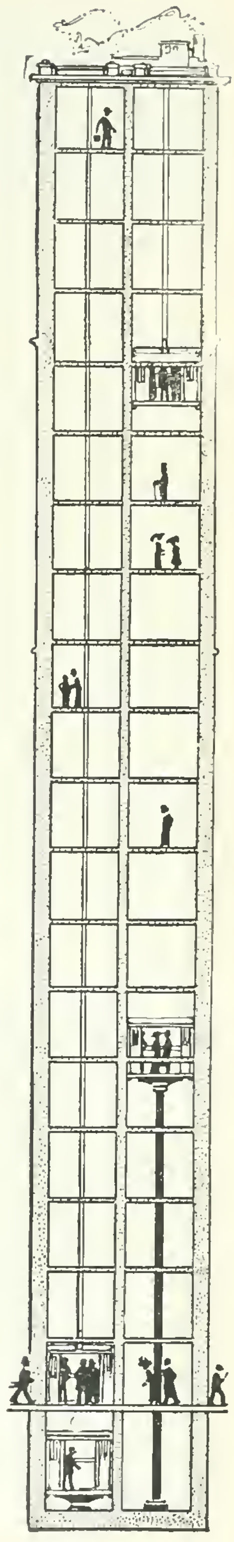




cars can serve their respective floors without interfering with each other.

While the cable-lifted car is rising from the first to the tenth floor, the plunger car will be taking on its load for the floors below the tenth. While the plunger car is delivering and receiving passengers between the first and the tenth floors, the cable car will be doing its work between the tenth and twentieth. It requires just about as much time to serve one floor as another, and in all well regulated buildings a perfect schedule is adhered to, so that there will be nothing new in this requirement. There is every reason to believe that the new plan will work and work well—to the saving of about half of that $504,000 in the State Street building, and considerably more than that amount in some of the Chicago buildings where fifteen or twenty elevators are required to serve twenty floors.

Suppose there are twenty buildings in Chicago that can save as much as that, by such a change of elevator methods—suppose there are twenty cities that have ten buildings each that follow suit—suppose there are a hundred more that have from two to five—and suppose that half the lower buildings, to say nothing of the higher ones can adopt adaptations of the plan? That leaves nothing at all to suppose about the results in savings, lower rents and greater profits, does it? And it's one more proof that we haven't been half so clever as we thought we were in the matter of economies. If all the inventors were to turn their attention to showing us where we Americans are wasters, as the efficiency engineers are showing the railroads, our much inflated conceit would look like a toy-balloon that is busted.



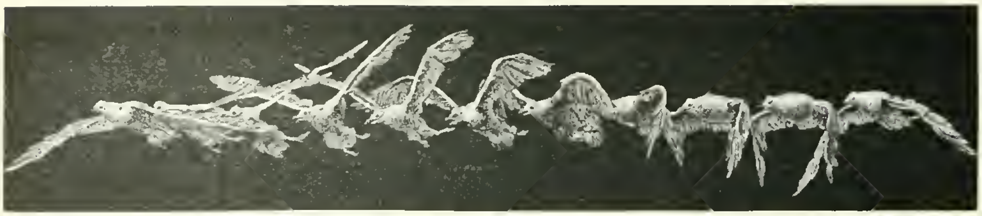


FIG. 1. SUCCESSIVE MOVEMENTS OF A GULL, MADE BY AN OBSERVER FOLLOWING THE LINE OF ITS FLIGHT.

BIRDS AS AVIATORS' MODELS

TRANSLATED FROM *LA NATURE*

By

MRS. F. M. C. HOLLEY

AMONG the unexplained things of nature that man has been fretting his brain over to little purpose as yet, is the fact that some birds have the power to holds themselves in the air without being dependent upon the beating of their wings. Direct observation of birds and the character of their flight has established the fact that birds of a certain size do not fly exclusively by beating their wings; they soar in the air. It may be said that this kind of movement is general with birds above the weight of four and one-half pounds, as if nature had not known how to enable large birds to use the same kind of flight as small ones.

How, under these conditions can we hope that man, surpassing nature, should be able to make a beating of wings that will lift not merely four and one-half pounds but his own weight?

Works on the flight of birds, undertaken during the past few years are very numerous, and it is becoming difficult to find one's way amidst the contradictions, uncertainties and obscurities which one meets. However a certain number of facts have within this time been ascertained by the experimental method which have often been corroborated by careful calculations.

The sparrow gives the impression of a living force which raises itself quickly and flies with rapid beatings of the wings to traverse only a few yards or to raise itself to a slight elevation. The pigeon rises with the same facility, but its beatings are less rapid and are produced with much more regularity; its flight, more ample than that of the sparrow, gives the impression that it belongs to a more powerful bird, capable of sustaining its course a longer time.

But a new element appears in the pigeon's flight—the facility, of which it frequently makes use, of suspending the beating of its wings in order to glide through the air. In ordinary weather with a moderate wind it holds itself thus when from a high point it wishes to descend to the earth; it half folds back its wings and lets itself fall in a concave curve which may become ascending. This practice is frequently followed by swallows, swifts and hawks, which use the momentum gained during the fall in order to mount again. During this fall and this automatic ascension, there is no expenditure of force necessary on the part of the bird, which benefits by this rest in order longer to continue its flight. It is in this way that swallows succeed in ploughing through the air, almost without stopping, from morning until evening.

The kite, the sparrow and the buzzard practice the kind of flight called the sailing flight, but the true kings of the air are the eagles, the vultures and the condors which travel through space without a single beating of the wings like living aeroplanes, capable even of remaining immovable, as though fastened in the sky.

Even superficial observation enables one to ascertain that the same bird may have different modes of flight and that the different species fly in different ways.

Two kinds of flying are in fact admitted; that obtained exclusively by the beating of the wings, the flight by rowing, as it may be called, and the soaring flight, during which the bird keeps its wings extended in the course of its progress through the air. There are two different modes of soaring flight: soaring flight properly so called, which is only

Fig. 2. The Fou de Bassan —a Bird of the French Coast—Poised for Flight.

temporary and accessory to rowing flight, and sailing flight, which is the normal mode of locomotion for large birds capable of remaining entire days in the air by utilizing the action of the wind for their movement. Simple observation permits us to establish among birds some clearly defined classes:

First, birds exclusively rowers; second, birds practicing the rowing flight and soaring flight; third, birds practicing rowing and sailing; fourth, birds practicing only sailing flight.

Are these distinctions, which are based only on the different variety of methods for accomplishing the action of flying, dependent upon the construction of the wing, and are there found in the wings of a bird such modifications that we may without hesitation attribute to them the special character of the flight? Observers have always replied in the affirmative, after having proved that the form of the wings is essentially variable and adapted to the kind of flying; but it is modern research which has scientifically established this dependence.

There exist two well defined types of wings among which, evidently, all the gradations are observed, but the distinction is easy. It is sufficient indeed, to glance at the two figures five and six in order to discover that the hawk's wing is stretched to a point, while the eagle's is rounded. This is due to the length of the quill feathers which diminishes from the first one to the last in

Fig. 3. The Fou de Bassan in Flight.

the hawk's wing, while in the eagle's wing the longest feather is the sixth. Besides, the rowing wing is homogeneous on its posterior side, whilst the sailing wing is jagged. This last peculiarity is due to the special conformation of the primary feathers which, instead of presenting the form of a knife as do the rowing feathers, become narrow at the middle of their length while the quill loses some of its rigidity. There results a certain suppleness of the edge of the sailing wing which, during flight, becomes convex and appears indented by reason of the divergence and the bending of the feathers. This attitude is striking in figure ten, and it is precisely this lack of rigidity which renders sailing birds unfit for rowing flight.

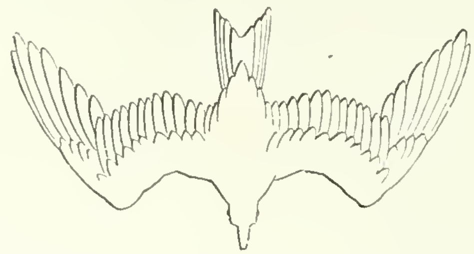


Fig. 4. Appearance of a Bird That Soars Slowly. The point of the wing carried forward.

Besides these characteristics, based for the most part on the structure of the wing, one may again examine the relation of the two dimensions, length and breadth. According to the French Mouillard, who was one of the most careful observers, the rowers all have short wings but the width of these wings varies according to the necessities of the bird due to peculiar character of its life. The sparrow, the partridge and the quail have no long distances to traverse by one flight but they must have powerful wings in order to rise from the ground and escape danger as swiftly as possible: so their wings are short and broad. The duck and the pigeon, which have a more ample flight, possess narrower wings which, in addition, facilitate their veerings. The wing stretches in proportion as the bird, from being a rower, becomes a sailer. But here again one finds some broad and some narrow wings. The latter, provided for work in violent winds, belong to sea birds, such as the petrel and frigate birds; the others have been given to the great birds of prey in order that they may take advantage of the least breath of wind and may cover enough space to find their prey.

Fig. 5. The Rowing Wing of a Falcon.

Now, how does the bird use its wings in order to keep itself up and to proceed through the air? Flying always comprises three phases or periods: the departure, the flight, properly so called, and lastly the alighting. We are going to study these three phases in each one of the groups of birds that we have described: rowers, half sailers, and sailers.

The average species of small size, belonging to the rowing group, take their start after a hop made by the relaxation of their legs accompanied by a vigorous beating of the wings which raises them from the ground at an angle of about forty-five degrees. The sparrow, the quail, the partridge, gallinaceous birds, and pigeons rise in this way. Certain aquatic species with short wings do not need to hop in order to release their wings; for some ducks it is sufficient to straighten their bodies vertically so

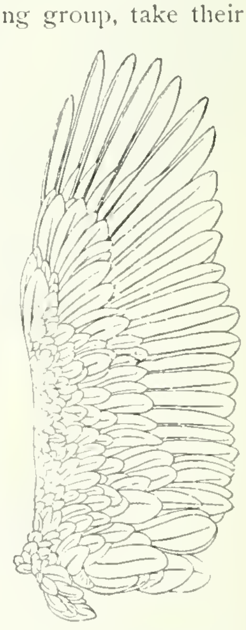


Fig. 6. The Sailing Wing of an Eagle.

as to permit at the first a flapping of wings. When these birds rest on an elevated support, it is sufficient for them to let themselves fall in order to acquire the start or indispensable spring for the action of the wings.

Fig. 7. The Frigate Bird—One of the Strongest of Flyers.

The necessary effort for flight is considerable, but it diminishes rapidly in proportion as the speed of the bird approaches the normal condition. One gains an understanding of this by appreciating the speed and amplitude of the flapping of the wings; in the sea gull the amplitude attains one hundred to one hundred and ten degrees at the departure and lowers from thirty degrees to forty degrees in normal flying; in the partridge the expenditure of force is so depressing that the little cries that this bird makes at the moment of its flight are attributed to fatigue.

During the flight the raising of the wing is obtained only by the action of the middle pectoral muscle which has no other function and acts intermittently; but this would be insufficient if nature did not aid by an artifice to reduce the resistance of the air to its lowest value. It has been discovered, in short, that, during the first flappings, the wings are like the slats of open Venetian blinds. The feathers meet the air edgewise. This arrangement, which offers a minimum of resistance to the passage through the air, is caused by an automatic pivoting of the feathers, due to a very complicated disposition of their elastic ligaments. In proportion as the bird gains speed the raising of the wing is caused by an increasingly weaker action of the middle pectoral muscle, and it becomes entirely passive when the motion is normal. It is indeed, the relative wind produced by the speed of the bird which acts on the convex face of the wing. Here again we find two components—the vertical and the horizontal; the first serving to raise the wing and the other, directed with a contrary motion, consequently slackens the speed of the bird. When to the relative wind there is added the absolute wind,—that is, when the bird flies against the wind,—the result is still more defined, and this explains why many rowing birds try always to take their flight with the beak toward the wind.

All authors are agreed in defining soaring as a word which signifies that kind of flight which a bird executes without flapping the wings, and with the wings more or less extended. Soaring thus understood comprises two different forms; soaring flight properly so called, for which the bird utilizes the speed acquired during a course of beating the wings or by a fall from an elevated point, and sailing flight, in which the bird has essential need of the assistance of the wind.

The bird that soars may be compared to a kite that one draws behind him while running and which rises and keeps itself up if the air is calm. All the rowers of medium size, herons, storks, buzzards, sea gulls and hawks, practice this kind of flying, and it is always easy to observe the periods during which they suspend the flapping of their wings, and continue their course, hold-

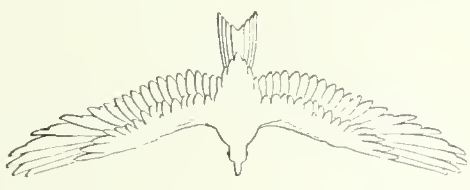


Fig. 8. Appearance of a Bird That Glides Rapidly.
The point of the wing is carried backward.

FIG. 9. THE STORK IN SOARING FLIGHT.

ing their wings extended almost without losing any speed; then a few vigorous strokes of the wings will quickly start them again on their way. Such flying is a gliding over the air, and the great force acquired during the period of the beating of the wings is utilized by the bird for taking support on the air and for continuing its course either while rising, remaining at the same height, or descending. According as its passage follows the one or the other of these directions the speed diminishes rapidly, slowly, or increases. The bird which presents most frequently these different modes of flying is the falcon in hunting. When from a great height it perceives its prey, it lets itself fall almost vertically in such a manner as to return and attack its victim from beneath; if it fails, it sets its wings and its body with the purpose of utilizing the enormous force acquired during the fall to mount again to a height when it commences again this manoeuvre and continues these duckings, without interruption, and consequently without fatigue, until the prey is captured.

The pigeon also offers us frequent examples of soaring. When, perched on a roof, it wishes to descend to the ground, it lets itself fall vertically then, reducing its speed by flapping its wings or, if it has some space before it, it lets itself glide following a parabolic curve which places it gently on the ground.

By observation of different soaring birds and by experiments performed with soaring machines it has been shown that, for the bird wishing to land as far as possible from an elevated starting point, it is necessary to fall one yard in order to traverse eight yards. A bird which would soar to the height of 1,000 yards would thus be able to land without fatigue at a distance of 8,000 yards.

Among soaring birds the sustaining qualities commence to gain on the propelling qualities; the concavity of the wing becoming no longer necessary except at the moment of the flappings, is assured only by the elasticity of the last quill feathers opposed to the rigidity of the first; besides, the surface of the wing is reduced and the tip gains a considerable development. Thus there is produced a narrow wing with a convex edge which is at once an excellent organ of propulsion and a very good soarer, qualities indispensable for assuring to these birds their busy existence in the pursuit of very fugutive prey.

Clearly then this condition, pushed to the extreme, will lead to flight by sailing, practiced only by birds which are no longed rowers and which borrow the necessary energy for their movement from another source than their muscles. Among the large sailing birds only the sustaining qualities exist; no more concavity of the wing, no more convexity or predominance of the tip, but large flat wings provided with extremely supple feathers with slight spread of the tip. The form of the wing itself is modified; the enlargement of the surface is obtained not by increasing the span, which would be inconvenient for the start, but by filling up the angle at the end of the wing which from being pointed becomes rectangular.

These are actual observations, and although denied by authors who have never witnessed this kind of flying, flight by sailing, are today definitely admitted, and no longer does any one deny that, in the large bird, the propelling and sustaining powers are obtained, simply by the reaction of the air in motion, by the wind alone. The agreement ceases when there is a question of explaining the mechanism of the flight by sailing and in particular this paradoxical fact that the bird can rise and make headway against the wind.

Many explanations have been proposed, some fantastic, others the discussion of which leads to such absurd deductions as the realization of perpetual motion; others again, true perhaps in certain particular cases, could not be embraced in a general theory. To this last class belong the hypotheses based on the utilization of the ascendant currents and on the variations of the velocity of the wind. It is certain that the bird gains in the ascending currents of the air; but there have been noted also many sailing flights with the wind horizontal or even descending; so that if the theory of the ascendant wind suits very well certain cases, as also that which utilizes the variations of velocity and direction of the wind, there remains to be found a general theory which may be applied to all these different cases.

FIG. 10. VULTURE SOARING.

The sailing bird, having only the aid of the wind to support it in the air, must be built for utilizing the slightest current of air from whatever direction it comes. It is necessary also that its organs be delicate enough to adapt it without delay to the changes of the direction of the wind which are almost always very sudden. These results are assured by the suppleness of the wings themselves and by that of the feathers, since the position of the plane to the air has to be modified. In fact each change of direction of the wind requires, if the wings are not sufficiently supple, an oscillation of the body and of the wings all together. This is what is produced in the semi-sailing birds with the wings relatively rigid, the tips of which are convex and predominant as in the case of the sea gull and swallow. There results in these birds a sort of balancing very clearly noticeable to observers. This balancing is very much diminshed in large sailing birds with supple wings; the shifting of the wings comes into play and as the total mass of the body and of the wings requires much greater energy in order to be displaced from its equilibrium, it is the wings alone that feel the effect of the changes of the direction of the wind. And when the variations of the wind are very slight, the feathers alone, the respective independence of which makes them like so many small wings for independent shifting, receive the puff of air and absorb its energy.

The large sailing birds having to count only upon the wind are necessarily constructed so as to utilize the lightest breath of air; everything with them tends to this result, from the sensitiveness of the feathers and the suppleness of the wing, to the ability of spreading the wing like a fan when, if they wish to rise, they have need to increase their sail. This explains the different positions reproduced in our figures 4 and 8, the first corresponding to a light wind for the utilization of which it is necessary to set full sail, the other becoming necessary when the wind freshens and there is need of taking a reef. Between these two extreme cases, there is an infinity of intermediate situations that the shifting of the feathers, or that of the wings, if it is necessary, suffice to regulate. The quill-feathers, in fact, constitute an automatic shifting device which assures the longitudinal and lateral equilibrium in normal conditions; the assistance of the wing, and of the entire body, are used only in extremely violent strokes. This automatic shifting is indispensable to birds that practice flight by sailing, and those which are not provided with it, the semi-sailers, are not as good flyers in high winds, unless they spread their wings like a fan as the stork in figure nine, in order to give a little independence to the extremities of the feathers. But this slight defect is not sufficient to destroy the brilliant qualities of flight which these birds present; powerful rowers, they are masters of the air, not being, like the large sailing birds, at the mercy of a dead calm, which is always possible and many render them powerless. In short, the latter have taken their qualities from the two extreme groups; the rowers and the sailers in order to utilize them according to circumstances. It is then the semi-sailers much more than the sailers that practice the most perfect flight, and man's imitation, which is often a criterion, gives actual proof of this. The aeroplane as it is conceived today, is only a semi-sailer with its screw propeller which allows it to take flight and sustain itself in the air, with its supporting and shifting planes, and its rudder which directs it. This gives us a hope that the day is not distant when automatic action will enable the machine to practice the true sailing flight without the aid of any motor whatever.

On a Bust of Dante

The lips as Cumae's cavern close,
The cheeks with fast and sorrow thin,
The rigid front, almost morose,
But for the patient hope within,
Declare a life whose course hath been
Unsullied still, though still severe;
Which through the wavering days of sin,
Kept itself icy — chaste and clear.

Peace dwells not here · this rugged face
Betrays no spirit of repose;
The sullen warrior sole we trace,
The marble man of many woes.
Such was his mien when first arose
The thought of that strange tale divine,
When hell he peopled with his foes,
The scourge of many a guilty line.

—T. W. Parsons.

THE MACHINE FOR POLLENIZING CLOVER.
Note the "fuzzy fingers" which the stooping man is touching.

MACHINE POLLINATES CLOVER

By

RICHARD C. BENTON

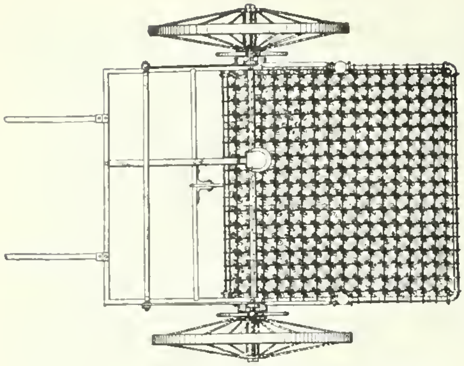
THE bumblebee is to be rendered almost superfluous in nature by a machine newly patented by an Indiana inventor—James M. Dennis, of Cambridge City.

This, at all events, so far as concerns clover and alfalfa plants, which have depended almost wholly upon the bumblebee for their production of seed. Where there are no bumblebees there is neither clover nor alfalfa. Which is why our government, not long ago, sent several batches of these useful insects to Australia, a bumblebeeless and cloverless country.

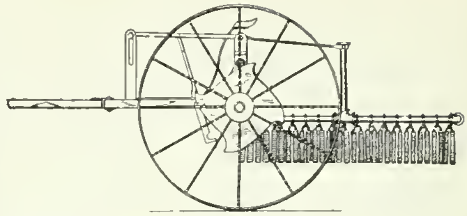
Up to date, it does not appear that the experiment has "panned out" as well as was expected. But this is a matter of no importance if the "fecundating machine," as the inventor calls it, works as well as he claims it does. One such machine, he asserts, is equal for fertilizing purposes to a whole swarm of bumblebees.

The contrivance is a two-wheeled skeleton cart, and is intended to be driven by a man over a clover field. In the rear of the axle is a horizontal frame extending almost the entire width of the vehicle. This frame is interlaced with numerous wires in such fashion as to divide it up into an arrangement of square meshes.

It will be understood, then, that the interlacing wires join each other at right



View from Above of Machine for Pollenizing Plants.



Side View, Showing the "Fingers" of Machine for Fecundation of Plants.

angles. From every joining there hangs downward a pair of spring-shaped wire fingers wrapped with some fuzzy stuff, such as lint or fibrous down. The fuzzy fingers thus prepared are made waterproof by dipping them in a thin solution of rubber. This is highly important, because they are the business members, so to speak, of the machine.

As the latter is driven slowly over the clover or alfalfa field, the horizontal frame, by an arrangement of cams, is made to move a few inches up and down. Four times during each revolution of the cart wheels, they are lifted gently and dropped suddenly. This keeps the frame continually agitated; likewise the fuzzy fingers, which brush the blossoms, take up their pollen, and deposit it upon other blossoms.

In order that clover or alfalfa shall produce good seed, it is necessary that the blossoms shall be cross-pollinated. In other words, the pollen of one blossom must fertilize another. This is a task satisfactorily accomplished by the bumblebee; but Mr. Dennis claims that his machine does it equally well, and that it can be relied upon to fertilize practically all the blossoms in any patch.

A smaller machine is also being made now for similar use among strawberry plants.

On a Grecian Urn

O, Attic shape! Fair attitude! with brede
  Of marble men and maidens overwrought,
With forest branches and the trodden weed.
  Thou silent form, dost tease us out of thought
As does eternity: Cold pastoral!
  When old age shall this generation waste
Thou shalt remain in midst of other woe
  Than ours, a friend to man to whom thou say'st,
"Beauty is truth, truth beauty"— that is all
  Ye know on earth, truth, and all ye need to know.

—Keats.

NOVEL SCHOOL LIGHTING

By

WILLIAM LEWIS NIDA

THE chief purpose of a school building is to render children comfortable and to protect their health while they are being taught. This protection to health should be brought about with the minimum of attention from the teacher who is likely to be absorbed in the process of instruction.

In the building of the Elm Street School at River Forest, Illinois, the board of education has adopted an entirely new method of lighting and with such success that it has already been taken up by surrounding towns.

While the problems of heating and ventilating schoolrooms have been fairly well solved, the science of lighting has as yet received little consideration, though it has been brought to our attention again and again that a greater percentage of school children are suffering from eye-strain than from any other trouble. Many eye diseases, headaches and nervous disorders are directly attributable to the use of the eyes under improper conditions.

When we consider that the eye, whose loss is more deplorable than that of any other sense organ, is subjected to con-

CONTRARY TO THE PREVAILING IDEA, ONE-STORY BUILDINGS COST NO MORE PER ROOM THAN TWO-STORY STRUCTURES.
This four-room school building at River Forest, Illinois, cost $19,000.

PHOTOGRAPHERS CALL THIS A POOR PICTURE.
The camera cannot work well in such a light. Consider the necessarily evil effects upon the eye-sight of these children.

stant and serious abuse—and this, too, among children who have no means of self-protection—we do not wonder that the percentage of spectacled people is increasing so alarmingly.

It is common experience that strong light, shining directly into the eyes soon produces exhaustion and sleepiness. Yet there is scarcely one schoolroom in all this broad land in which a large proportion of the children are not forced to endure this strain. On the other hand a soft, steady and well-diffused light from overhead enables one to continue visual effort for a great length of time without fatigue. The explanation is simple. The pupil of the eye soon adjusts itself to this steady, well-distributed light, and no readjustment is necessary as the head is turned from side to side. Consequently vision is perfect, the retina protected and nervous energy conserved. In like manner, when one is out of doors the field of vision is illuminated by a steady, perfectly-diffused light and the pupil of the eye adapts itself to this unchanging intensity once for all and no harm done.

That the adjustment of the pupil of the eye to changing intensities of light is not instantaneous, is well known. In rooms lighted by side windows there are marked differences of light-intensity since the walls, absorbing much, reflect a soft light, while the glare from the side windows is unabated. As the head turns from side to side and the eye is met by widely varying light intensities, the slow-adjusting pupil is hopelessly unable to protect the sensitive retina. Vision is therefore obscured and nervous energy needlessly and harmfully wasted.

One of our illustrations shows a modern schoolroom—one that has always been considered well-lighted. The camera shows that part of the children are suffering from too little light and the others from too much, that the room is very unevenly lighted and that nearly all are subjected to severe eye-strain because of the great volume of rays bursting upon the faces of the children. Nature's provision—deep eye-sockets, eye-brows and eye-lashes—prove totally inadequate protection against this overwhelming light in front.

THE ONLY WAY TO SECURE A WELL-DISTRIBUTED LIGHT IS FROM OVERHEAD.
This illustration shows a room in the new sky lighted school in River Forest.

Nothing reveals the exact lighting of a room so perfectly as a camera. By placing the instrument in various positions in order to take the four walls of the room, a fine test is made. The camera is as delicately sensitive to light as is the human eye, after which it is patterned.

When the writer asked his photographer to place the camera in the position required the latter demurred, declaring that it would spoil the picture. Photographers well know that the camera requires an even light, that it cannot work well amid two different intensities at the same time. But this is exactly the position in which the school children are placed five hours each day.

If the health of our children is of primal importance, as we all admit, then it is high time the educational world should be considering the question of light.

The only way to secure a well-distributed light is from overhead. For thorough diffusion it should pass through ribbed or prism glass. The walls of a room should always be of a light color as a further aid in diffusion. One illustration shows a room in the new sky-lighted school in River Forest. This picture was taken on a cloudy day in December with all side window shades closely drawn. The regular practice here is to keep all shades drawn to the horizontal line, thus ensuring entrance of light from above only.

The pupils and teachers in this building report better spirits and less weariness when the day is over than they ever experienced before. Here is a soft, thoroughly diffused and perfectly distributed light; no dark corners, glaring windows nor squinting eyes. Artificial light is never needed in this sky-lighted building even on the darkest winter days.

To illuminate school rooms by means of skylights necessitates one-story buildings with flat roofs. Flat roofs of tar and gravel cost far less than the high gable roof even after including the expense of the skylights.

One-story schools may be made quite acceptable in the hands of competent architects. It is necessary to extend the parapet walls a few feet higher in order

THE SAW-TOOTHED SKYLIGHTS WHICH ARE PARALLEL RIDGES RUNNING EAST AND WEST.
The south slope is covered with tin, the north is of reinforced ribbed glass. Thus a steady north light is assured.

to mask the lights. The four-room Elm Street School of River Forest, Illinois, was completed in November, 1910, at a cost of $19,000. It is strictly modern, having, besides top-lighting, a superior ventilating system of a novel type.

Still another of our illustrations shows the saw-tooth skylights, which are parallel ridges running east and west, the south slope of which is covered with tin so as to exclude sun-rays, while the north slope is of reinforced ribbed glass. Thus is assured a steady north light with no interference from sunshine. The ceiling glass of the classrooms is also of ribbed glass which has proved to be the best light diffuser.

Contrary to the prevailing idea, one-story buildings cost no more per room than two-story structures! The large halls required to make room for the stairways in the latter and to accommodate the numbers using the same exit, necessitate the enlargement of the ground plan of the entire building, which adds enormously to the cost without corresponding increase in the number of classrooms. The costly stairways, the heavier walls and foundations needed for a two-story structure, overbalance the added cost for excavation and roofing of one-story buildings. Moreover, in the latter, the partition walls need not be of brick.

One-story schools require much more space, however, and where land values are very high such construction may be impossible. But for smaller cities, villages and suburbs there are no obstacles to this novel type of school architecture. Boards of education ought to consider well before burdening future generations with ill-lighted school buildings that may have to be torn down to make room for an intelligent progress based on scientific investigation.

Mecca Railway—a Provisional Station in the Desert.

One of the Belgian Locomotives Used in the Construction Work.

TO MECCA BY RAIL

By H. J. SHEPSTONE

THE decision of the Turkish government to extend the famous Hedjaz Railroad by carrying the metals of this line across the desert from Medina to Mecca calls attention to what is undoubtedly one of the most daring railroad enterprises of the age.

This railroad is unique in its claim of being the only railroad built for the purpose of carrying pilgrims. Indeed, known as "The Railroad of the Pilgrims," it is being used for the transportation of Mohammedan pilgrims to Medina, the burial place of their prophet. Starting from Damascus it runs almost due south through wild and sterile country for more than 820 miles to Medina. A short distance from the terminus is Daraa, now quite an imposing and important station, where the line joins that coming up from Haifa round the southern shores of the Sea of Galilee.

From Daraa the line gradually ascends the undulating slopes of a plateau as far as Zerka, where it drops into a deep valley, and climbs out again by a winding belt. As the line proceeds southwards, signs of civilization become fewer and fewer, and the sense of desolation more pronounced. Pursuing a course parallel to the River Jordan, and almost identical with the old caravan route, the railroad traverses a district as full of interest for the Christian as for the Mohammedan. Decayed ruins of past civilizations and silent monuments of long-departed prosperity are visible on all sides.

So the journey continues until El Ula is reached, 609 miles from Damascus and 210 from Medina. Beyond El Ula none but Mohammedans may go, even the engineer-in-chief, who is a German, had to relegate to a Mohammedan assistant the carrying of the metals into Medina. The railroad is now to be extended to Mecca, the birthplace of Mohammed, but to accomplish this, 285 miles of track has yet to be laid across the desert. This is now being rapidly done and construction trains carrying the necessary material have proceeded south from Damascus with Turkish soldiers who will build the line under the direction of a Mohammedan engineer. It is interesting here to note that when the Bagdad Railroad has progressed another 200 miles and the Bosphorus is spanned by a bridge, the sacred city of Mecca will be in direct railroad communication with Constantinople.

Why, of Course!

Miss Chatterton (gushingly)—"What a magnificent great Dane! And, of course, his name is Hamlet?"

Mr. Gaiety (the owner)—"Not exactly; you see, I—er—couldn't consistently use that name. The best I could do was to call her Ophelia!" —*New Orleans Picayune.*

His Quietus

Mrs. Cobb—"Was the grocer's boy impudent to you again when you telephoned your order this morning?"

Maid—"Yes, Mrs. Cobb, he was that; but I fixed him this time. I sez, 'Who the hell do you think you're talkin' to? This is Mrs. Cobb.'"—*Life.*

Maybe the Printer Knew

"My pigmy counterpart," the poet wrote
Of his dear child, the darling of his heart;
Then longed to clutch the stupid printer's throat
That set it up, "My pig, my counterpart."
—*Harper's Weekly.*

The Mouse and the Cat

The Tailor—"Married or single?"

The Customer—"Married. Why?"

The Tailor—"Then let me recommend my patent safety-deposit pocket. It contains a most ingenious little contrivance that feels exactly like a live mouse."—*Chicago News.*

Anticipation

The new maid seemed eminently satisfactory, but the mistress of the house thought a few words of advice would be just as well. "And remember," she concluded, "that I expect you to be very reticent about what you hear when you are waiting at table." "Certainly, madam, certainly," replied the treasure. But then her face lit up with an innocent curiosity. "May I ask, madam, if there will be much to be reticent about?"

Candor in the Home

"Your sister's a long time about making her appearance," suggested the caller. "Well," said the little brother, "she'd be a sight if she came down without making it."—*Cleveland Leader.*

Hard to Please

Mrs. Nagleigh—"I suppose you are satisfied now that you made a mistake when you married me?"

Nagleigh—"I made a mistake, all right, but I'm not satisfied."—*Boston Transcript.*

More Homelike

Hospital Physician—"Which ward do you wish to be taken to? A pay ward or a——"

Maloney—"Iny of thim, Doc, thot's safely Dimocratic."—*Puck.*

Any New Methods?

"Ain't it strange, th' way Kelly beats his wife?"

"I dunno. How does he do it?"—*Cleveland Leader.*

Too True

He—"Yes, it's very true, a man doesn't learn what happiness is until he's married!"

She—"I'm glad you've discovered that at last!"

He—"Yes, and when he's married it's too late!"—*Dorfbarbier.*

Good Government

"What's the trouble in Plunkville?"

"We've tried a mayor and we've tried a commission."

"Well?"

"Now we're thinking of offering the management of our city to some good magazine."—*Louisville Courier-Journal.*

His Opinion

"Do you believe there really is any such thing as platonic affection, Henpeck?" queried Dobson.

"Well," said Henpeck, scratching his head

reflectively, "I believe that after five or six strenuous years of married life one can acquire it."—*Harper's Weekly.*

Right Again

Singleton—"Do you believe in the old adage about marrying in haste and repenting at leisure?"

Wedderly—"No, I don't. After a man marries he has no leisure."—*Smart Set.*

A Fair Sponger

She—"Yes, I like Ted; he is so extravagant."

He—"That is hardly the best quality for a husband, is it?"

She—"Of course not; I am not going to marry him."—*Boston Herald.*

Nothing Much

"I don't know whether I ought to recognize him here in the city or not. Our acquaintance at the seashore was very slight."

"You promised to marry him, didn't you?"

"Yes, but that was all."—*Louisville Courier-Journal.*

Wild Oats for Him

Little Walter was always carefully guarded against germs. The telephone was sprayed, the drinking utensils sterilized, and public conveyances and places were forbidden him.

"Father," he said one night, in a tone of desperation, "do you know what I am going to do when I grow up?"

"What?" asked the father, preparing for the worst.

"I am going to eat a germ."

One Thing at a Time

"How is the new filing system? Success?" asked the agent of the merchant to whom he had sold a "system" a few days before.

"Great!" said the merchant.

"Good!" said the agent, rubbing his hands. "And how is business?"

"Business?" echoed the merchant. "Oh, we have stopped business to attend to the filing system."—*San Francisco Star.*

Her Choice

A fashionably dressed young woman entered the postoffice in a large Western city, hesitated a moment, and stepped up to the stamp window. The stamp clerk looked up expectantly, and she asked: "Do you sell stamps here?" The clerk politely answered,

"Yes." "I would like to see some, please," was the unusual request. The clerk dazedly handed out a large sheet of the two-cent variety, which the young woman carefully examined. Pointing to one near the center, she said, "I will take this one, please."

POPULAR · SCIENCE & MECHANICS SUPPLEMENT ·

HIS FIRST AEROPLANE

IT is hard for "grown-ups" to realize that to our children the art of flying is accepted quite as a matter of course, just as we accepted roller skating or swimming. This photograph shows a child of the twentieth century, a six-year-old, at work on his first airship, a monoplane with propeller in front. The youngster watched the aviators skimming through the air at the Los Angeles aviation meet and has been experimenting with flying machines ever since. You and I were trying to construct a top schooner or a coaster at that age but none of us ever dreamed of building monoplanes. The generation to which this small chap belongs will probably perfect the new science, simply because they will regard flying as a matter of fact instead of as a startling novelty.

HIS FIRST AEROPLANE—A CHILD OF THE TWENTIETH CENTURY.

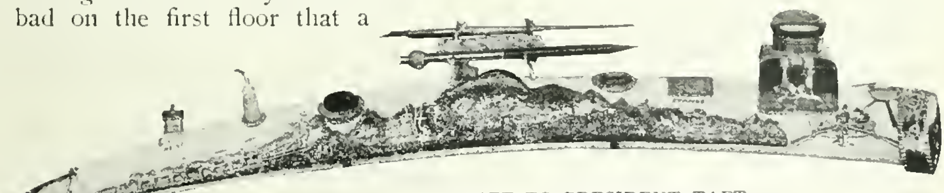
KING ALPHONSO OF SPAIN, ON HIS RECENT VISIT TO MOROCCO, TRAVELED FOR LONG DISTANCES ON A CAMEL.

NEW AID TO FIGHT FIRE

THE illustration on the next page shows the unusual construction and use of a deluge water pipe for putting out fires in basements, elevator shafts and under roofs of buildings.

Basement fires are said to be the most difficult fires that a fire chief has to contend with. The fire may be 100 or more feet from the front of the building and impossible to reach from windows or deadlights. It is very seldom so bad on the first floor that a man cannot get in long enough to chop a hole in the floor so as to set in the pipe. When the pipe is set down in the hole it is in a position which sends an inch and a quarter stream directly up to the side of the opening, driving away the heat and smoke. The operator by turning the wheel in his right hand a quarter of turn changes the pipe from one position to another in less than a second, covering about 300 feet and all the ceiling.

If conditions are such that a man can-



AN ODD GIFT TO PRESIDENT TAFT.
This is a tusk of a "king" walrus, presented by citizens of Fairbanks, Alaska. It is 2½ feet long and 10 inches in circumference. It is embossed in gold.

New Aid to Fight Fire.
An unusual type of deluge pipe.

not get in on the first floor to chop a hole he can break the basement windows and get the pipe through.

The amount of water from an inch and a quarter nozzle, with 150 pounds of pressure behind it makes this the coolest part of the building, as it drives away the heat and smoke. A half turn of the wheel on top will send this powerful stream over 150 feet either way. Each pipe has a set of spikes to hold it to the floor in case it is desirable to use 200 pounds pressure. A set of hooks are employed to break the deadlights, to hook the pipe to them, so that if the wall looks bad the men can leave the pipe and still have a powerful stream in any direction they wish to leave it.

HAVANA'S NOTABLE FLOODS

A HURRICANE which also did great damage along the Atlantic seaboard of the United States flooded the streets of Havana, making boats the only safe method of transportation. People were rescued from their houses by patrol wagons and then, when this became impossible, in boats. The financial loss in Havana alone as a result of this flood was more than one million dollars. The coal docks were wrecked, customs houses and wharves flooded and lighters and barges sunk in the harbor and valuable household effects in houses in the submerged districts ruined. For several days communication by Havana with the interior was cut off so great was the flood and the destroyed telegraph and telephone system. While the damage to property in Havana was so great fortunately only two lives were lost, two men being drowned in the harbor.

The group in the picture seem to be posing as contentedly as if standing on dry land.

HAVANA'S FLOOD VICTIMS BEING RESCUED BY POLICE PATROL.

HAULING GUAYULE SHRUBS TO MARKET IN TEXAS.

GUAYULE SHRUBS IN TEXAS

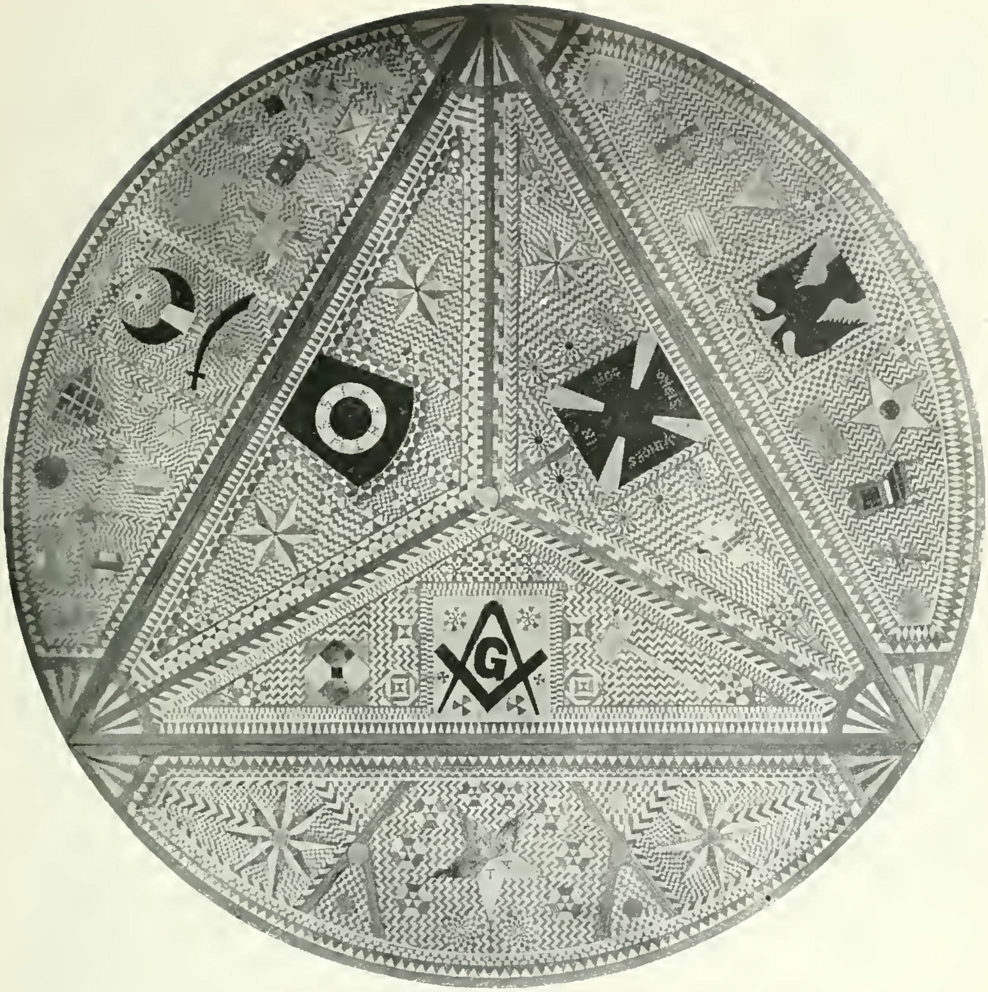
SINCE the discovery was made that the guayule shrub contains ingredients from which a high grade of crude rubber may be manufactured, the industry of gathering and baling the shrubs has become very important in the upper Rio Grande border region of Texas where it grows in more or less profusion. This desert shrub was considered more than worthless a few years ago. The ranchmen despised it because it was unfit as forage for their cattle, and it was a menace to the raisers of sheep and goats for the reason that these animals would eat the branches of the shrub and die from indigestible balls of rubber that formed in their stomachs. It grows only upon the poorest land, being found chiefly upon the limestone ridges. With the establishment of a rubber factory at Marathon, Texas, in the heart of the guayule shrub territory, a large demand for the shrub was created. Many men are employed in cutting, baling and hauling the shrub to the factory. Large shipments of the shrub are also made to other factories. Land that was formerly non-productive, even of grass, is now bringing in a handsome revenue from the shrub which it produces.

The discovery of the virtues of the guayule shrub is merely another addition to the long list of plants, which, formerly, men did their best to destroy, but later found them to be of great commercial value.

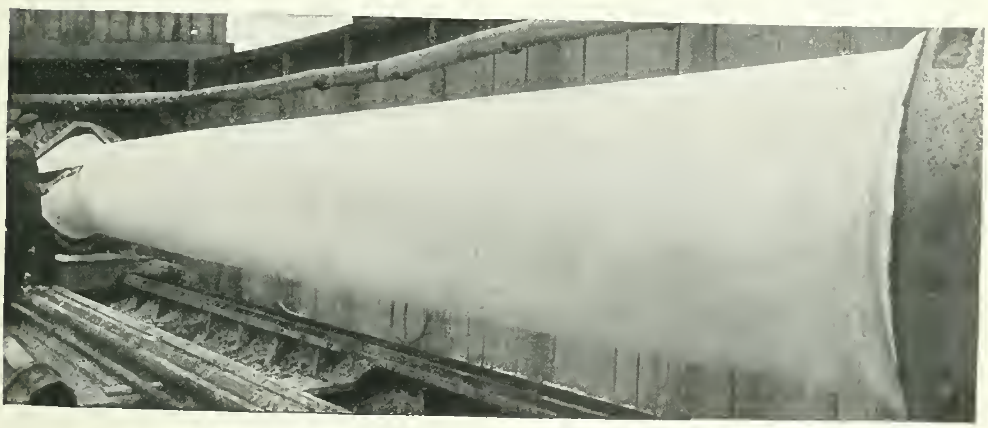
REMOVING A SNAKE'S FANGS.
The photograph depicts a physician engaged upon the delicate operation of extracting poison from the fangs of a snake. This operation is, of course, one fraught with considerable danger, and naturally can only be performed—and then with great care—by an expert.

PARISIAN ACTRESSES, WHO, IN THE PARKS, MADE MERRY BY THIS BURLESQUE OF THE HOBBLE SKIRT.

BULL DOG PLAYING BASEBALL.
This sturdy beast fearlessly meets the sphere "head on."



MASONIC TABLE MADE IN A MICHIGAN TOWN.
There are 34 473 pieces of wood in this piece of furniture, gathered from every state in the Union.



BIGGEST OF MARBLE MONOLITHS.
This column cut from stone quarried at Pittsford Valley, Vermont, weighs thirty-three tons.

Mexican Sundial.

A Thread Holder.

SUNDIALS IN MEXICO

In many of the smaller towns as well as in some of the larger cities of Mexico sundials are still in general use. The general adoption of clocks and watches for time-keepers has not done away with the public sundial which is usually marked upon a stone pedestal in plain view of the populace. Upon the great central plateau of Mexico there are few days during the year that the sun does not shine.

AIR BY THE NICKEL'S WORTH

An enterprising inventor in Pasadena, California, has gone into the business of retailing compressed air for bicycles and motor-cycles on the principle of "drop a nickel in the slot" to get value received. His device is a cast iron pump about half as large as a U. S. mail box, which is attached to telegraph poles along the streets most frequented by cyclists. It is provided with a crank which is easier to operate than the small hand pump carried in the tool kits.

WHERE'S THE THREAD?

Here is an idea for the housewife during sewing time. Instead of keeping the spools of thread in an open basket and fishing for them as wanted from a mass of other material, make one of these spool holders by driving a series of nails in a piece of wood. The spools can be slipped on over the nail, through the hole in the center of the spool, and can be readily picked out as wanted.

Air by The Nickel's Worth.
Here the cyclist may inflate his tires.

SAID TO BE THE ONLY VESSEL OF ITS KIND.
The *Currier*, an American craft, built to carry shipments of molasses, petroleum, or general freight.

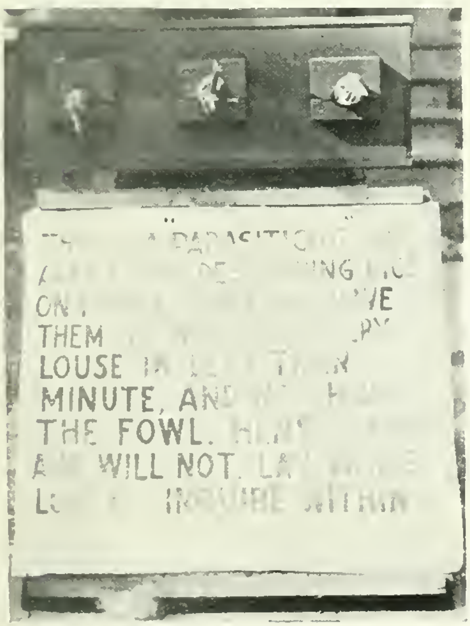
Statue of Dancing Maori—New Zealand—Warrior, in the Museum of Natural History, N. Y.

Zebras—Extraordinary Example of the New Plastic Taxidermy.
The figure is first cast in clay, and the skin is then fitted over.

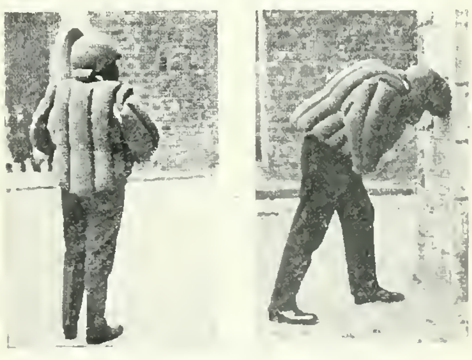
Prince Henry, of Prussia, Playing Golf.

HENS IN THE PILLORY

A CURE which must be as painful as it is beneficial is shown in the accompanying photograph of live hens undergoing fumigation. This remarkable invention is in the shape of a flat box large enough to hold the bodies of five hens, and supplied with openings just of a size to take the necks of the victims without choking them. The fowls are thus held like a culprit in an ancient pillory, the heads being exposed while



A Photo That Explains Itself.

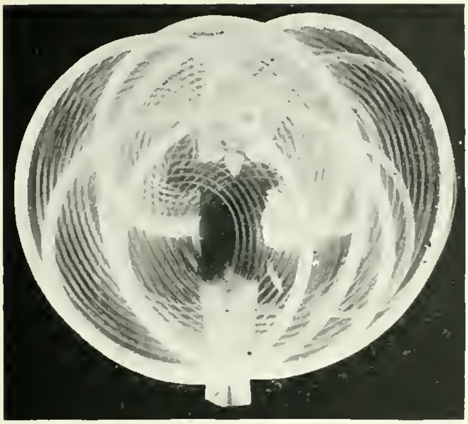


Safety Helmet for Aviators.
The "Marie." Testing an aero jacket safety helmet.

the bodies are enclosed in the box which is placed on a barrel, and in the latter sulphur is burned. The sulphur fumes rise through perforations in the bottom of the box and destroy the parasites which prey upon the hens and keep them from doing their duty in the way of laying eggs.

From the viewpoint of the hens, however, doubtless the treatment may be regarded as being far worse than the disease.

PAJAMAS FOR THE HOUSEWIFE.
When the doorbell rings, or a visitor calls, it is easy to slip on a kimona



WHIRLS OF ELECTRIC LIGHT.

WHIRLS OF LIGHT

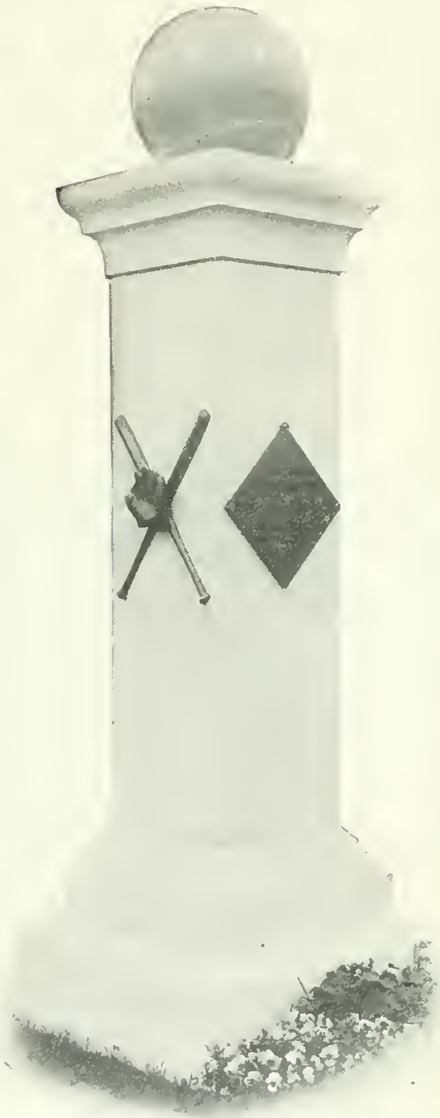
MR. GEORGE W. PATTERSON has devised a means of swinging electrically-lighted clubs in such a way as to produce startling yet beautiful effects. He hit upon the idea entirely by accident. At one of his gymnastic performances the lights suddenly went out, and the electrician declared that he was helpless.

Mr. Patterson happened to have in his dressing room a number of electric torches. He attached them to the clubs, lighted them, and swung them round until the electrician had got his wires working again. Apart from saving the situation, the lighted clubs were very popular, and he determined to see whether it would not be possible to fix electric lights to the clubs.

The first thing was to design a special club. The ones now in use are made in two parts, the split being lengthwise. A flexible cable of five wires leads into the club handles through a rubber tube, the wiring of course being concealed. Three series of eight three candle-power miniature lamps are set in small, specially-turned brass sockets the length of the club, so the lamps stand out at right angles to its surface. As the little globes are colored, there are no fewer than six series of different colored lights when the current is turned on. But these clubs could only be used in halls or houses wired for electrical illumination. To overcome this difficulty Mr. Patterson carries a battery about with him.

MONUMENT TO FATHER OF BASEBALL

NEW YORK "fans" have erected in Greenwood cemetery, Brooklyn, New York, this monument to the "Father of Baseball," Henry Chadwick, for many years editor of Spalding's Baseball Guide, and a leading baseball writer of New York. It is surmounted by a large facsimile of a regulation ball executed in granite, with the threads and leather



IN HONOR OF HENRY CHADWICK, "FATHER OF BASEBALL."

Trackless Trolley in the California Mountains.

surface cleverly imitated. Fastened to the sides of the shaft are bronze decorations in the form of bronze crossed bats, a catcher's mitt and mask, and a tablet bearing the inscription. The monument was erected by private contributions from admirers of the game and the man.

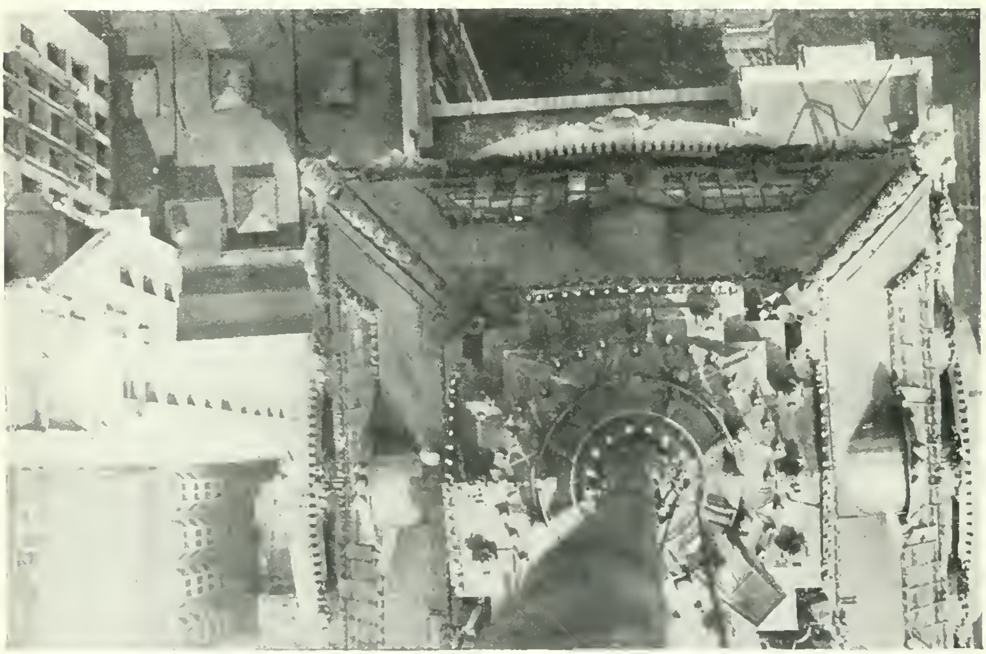
TRACKLESS TROLLEY IN THE MOUNTAINS

THIS electric trackless trolley is traveling over a winding path cut out of the side of the mountain to an average width of twenty-five feet. It has a high bank on one side of the road and a mountain brook on the other. The average grade is about eight per cent. and the maximum grade is twelve per cent.

This is a regular trackless line in California. This highway is also largely used by automobiles and other vehicles and experience shows that the trackless trolley cars are able to turn out for any passing vehicle or any obstruction, and still have a safe clearance.

During the early part of the operation of this system it was necessary to operate over a portion of road which was being plowed up. This made it necessary to drive the cars across deep furrows.

The Photographer at Work—with Result Below.



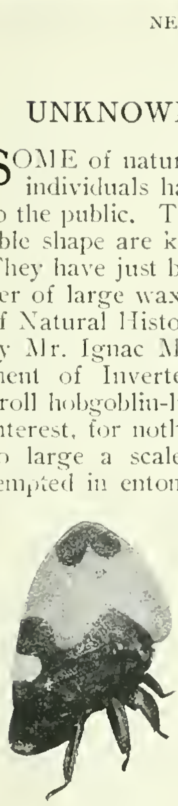
NEW YORK UPSIDE DOWN.

George Nealy, 700 feet up, on flag staff of Singer Building, took this remarkable photo.

NEW RAPID FIRE GUN RECENTLY TRIED OUT IN THE ARMY.
It shoots 600 shots of .30 caliber, per minute.

UNKNOWN HOBGOBLINS

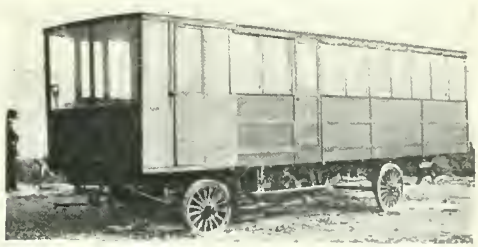
SOME of nature's most grotesque little individuals have just made their bow to the public. These midgets of remarkable shape are known as "tree-hoppers." They have just been portrayed in a number of large wax models at the Museum of Natural History, New York, executed by Mr. Ignac Matausch, of the Department of Invertebrate Zoology. These droll hobgoblin-like insects are of special interest, for nothing of this character on so large a scale has hitherto been attempted in entomological work.



A Hump Backed Chroan "Hobgoblin."

A Harmless "Monster" from Brazil.

The "tree-hoppers" have sucking mouthpieces and live on the juice or sap of small trees and plants, which they extract from the stems by means of their sharp beaks, consisting of several bristles enclosed in a fleshy joined sheath. The tropical types are gorgeously colored in many hues. They have four eyes — two large and protruding ones, and two below, partly developed. Their two large eyes have a keen, droll look, and the line that separates the head, in some instances, gives them the appearance of wearing spectacles. They have four wings. Some are clumsy in flight, and use their wings mostly as a parachute. The hind pair of legs is longer than the front ones, and is employed in leaping and jumping to considerable distances, which has given to these insects their common name of "tree-hoppers." They are especially interesting on account of the peculiar development of the thorax, which, in grown specimens, is provided with singular horns or protuberances. These horns are often so freakish and extravagantly shaped that entomologists have hitherto been unable to account for their development and form. They remind one of some of the highly specialized horns and tusks of fossil reptiles and mammals. It is difficult to conceive of their being used by the insect in any way. This peculiar development is not so clearly seen in tree-hoppers of temperate regions as in the species from South and Central America, where they are often most surprisingly shaped. Many have mountain-like humps on their backs; the prothorax is prolonged back-



"Captain" George Streeter's Auto House Boat.
Claiming part of the lake front of Chicago as his property, for a long time "Captain" Streeter, besieged in his auto, defied the authorities, but finally yielded.

Henry Barrington, an Englishman Playing Popular Melodies with His Eyes Covered.

Mr. Barrington, Supported by a Special Attachment, Playing in a Somewhat Unusual Position.

ward, like a roof, over the body, often quite covering the entire insect. In some instances, the prothorax is an elevated nightcap, in others it is shaped like a Tam O'Shanter; and sometimes it has long horns, one on each side. Some possess a wonderful sword or blade-like appendage, having ball-like projections, which are oftentimes several long hairs. The little tree-hoppers are practically harmless and are not usually found in sufficiently large numbers to constitute a pest. Nearly all the best and most curious specimens are obtained from various tropical parts of South and Central America, and India. The construction of the wax models requires most patient and delicate modeling and painting, in order to bring out the hundreds of indentures, cavities, and lines.

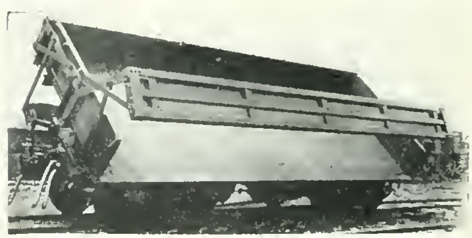
NEW STYLE OF DUMP CAR

THE style of dump car which has found favor with Uncle Sam in the excavation of the Panama Canal is shown in the accompanying illustrations. A large number of these cars are being used in work upon that project.

The dumping of the cars is controlled by compressed air from the engine, the cars being equipped with an extra set of pipes and connecting hose, which extends to a special valve in the engine cab. With air from the same supply used for brakes, the mechanism of the cars is worked, and is under such perfect control that the entire train may be dumped at the same time, or one car at a time, part of the load on one side and part on the other, as the work may require.

By another movement of the valve in the engine cab the cars are restored to normal position and are ready to receive another load.

Panama Canal Dump Car as It Appears Loaded.



The Car as It Appears When Dumping Its Load.

SAILING SHIP "COMES BACK"

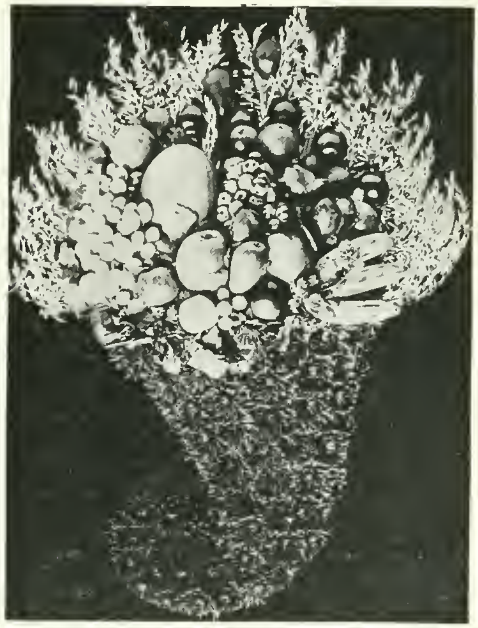
WHILE the eyes of the world have been focused on the progress in shipbuilding in the steamer class there has been prepared for sea, almost unnoticed, a wooden vessel that far surpasses in capacity any ship of its class that ever put to sea. It is a six masted schooner named the *Wyoming*. The gross register of this great sailing craft is 3,730 tons or twenty-two tons more than the steel hull six masted schooner *William L. Douglas* of Boston.

American ambition refused to stop short at six masts. It was thought that one more could be added and the experiment was made with the *Thomas W. Lawson*, a photograph of the model of which ill fated monster is shown on this page. It is still argued that the seven master could be made to stay afloat, the *Lawson* having been built too narrow and too light below the water line for the safety of the ship. As the *Lawson* turned turtle ship builders who predict a great future for the sailing ship are content to leave a seven masted schooner out of their calculations. It is also asserted that the six masted schooner is a more profitable sailing craft than a seven master could possible be, so that the factor of commercial gain will probably settle the limit at six masts.

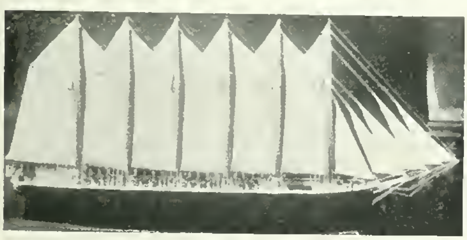
HUGE FLORAL CORNUCOPIA

THE accompanying photograph depicts a remarkable cornucopia that was prepared by a well known floral artist for use in one of the big West End London churches during a festival. This cornucopia stood over six feet high and contained besides the fruit over one thousand blossoms, which had been arranged

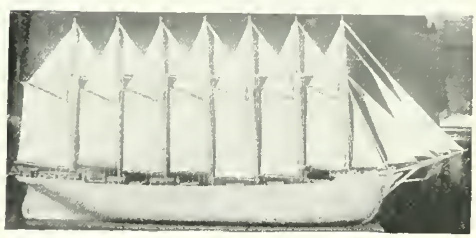
THE LATEST IN FRENCH FASHIONS.
Handbag for those who may care to travel in a dirigible balloon.



HALF-TON FLORAL CORNUCOPIA.
This was displayed in a West End London church during a festival.



SIX MASTED MODEL OF *Wyoming*.
This seems to be the limit of size compatible with safety.



MODEL OF THE ILL-FATED SEVEN MASTER, *Thomas Lawson*.

A Mexican Garb of Old.

to form the horn of the cornucopia. The mouth of "this horn of plenty" brimmed over with many kinds of choice fruits. The weight of the whole structure was nearly half a ton. After it had served its use, the fruit and flowers were distributed among the London hospitals.

A NOVEL FLY TRAP

MODERN science is waging relentless war upon the house fly, now commonly referred to as the "typhoid fly," and one of the ingenious devices recently patented is a trap which stands more than two feet high and which is designed for use about stables, butcher shops and other places where flies are thickest. It is an upright cylinder of wire screen mounted on a wooden frame and elevated an inch or two above the ground so that the flies can get underneath to a can of "bait." Above this bait can is the entrance to the trap in the shape of a cone with a small hole at the top. The flies that are attracted by the bait climb the cone and once inside the cylinder cannot find their way out. The trap shown in the photograph has accumulated thousands of flies which are easily disposed of by shaking the dead ones out of the bottom.

A Novel Fly Trap.

Decanter Made of Elephant's Foot—a California Novelty.

A MEXICAN FESTIVAL SCENE.
Priests of the olden time accompanied by tribesmen arrayed in barbaric splendor.

UNUSUAL METHOD OF ADVERTISING.

BUGGY ON THE ROOF

A NOVEL method of calling attention to his place of business has been adopted by a western blacksmith and carriage builder who placed a superannuated buggy on the ventilator which forms the highest part of his work-shop roof. The oddity of a buggy balanced forty feet above ground attracts much comment and makes a very conspicuous sign. Most people regard it as a halloween prank or the trick of some of the college boys, but as a matter of fact it is a cold business proposition.

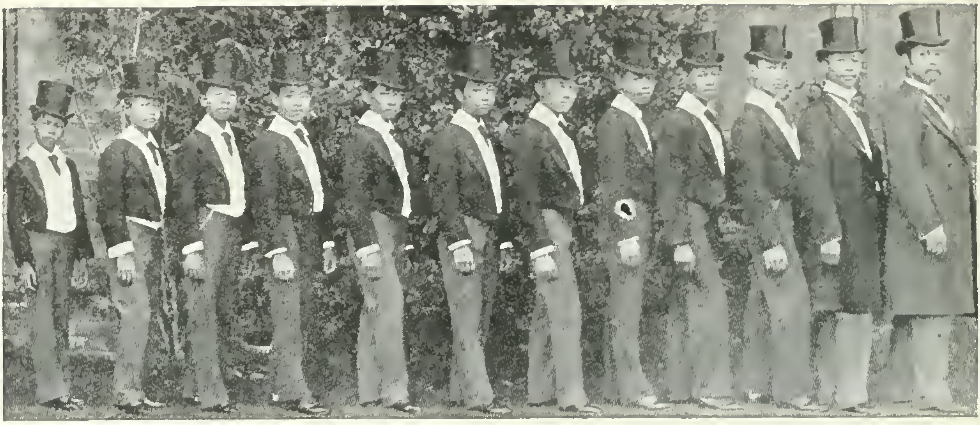
DIGGING TILE DITCH TO RECLAIM LAND.

TAKING WATER OFF LAND

THE Reclamation Service, having managed to put water onto the arid lands of the West is now busy with another great problem, that of taking it off again. The greater part of all the lands under irrigation in the West and particularly in the Southwest is alkalied. It may not show when the land is first put under cultivation but after a few years, the water gradually floats the alkali to the top and ruins the crops.

CONSTRUCTING NEW RACING "SHELL" FOR HARVARD UNIVERSITY'S BOAT CREW.

SAILORS OF U. S. BATTLESHIP *CONNECTICUT* GOING ASHORE AT SOUTHSEA, ENGLAND.
Note how youthful they look.



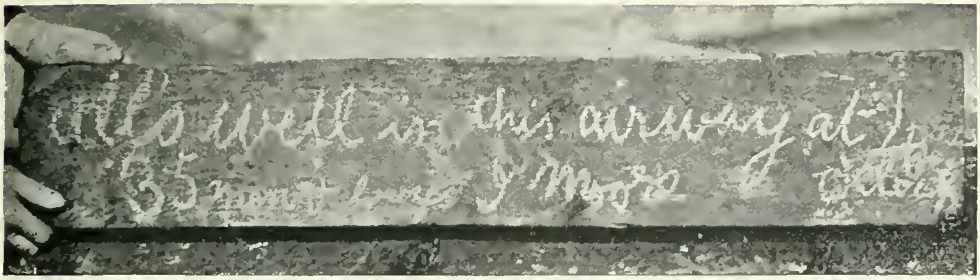
THE LATE KING CHULALONGKORN OF SIAM AND ELEVEN OF HIS SONS.
This monarch had eighty wives and seventy children in all.

This makes it necessary to wash the land free from the deadly white crystals by means of tile ditches and flooding. By means of this machine a ditch eight feet deep can be dug and the tile laid in it at one operation. The total cost of tiling and filling in costs about six dollars an acre. Lands that were not worth fencing are made extremely valuable by the ditcher and a little water. In the Pecos Valley there are a number of farms that are almost worthless because of the alkali on them. These are being tiled and washed and next spring will be worth from $300 an acre up.

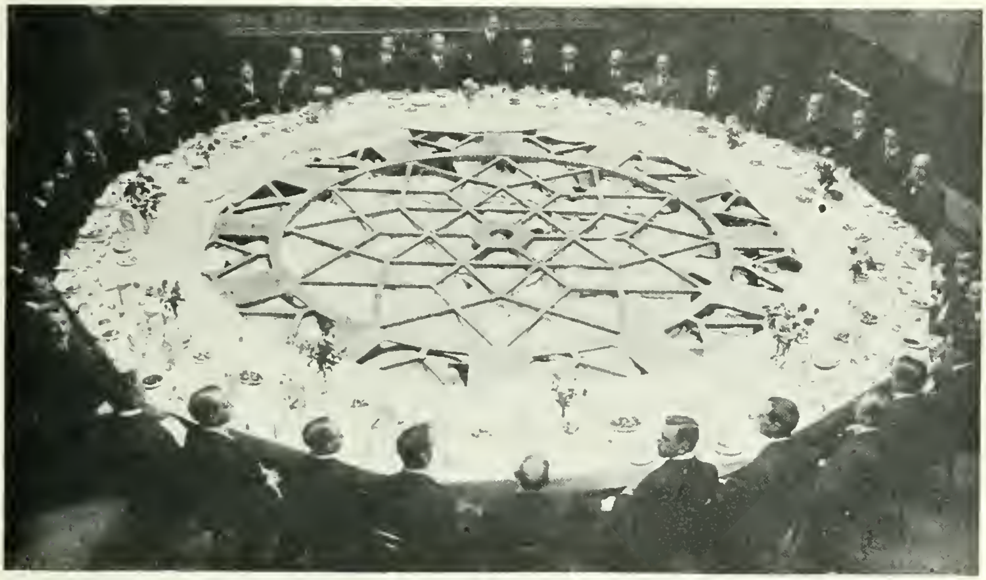
INDIAN PLOUGHING SCENE

THE picture below depicts a spring scene in India, and shows the natives ploughing the flooded rice fields of the East with their open-yoked ploughs. As will be observed this space of ground is artificially flooded. The result is that two and sometimes three crops of rice are obtained in a single year.

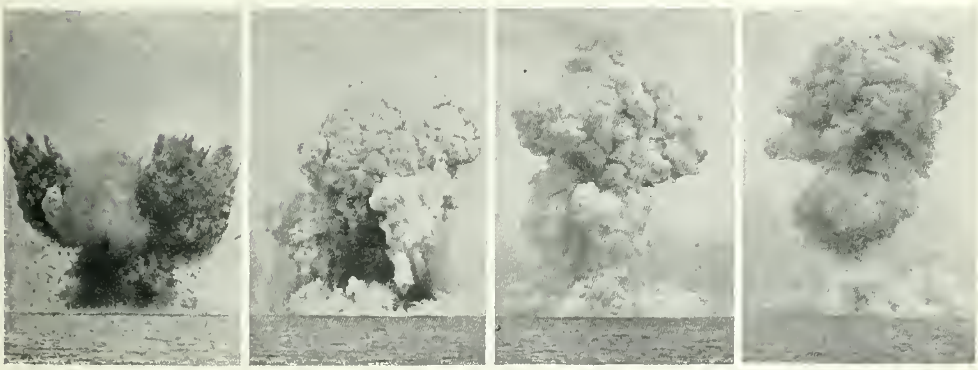
PLOWING THE RICE FIELDS OF INDIA.



LAST WORD FROM MINERS WHO DIED IN THE PIT.
In the Wellington Colliery, Whitehaven, England, 136 men lost their lives.



DINING AROUND THE FACE OF A CLOCK, AT LEICESTER, ENGLAND.
The dial of this huge timepiece is twenty-five feet in diameter.



BLOWING UP A CARGO OF DYNAMITE OFF YARMOUTH, ENGLAND.
The dynamite had become saturated with water, and hence was "tricky."



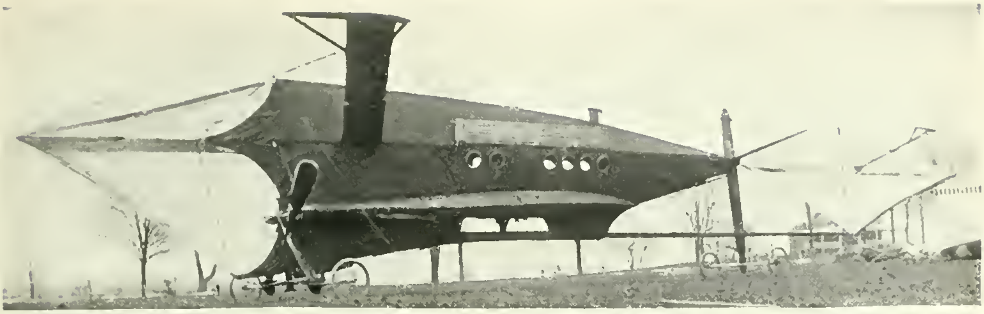
FRENCH WEAPONS FOR PROTECTION AGAINST HOLD-UPS.
These are respectively, walking stick and bayonet combination; metal frame to steady stick when shooting the revolver and dagger walking stick.

MUSIC AND SERPENTS

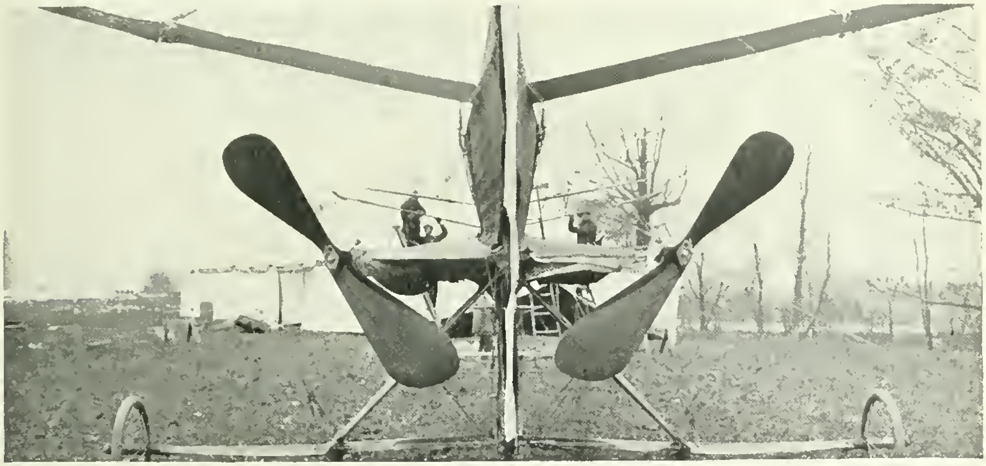
MR. BARNARD, who has been making a study of serpents, especially the cobra, in Ceylon as well as in the London Zoo, has arrived at the conclusion that their love of music is a pure and simple myth without any foundation whatsoever.

According to Mr. Barnard the cobra is not sensitive to music, but simply to noise, musical or not if on a sufficiently high key; on the other hand it pays no attention to the low notes either on the flute or the drum. He affirms also that it will be necessary to place among fables the pretended power of fascination exercised by serpents over birds as his observations show there is no foundation for this belief.

GERMAN ARMY OFFICERS WATCHING THE MANEUVERS IN THE PRESENCE OF THE KAISER.



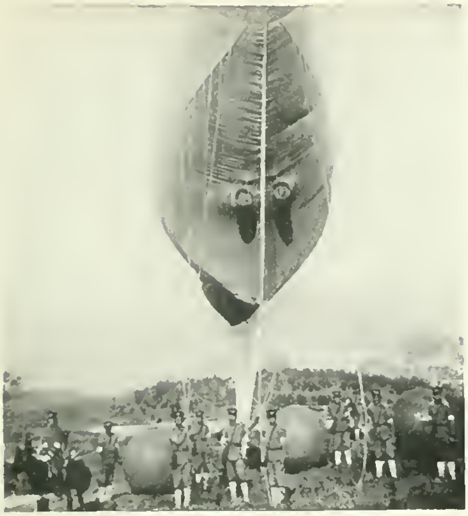
HUGE MONOPLANE THAT, IT IS CLAIMED, WILL SOLVE THE PROBLEM OF SAFE AVIATION.
It is constructed by J. F. Cooley, Rochester, N. Y.



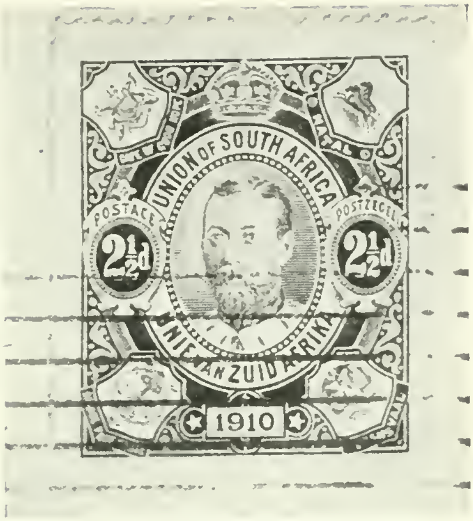
THE MACHINE WITHOUT ITS COVER.

AFFORDS PROTECTION AGAINST WIND AND WEATHER.
A pneumatic system aids the aviator in controlling the machine.

A CONTRAST OF TWO REMARKABLE INVENTIONS.
Airship passing over the Brennan monorail, near London, on its way to France.



A Balloon in Use in the Chinese Army for Military Observations.



An Historical Stamp.
The new stamp commemorating the Union of South Africa.

NATURE AS A BOX-MAKER

FEW people have any notion that Brazil nuts grow in spherical boxes somewhat resembling cocoanuts in shape and size. Such a box, contrived by nature, as it hangs on the tree, will contain a considerable number of the three-cornered nuts, packed so skillfully that if once removed nobody can ever get them back again into the receptacle. The substance of which the latter is made resembles wood, and is so hard that it can scarce be cut with the sharpest knife. But the specimen shown in the photograph has had part of its rough outer coat removed in a lathe.

SAFEGUARDING A RAILROAD

TO prevent the possibility of old mining drifts caving in beneath the tracks of the St. Louis & San Francisco Railroad, west of Joplin, Missouri, and endangering the lives of train crews and passengers, the railroad company resorted to a decidedly unique method of

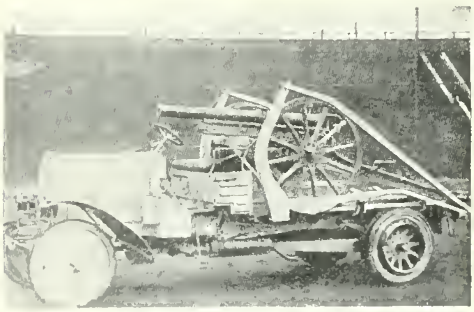
Safe-Guarding a Railroad.
An ingenious solution of a knotty problem.

How Brazil Nuts Grow.
The nut—held in the hand—grew in the "box."

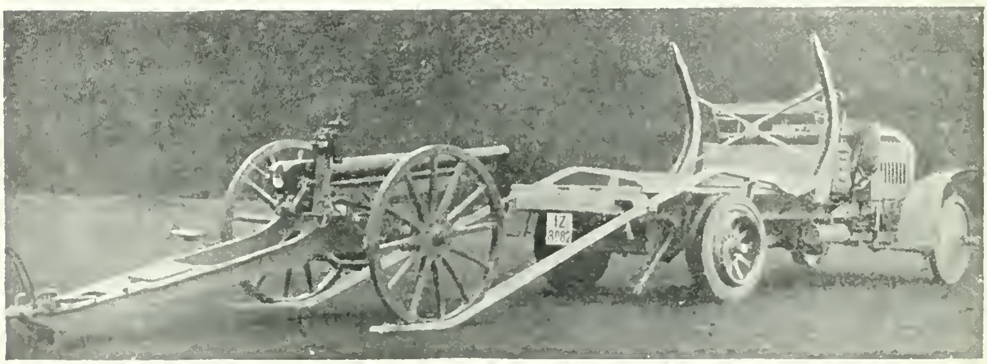
RECRUITS CHARGING DUMMIES AT THE CAVALRY TRAINING SCHOOL AT NETHERAVON ENGLAND.

filling the old, abandoned mine workings. More than 16,000 cubic yards of waste gravel, or tailing, from a nearby zinc and lead mine, were forced through four eight-inch drill holes sunk squarely in the center of the track at intervals of about twenty feet apart.

Former mine development was conducted beneath the railroad right of way at a depth of 140 feet. Ore pockets of mammoth dimensions were mined out, leaving vast, gloomy caverns, the crust of earth between the drifts and the railroad tracks above being, in some instances, so thin that there was possibility of the ground caving, and, at intervals, several disastrous cave-ins actually resulted, the track being left sagging like a limp string across the dizzy opening of the shadowy pit. Where the ground caved in thousands of cubic yards of dirt were dumped in and eventually the yawning opening was filled, but in the mammoth caverns yet untouched and which, it would seem, could not be reached without shooting in the surface earth, there was a lurking danger that threatened at any moment to leave the track suspended in a most disastrous position indeed in mid-air.



READY TO BE MOVED AT FULL SPEED.



AN AUTOMOBILE DESIGNED TO CONVEY A WHEELED GUN FOR GREAT DISTANCES AT HIGH SPEED.
How the gun is run up on two grooved lines to its place on the car.


May.

GERMANY'S REMARKABLE SPEAKING DOG, DON.
Miss Martha Ebers, his master's daughter, out with the "celebrity" for a walk through the park at Hamburg. Don's residence in the city is of but temporary duration.

THE TECHNICAL WORLD MAGAZINE

VOL. XV MAY, 1911 NO. 3

DOG TALKS GERMAN

By

DR. ALFRED GRADENWITZ

HAMBURG, the old sea-faring town of German merchants, has for some weeks been the temporary home of Don, the greatest celebrity in the animal kingdom, a prodigy partaking, it would seem, of the nature both of man and animals, the "*speaking*" dog that is puzzling alike the scientific world and the general public.

When a few months ago faint rumors about a dog endowed with the gift of speech, first reported by German papers, gradually spread to America, most people skeptically shook their heads, believing it an open mystification or an effect of self-delusion. When, however, the most distinguished men of science showed their interest in that wondrous dog by a thorough investigation of his capacities, doubt was no longer permissible and the veracity of the report had to be conceded. As so frequently happens in such cases, those who in the beginning had been the most perfect skeptics now went to the extremity of asserting that after all, there was nothing wonderful in the matter, cases of speaking dogs having been on record for nearly 2,000 years and that Pliny, the famous naturalist of Roman antiquity, and, in more recent times, the philosopher Leibniz Perty, a distinguished philologist, had all referred to the ability of dogs to imitate their master's speech. Nay, even among the canine contemporaries of Don, there were not a few possessed of the same capacities, no less than twenty to thirty rival dogs being quoted, while one lady in a letter to the director of the Hamburg Zoological Gardens even attributed to her cat not only the ability to pronounce whole sentences, but even to sing the most popular songs. Again, according to others, seals, walruses and even stags would sometimes prove speakers of more or less talent.

These exaggerated statements doubtless were quite as wrong as the utter skepticism shown in the beginning. Don's case is both authentic and unique and whatever reports on other "speaking" dogs may be current should be put down to effects of imagination. There may be other dogs capable of imitating one or two words, very much in the fashion of parrots, as a purely mechanical repetition of sounds to which no meaning is attached. Don, however, does speak, and is the only animal so far proved to do so.

Speech to him is the expression of an inward impulse to communicate with his master and other persons, showing them his affection or requesting the fulfillment of some wish. When quite young, he

DON SHOWS CUSTOMARY CANINE GRAVITY WHEN "SHAKING HANDS."

already gave evidence of exceptional intelligence and a number of remarkable feats are told of these early days. He never underwent any training, apart from his hunting drill. Speech like his other accomplishments developed quite spontaneously and without any outward compulsion. In fact, everything about this marvelous dog is spontaneous. When in good spirits, he may begin talking of his own accord; should there be, however, the slightest reason for dissatisfaction, he will not utter a word and nothing will make him show his speaking capacities.

At the age of six months, very much earlier than a human baby, he for the first time showed his extraordinary gift by pronouncing the first articulate word. He was standing near the table, looking with begging eyes at his master and when the latter happened to ask him: "Would you like to have something?" he clearly replied: "Haben" ("have"). After this startling performance, he obviously became the object of unusual interest. It may be remarked, in passing, that the word "haben" is one of the first acquired by German infants, thanks to the instinct of imitation innate in man. All the dog-wonder learned in after-life he did under the impulse of the same instinct, training being only resorted to from time to time. This is why the dog produces that wonderful impression of a strong individuality, doing everything out of his own free will and, it seems, without any outside compulsion.

His ways and manners, by-the-bye, have always been remarkably independent. In his master's house at Theerhütte, in the midst of the royal hunting grounds, he would lead a life of nearly absolute liberty, apart from his professional duties as setter-hound. Every day he would set out for a solitary morning walk, strolling through the heath and woods, and paying an occasional call to one or other of his master's friends. After opening the door himself, drawing back the latch in strictly human fashion, he would walk in, lie down comfortably at the fire-side and, if in good spirits, have a little talk with the inmates of the house. School children met on the road he would accost, requesting a share in their breakfast by the words "hunger" or "kuchen haben" ("have cake"). It is told of him that on once meeting an old woman from the neighboring village on her way to the market, he quietly stepped towards her, distinctly pronouncing the words: "Don hunger, kuchen haben." The poor woman was so frightened that she took to a speedy flight, leaving her basket behind her, in the firm belief that the dog was possessed of the evil one.

Don's master, royal gamekeeper Hermann Ebers, was at first quite averse to any idea of parting with his dog and agreeing to his exhibition before strangers. In fact, during the first seven years of Don's life, no rumor of his extraordinary capacities ever reached the world at large, and but for Mr. Haberland, a journalist who is to be Mr. Ebers' son-in-law, the dog might have finished his days quietly in that out-of-the-way place, without ever knowing the joys of celebrity. The most wonderful thing about him is his talking with strangers quite as freely as with his own master. When therefore Dr. Pfungst, the well-known expert in the psychology of animals, and Dr. Vosseler, Director of the Hamburg Zoological Gardens, wished to submit Don to scientific tests, they had no difficulty whatever in making him pronounce every word of his repertoire. The phonographic records made on this occasion prove beyond doubt the identity of Don's speech with that of human beings. There are, it is true, some slight differences in pronunciation due to differences in the structure of the larynx, but these in no way detract from the distinctness of the words. A strange impression is produced by comparison between phonographic records of human and canine speech; as in fact the dog speaks so very much louder than man, the two voices seem to have exchanged their respective roles.

After the authenticity of the speaking dog had thus been certified by some of the foremost scientific experts, many tempting offers were made to the fortunate master by those desirous of exhibiting the dog in public. In order to protect him against the many amateurs who soon found their way to Theerhütte, the dog had for some time to be kept in perfect seclusion. Mr. Ebers having eventually accepted the offer of an enterprising firm of Hamburg merchants to finance the dog and to prepare him for public exhibition, Don was then taken to Hamburg where his old friend Dr. Vosseler gladly received him in his house. However, the absolute change in his mode of life at first exerted an unfavorable influence on Don, who seemed to have lost his admirable powers, so that a few weeks had to go by before the animal was acclimatized to his new surroundings. But very soon he not only recovered his old capacities but even showed his ability of extending his knowledge by acquiring a few more words; he is in the best of health and well prepared to start for his artistic *tournée*. So far from exhibiting his art at the ordinary music halls, he will however be shown in more select surroundings, namely at the zoological gardens of the various towns.

As soon as the American daily papers published the first report about Don, the editors of the TECHNICAL WORLD MAGAZINE manifested their desire to place before their readers the first authentic illustrated story on the dog by entrusting the present writer with the honorable mission of going to Hamburg and interviewing, as it were, the dog wonder. However, bad luck would have it that there was no end of obstacles, the financial representatives of Don being intent upon keeping him aloof from any publicity and even preventing the reproduction of any picture so long as the critical transitory stage just referred to was not concluded. As moreover Drs. Pfungst and Vosseler had not yet announced the results of their work, no information could be obtained from those quarters. I was near giving up any hope of ever succeeding in the task when an unexpected invitation to the first exhibition before a limited circle of Hamburg journalists at Dr. Vosseler's house reached me. As this performance was to take place the following day, no time was to be lost and I at once took the Hamburg express. It being interesting to ascer-

HIS MISTRESS ASKING, "WHAT IS YOUR NAME?" AND HE REPLYING, "DON."

tain how far the knowledge of Don's capacities had penetrated among the general public, I whiled away the dullness of the railway journey by suggesting to some of my fellow-travelers the subject of the speaking dog and was only half-surprised on discovering that nobody ever seemed to have heard of such a prodigy, my account being received with interest mingled with a slight dose of sarcastic skepticism.

Once arrived at Hamburg I had barely time to announce my visit by telephone and to take a cab to the Zoological Gardens. In fact, when reaching the director's house, I found that the séance had just begun, Dr. Vosseler having said the first introductory words of an interesting lecture in which the speaking problem in animals generally and in dogs more particularly was treated from a scientific point of view. He drew attention to the fact that some birds, such as parrots and the species belonging to the raven family, possess a remarkable ability to imitate human speech, some of them singing even songs with words, in spite of the absolute diversity of their larynx from the human organ of speech.

In the case of mammalia, this ability is no doubt an absolute exception, though the larynx and other acoustic organs are so very much more closely related to those of men. In fact, the organization of a dog's larynx in some respects is even more favorable than that of man. As it is, Don is an absolute prodigy and the first case on record of a dog not only pronouncing some words, but even attaching a meaning to them and making a frequent use of his powers in satisfying his daily wants and showing his attachment to persons of his surroundings. He is more or less talkative according to circumstances. If in low spirits, as after a punishment, he absolutely refuses to speak and the same effect is produced by bodily indisposition. In bad weather he is less inclined to speak than in good weather. Moreover, it is readily seen that speaking involves a considerable fatigue to the dog who after some repeated exercises always is tired to some extent. Though the formation of vowels and consonants does not always occur according to the same principles as in the human organ of speech, his pronunciation is quite clear and even to unskilled ears, frequently of an absolutely human distinctness.

While the doctor thus was delivering his learned discourse, the dog did not seem to attach any particular interest to his words. The guests were seated to the right and left of the door, the interval being reserved for the dog and his mistress, Mr. Ebers' daughter, a slender young lady who all the time seemed busy keeping up Don's good spirits.

When I entered the room and took my seat in one of the front rows, Don immediately rose from his place at Miss Ebers' feet and came to welcome me, nestling himself up to my knees and wagging his tail as though he wished to show his appreciation of and gratitude for the honor done him in coming all the way from Berlin with no other purpose than making his acquaintance. I was not a little proud of this token of sympathy, though I soon found out that I had to share the distinction with some other gentlemen with whom the dog tried to make friends. His extraordinarily determined and self-confident nature also asserted itself in the independent way he strolled about the room, stopping here and there with some congenial person and then returning to his mistress' feet.

Don is a beautiful brown hound of strong build and remarkably intelligent eyes. In fact, there is something almost human in his look, and his movements and manners also remind, in some respects, of his apparently intermediate position between dog and man.

When Dr. Vosseler had ended his speech, there began the performance to which all those present had looked forward with eager expectation. A plate with some meat—all dainty bits are "kuchen" (cake) to Don—was produced. He was first asked his name, to which he promptly replied, "Don," with a clear, deep voice and a characteristic inflection of the word. The next question was: "What is it you have?" which the dog answered with the word: "Hunger," the second syllable lagging somewhat behind the first, though with a distinct articulation of the "r." After having next been asked: "Do you want anything?" he most eagerly shouted, "Haben, haben," which word, like some humans, he apparently prefers to all others. On being then shown a piece of meat, he spontaneously pronounced the word: "Kuchen," the difficult letters *k* and the guttural *ch* being clearly audible. To certain questions he also replies "ja" and "nein" ("yes" and "no") and his most recent acquisition of which he seems to be especially proud is the trisyllabic word "Haberland," the name of Miss Ebers' fiancé, to whom he is indebted for his present celebrity.

There seems to be no drill in Don's demeanor, a free son of the heath he is and will remain all his life. There are still many years of a promising artistic career before him during which he will no doubt perfect his present knowledge of the German language by acquiring a number of new words. But never will he become like the trained dogs shown in music halls which, under the absolute suggestion of their masters, will completely lose their own personality, doing everything at command and mechanically. With him all is conscious; he seems to know the meaning of his words and the effect they are to produce on his human fellow-beings and he obviously is glad of their sympathy and applause. There is something good-natured about him which immediately wins the hearts of those he comes in contact with and he leaves in everybody the impression of a superior intelligence.

Though Don's vocabulary so far only comprises nine words, this does not compare unfavorably with the 150 words mastered by the natives of Australia and the 200 words a person of the most elementary education is said generally to use even in the most civilized countries.

If the gift of speech in that dog could be driven so far as even to become an expression of his feelings, what interesting things would he not be able to tell concerning his views on man?

WHAT A THOUSAND TONS OF POWDER AND DYNAMITE CAN DO.
This is where the powder mill stood.

AN ARTIFICIAL EARTHQUAKE

By

HENRY M. HYDE

AT 8:20 o'clock on the evening of February 9th, a farmer living on the prairie near Kenosha, Wisconsin, went down into the basement of his house to inspect his incubators, which held 1,000 eggs. Suddenly the iron covers of the heaters rose up on end and the man was thrown forward into the midst of the eggs.

A moment later a huge pane of plate glass leaped out from the third story window of a skyscraper in Chicago—fifty miles away—and shattered itself on the pavement.

At almost the same instant, at Michigan City, Indiana,—fifty miles still farther away—more than a hundred convicts dropped down on their knees and prayed that God would spare them.

And over at Elgin, Ill., thirty miles west of Chicago, fifteen young women working over-time in a book-bindery, unanimously fainted and fell over in a long, unconscious row.

For a few seconds the equilibrium of five states was disturbed. A whole village was wiped out of existence; chimneys were overturned and thousands of panes of glass were broken over a section a hundred miles in diameter. In Chicago and a score of smaller cities the police were called out and fire companies rushed madly around the streets searching for unlocated and non-existent explosions. The emergency exits in a hundred theatres were blown open by the same sudden blast and in one or two instances frightened men attempted to save themselves by leaping from the windows.

At least half a million terrified people rushed out of their houses into the streets, crying, with white lips, that an earthquake was upon them.

It was not an earthquake. It was merely the explosion of a powder mill at Pleasant Prairie, Wis., fifty-five miles north of Chicago, one of the many scattered plants for the manufacture of high explosives, which are owned by the Dupont Powder Company.

But as an explosion it appears to have been vastly the greatest and most far-reaching in its effect, since gunpowder was first invented. It was perhaps the nearest man had ever come to rivalling the resistless and elemental forces of nature. As an artificial cyclone and earthquake in combination, there has never been anything like it. Cities across the Mississippi River in Iowa felt the force of the shock, while the seismograph in the observatory of Saint Ignatius College at Cleveland, Ohio, three hundred and fifty miles away from the scene of the blast, recorded for nearly half an hour the tremors of the stricken earth.

The largest amount of explosives ever intentionally discharged at one time seems to have been 120 tons of blasting powder, backed by twenty tons of dynamite, used in the destruction of the Great Hell Gate reef, which, until 1876, made East River, New York, a terror to shipping. But that was a mere baby's firecracker when compared with the more than a thousand tons of giant powder and the 35 tons of dynamite which—exploded by some mysterious and forever hidden accident—dug holes in the earth a hundred feet deep, by three hundred feet square, and threw half the population of the middle West into a spasm of fear.

As in most powder explosions, the exact cause of the disaster will always remain a mystery. The first explosion occurred in and utterly destroyed the glazing mill. It is in this room that the granules of blasting powder, after being moulded, are glazed with a thin coating of graphite, to prevent the absorption of moisture which will ruin unglazed powder in a short time. For the purpose of glazing, the powder is put into steel cylinders containing graphite. There were two men in the glazing room when the explosion occurred, E. S. Thompson and Edward Hilliard. Thompson was one of the oldest and most experienced men in the plant. He was instantly killed by the blast and his mangled body was found some distance away. Hilliard was blown through the roof of the glaz-

A HEAVY BOX CAR JARRED TO PIECES ONE-HALF MILE FROM THE EXPLOSION.

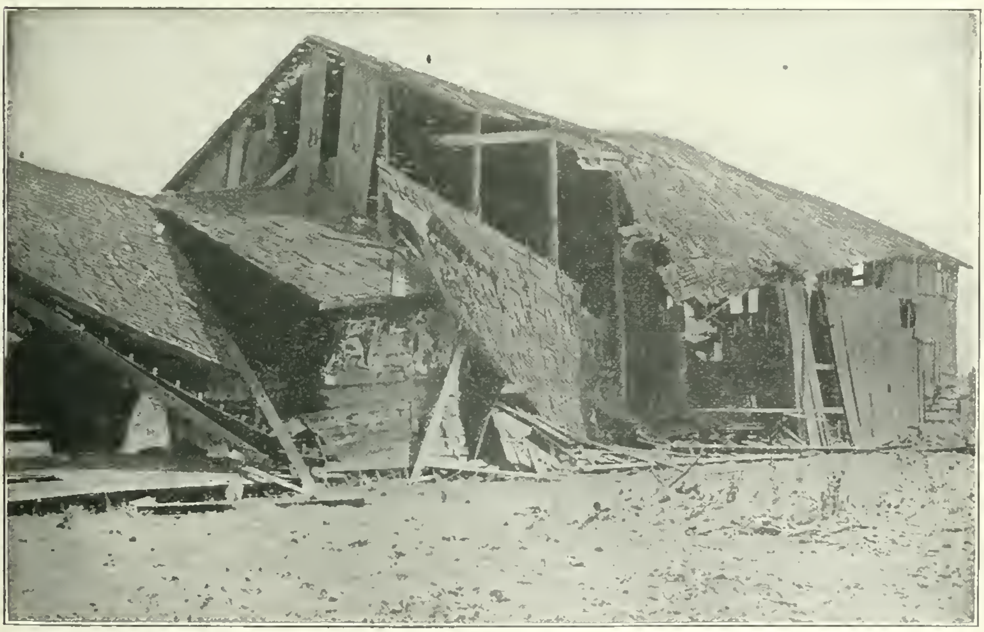
AS THOUGH IT HAD BEEN STRUCK BY THE LOOSE END OF A TORNADO.
A dwelling three-fourths of a mile distant from Pleasant Prairie.

ing mill, but escaped unhurt. Even more remarkable was the escape of half a dozen men working in the soda mill some distance away. When the soda mill went up—following the glazing mill blast—they were blown up into the air and alighted on another building, which, in its turn, then exploded. The second

STANDING ONE HALF MILE AWAY, BUT SHATTERED BY THE EXPLOSION.

THE ALMOST INCREDIBLE POWER OF THE EXPLOSIVE.
A hole one hundred feet deep dug in the earth.

explosion deposited the men on the ground at the side of a third building, which, as they fled for safety, rose up into the air and dropped tons of machinery and debris on the spot which they had just left. Nothing could better illustrate the whimsical and mysterious action of high explosives than the fact



THIS BARN, NEAR PLEASANT PRAIRIE, CRUMPLED AS IF BUILT OF CARDBOARD.

that these human missles went unscathed through a series of tremendous blasts which broke a thousand windows and shook great skyscrapers more than fifty miles away.

The first result of the explosion was the instant liberation of billions of cubic feet of gas, which swept out from the common center with almost incalculable violence. It was this first hammer blow of the gaseous wave, seeking room for expansion, which shook buildings and overturned brick chimneys. It was followed an instant later by the return of the compressed air about the circumference of the circle, rushing in toward the center, where something like a vacuum had been created. This rebound of the great air wave greatly lowered the pressure outside the houses and other buildings, leaving the pressure inside much higher and more nearly normal. It was this higher pressure on the inside that caused the destruction of window glass, every pane, so far reported, having fallen out, as if struck a heavy blow from within. The pressure from without, in the first instance, was undoubtedly as strong as the reaction which followed it. That it was not as effective in destroying the glass may have been at least partially due to the fact that a window-pane is supported against outside pressure by the whole strength of the heavy window frame, while against pressure from within, there is no protection but the putty.

In addition to the air waves, earth waves of great intensity and duration were set up by the explosion. Much comment was caused by the fact that while at a distance of more than 300 miles in certain directions the earth vibrations were strongly felt, in other directions and at a distance of only fifty miles they passed unnoticed. Over a large portion of the South side of Chicago, for instance, there was no recognition of the explosion, while in Cleveland, Ohio, the seismograph vibrated violently. The great difference is due to the varying constitution of the crust of the earth. In directions where continuous strata of solid rock ran away from the center of the disturbance earth waves were transmitted quickly and with slowly diminishing violence, while when such strata gave way to great deposits of sand and gravel the shock was poorly transmitted and quickly absorbed. The fact that a terminal moraine of loosely packed sand and detritus underlies much of Chicago accounts for the escape of certain parts of the city from any very noticeable effects of the earth waves.

The after effects of the explosion have been varied. In two or three cases the deaths of people who were seriously ill at the time have been ascribed to the shock. The Dupont Company has come forward and voluntarily offered to pay all damages caused by the blast. And in both Wisconsin and Illinois bills have been introduced in the State legislatures looking towards the more strict regulation and control of powder mills and other places where great quantities of high explosives are stored.

What seems to be needed is a law—backed by competent and honest inspection—which will prevent the accumulation and storage in a single location of any such tremendous amount of blasting powder as a thousand tons.

As well live on the crest of a live volcano as within fifty miles of such a potential and ever-ready earthquake!

PLOWING AT COLBY, KANSAS, ON A TEN-THOUSAND ACRE WHEAT FARM.

JUST A FARMER

By

HARRY F. KOHR

WHEN "Jim" Fike drew up a pair of jaded ponies hitched to a dilapidated wagon and faced the setting sun on the lonely prairie in Thomas County, Kansas, twenty-five years ago, he didn't have $25 to his name. Now that same "Jim" Fike spends that much every week for gasoline alone and the most of the prairie he saw by the light of that setting sun is his own and on it is the largest wheat farm in the world.

Twenty-five years ago there were not ten carloads of wheat raised in Thomas County. "Jim" Fike requires that much now to seed his one farm. To do the work on that farm requires the services of more men than there were in Thomas County when "Jim" Fike went there.

When James Fike arrived in Thomas County he took up a quarter section of one hundred and sixty acres. He stuck to it through fat years and lean, through the grasshoppers and the drought, until Fortune began to smile. He picked up a few more acres at a time until he became among his neighbors what they call in Kansas a "prominent farmer." He was the kind of man who wins popularity easily and his neighbors called him "Jim." He was appointed registrar of the land office under President Cleveland's second administration and after his term expired he was elected a railroad commissioner. Then Jim Fike quit politics and went back to farming.

JAMES M. FIKE.
The farmer who manages his farm as a merchant does his business.

By that time the farmers in western Kansas had begun to learn to grow wheat. Fike started in with sixteen hundred acres and he gradually increased his holdings until in 1909 he sowed ten thousand acres. From that area he harvested 120,000 bushels and made a profit of $60,000. Last year he had twelve thousand acres in winter wheat and harvested 600 acres more in spring wheat. His profits last year probably were at least $75,000. Every

"Jim" Fike in the Field.
Not "too successful" to direct personally.

pound of his winter wheat last year graded No. 2 hard, Turkey red. Most of it went directly to Kansas mills, the balance selling in the market for $1.04 a bushel.

Jim Fike manages his wheat farm on exactly the same principle that the merchant or the manufacturer in the city does his. The leaks that cost the average farmer half his yearly income are absent from the Fike farm. He has his business office and his bookkeeper and a strict account is kept of everything that is bought, sold and issued to be used. He knows just what he has all the time and just where it is. He employs 250 men and five hundred horses in the harvest season and he is always the first man awake and the last man to bed. He drives over his farm in a forty-horse power motor-car and directs the operations like the field marshal of an army.

After the harvesting is finished, four threshing machines are kept busy for a month, threshing the grain. The granaries on the farm make a small village in themselves. Immediately after the harvesting is finished, the big plows are put to work, hauled by steam or gasoline tractors, and the ground is thoroughly stirred to a depth of from eighteen to twenty-four inches. In this way the moisture that comes in the fall and winter gets a chance to permeate to a great depth and the effect of the occasional drought is minimized.

In Colby, the county seat, Mr. Fike has a large machine-shop where all his repair and manufacturing work is done. There, through the winter, his machinery is overhauled and made ready for the spring and summer, and between times new machinery is built. The surplus product is sold to neighboring farmers, who prefer the home-made machine to the factory-made because it embodies Fike's ideas and their own of what it should be. Last year Fike employed six steam-plow outfits. Now he is changing them all to gasoline power because of the expense of hauling fuel and water to make steam.

Ten years ago when Fike began his extensive operations his neighbors warned him to "stop before you go broke." Now they look upon him as an oracle. His income is said to be greater than any other man's in Kansas, but he is still "Jim" Fike and not to be distinguished among his neighbors by any extraordinary exterior mark. They call him the wheat king, but he says he is just a farmer. That's the secret of it. He is "just a farmer," and nothing else. He's a specialist. So wherever men grow wheat or sell it he is known and no man's advice is more eagerly sought in the wheat region or on the board of trade.

His motto is plow deep and plow early. "When you plow early you kill the weeds," Fike says, "and when you plow deep you conserve the moisture. Most farmers sow too much seed. I sow from half a bushel to three pecks to the acre."

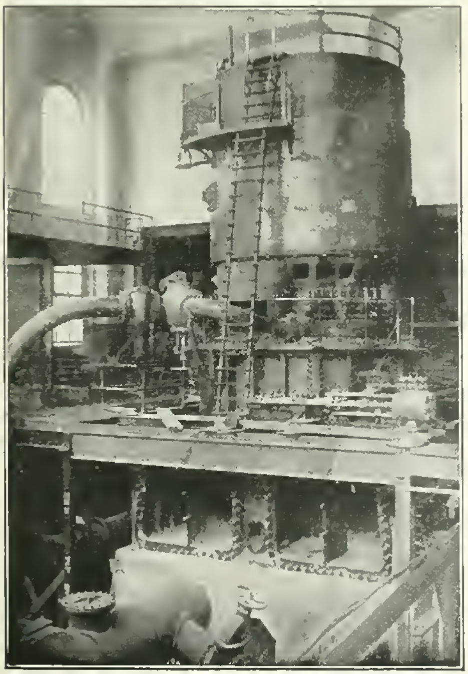
CAN OF CONDENSED POWER

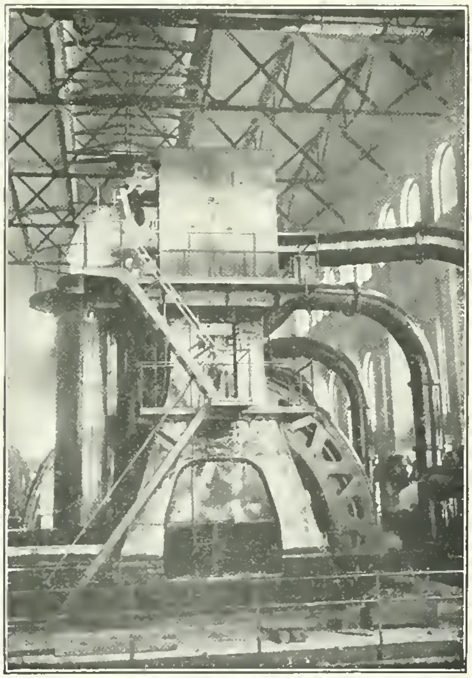
By

BENJAMIN BROOKS

FAR out on the southwest coast of the country—almost on the beach, in fact—as if taking a last desperate stand against an advancing conqueror, stand three giant engines. The man who placed them there received a small fortune in bonuses over his contract price on account of their high efficiency—which shows that they are among the very most efficient engines in the world. But still they are not good enough. Notwithstanding faithful turning out of 20,000 horse-power for twenty hours a day so that the people of Los Angeles can enjoy trolley rides, they now find themselves coldly regarded as only has-beens.

Beside them in the same engine room now stands a new engine. Nobody would suspect it of being an engine, for it seems to be nothing but a round steel tower having the appearance of a young light-house. This new giant came on sixteen freight cars and is known as a Curtis Vertical Turbine. On the 20th of last December he began to spin and to roar, and ever since has stood out in wonderful contrast to the three old-time giants. While they are able to turn out 20,000 horse-power together, the new-comer—although not a bit bigger—can





THE SMALLER IS THE MORE EFFICIENT.

A 15,000 kilowatt turbine, occupying 2,128 square feet of floor space.

A 5,000 kilowatt engine. Three such as this occupy 10,640 square feet of floor space do it single handed. While they occupy a space one hundred and forty feet by seventy-six feet, he works comfortably in a corner fifty-six by thirty-eight. The old timers, grinding out a hundred turns a minute, shake the earth so it can be seen in the bubble of a surveyor's level hundreds of feet away: but the new boy turns 750 times a minute and never quivers. All the beautifully scientific cams and levers on the old timers that have been perfected and refined to such exactness since the time of James Watt—these the new giant dispenses with altogether. He is a most deceiving individual, and were it not for his trick of blowing your hat off when you come into the hot draft from his whirling magnets, you might never suspect him of moving at all.

There's the beauty of your turbine. As an exponent of the simple life he is not to be excelled. He just spins. There's nothing to him. Anybody can understand him. We could make a small one ourselves in an hour out of a tin can. Let us choose one of those tall round cans such as ginger cookies come packed in, and begin by melting the bottom out of it. Next we will procure a dozen of those little brass wind-mill ventilators such as are sometimes put into office windows to whirl around and distribute the incoming air. Six of these must be just the right size to fit tightly in the can; the other six must be a trifle smaller so as to go loosely into the can. The first six must be cut to whirl to the right; the others to whirl to the left. Now we start with a tight one and fasten it near the bottom of the can. Through the little hole in its center we put a smooth round rod for a revolving shaft. The next windmill is opposite in direction, loose enough to whirl in the can but tight on the little shaft. The third is right handed again, firmly fixed in the can and loose on the shaft—and so on till the can is full. Now we take a long breath and blow down through the can. The wind, hitting the first wheel, starts it spinning; but, in passing through it, is itself spun in the opposite direction. No sooner is it past the first wheel, however, than it strikes the second wheel of opposite direction and stuck fast in the can. This wheel reverses the air again to its original direction. It is then ready to give the second moving wheel a push. The second tight wheel again directs it for the third revolving one. And so it finds its way down through the can and away, giving each of the six little wheels a kick as it goes.

A turbine is nothing more. The great steel tower which encloses it is the cracker can. The alternate discs are very much like the little ventilators, being alternately spinning and stationary. They have many thousand little vanes, are some fourteen feet in diameter and run over six miles a minute. The central spindle is a massive shaft as thick as a policeman and weighs as much as a switch engine. Instead of our long breath of air, the turbine has a perpetual blast of superheated steam roaring through it, starting at nearly 200 pounds pressure and gradually expanding larger and larger and dropping down in pressure till it blows out underneath into the cool condenser at only about one thirtieth the pressure of the air one breathes. This extraordinary transition from 175 pounds steam at a frightful heat to cool fog at almost no pressure at all occurs in the space of ten feet and takes place in a small fraction of a second; yet there are no valves intervening and a ten penny nail could be dropped from the top down to the bottom through the little ports without interruption. If the noise of this continuous explosion of steam could get out of the steel jacket it would probably be heard for five or ten miles.

Now all this mass of metal—the discs, the shaft, the great electric "field" on its upper end, weighing altogether about 100 tons, or as much as a powerful locomotive, revolves twelve and a half turns every second; and if the shaft should ever rest its weight on even the smoothest possible bearing it would melt it in a mighty few minutes. This entire 100 tons, however, rests on no bearing at all, but floats—floats on a little pool of oil no bigger than a wash basin; and two strong pumps see to it that the oil in the little pool never drops below a pressure of 900 pounds per square inch.

The beautiful ease with which this huge top spins was impressed upon the writer on last New Year's Day. A careless or ill-informed mechanic, working near it, accidentally short circuited about a third of its total current through the handle of a monkey wrench and into a steel column. Instantly there was a noise like an explosion, followed by a gorgeous copper-colored fire that burned with a roar like a hundred rolling drums. The tremendous jolt thrown back by this flaming arc upon the power-house threw the three old giants all out of step so that their pulsations of current interfered and stopped all the trolley cars in the whole city; but the turbine spun serenely on; and, after they had pulled the switches and shut off the steam, continued to spin by its own momentum for three hours.

Before this article shall have time to appear, the turbine will have a twin brother spinning beside it in the opposite corner; so that a power company on the same land and in the same building (save for extra boiler room) has increased an old plant to three times its original capacity.

THROWING DEATH OFF THE TRAIL

A SEQUEL TO "HAUNTED HOUSES OF DEATH"

By

F. C. WALSH, M. D.

THE cure of "consumption" is a medical problem; its prevention a social one,—not from choice, but rather from necessity. If the available figures be made to conform with facts instead of meeting the requirements of optimistic theory, it must be admitted that tuberculosis is on the increase, regardless of all statements to the contrary. In questions of public policy, physicians are poor executives, and weak in militant, harmonious organization. As regards the prevention of tuberculosis, they have had their hour of opportunity, and failed; it is becoming a necessity that this phase of the problem be turned over to a properly informed public. If the medical men cannot or will not act except as isolated individuals, then the people themselves must take some collective action on their own initiative. The public cannot do this without some information as to a proper method. Unfortunately, any information which happens to be practical, is usually buried out of sight of the people in the purely technical pages of the medical journals, ending then and there any possible career of usefulness. It would appear from this that the popular magazines, if given the opportunity, will continue to do more for the future, in the way of disseminating practical information, than all other methods combined. Even now they are performing a function properly the duty of good government.

There is no cure for tuberculosis, and probably never will be,—accepting the word "cure" in the sense of some special medicine. From many points of view this very hope of a cure has had its bad effects. For one thing, it has taken both the public and medical mind too much away from the important necessity and practical benefits of prevention. A disease prevented is better than cured, for no one is so well off physically or financially after any illness, and particularly does this truth apply to tuberculosis.

All disease is undesirable, except for those who live by it. Furthermore, the successful prevention of a disease does away with any need for its "cure." This is well exemplified in the case of yellow-fever. We have never succeeded in finding a cure for that former scourge of the South, but we have done far better. We have wiped out the disease bodily, bag and baggage, by simple, preventive

PORCHES WHERE TUBERCULOSIS PATIENTS ARE KEPT SHOULD BE DISINFECTED OFTEN.
Outdoor sleeping will not alone suffice to cure.

methods. We no longer need a cure for that which has practically ceased to exist. Why can't we do the same with tuberculosis? We can. Why don't we?

Consumptives are being bred hourly, more rapidly than they can be cared for, much less cured, by any present arrangements of any kind whatsoever. Special hospitals and sanitaria can not be built fast enough to meet the essential requirements, now or for the future. Even were it possible to make the demand for hospitals equal to the supply of patients, the economic drain on the public purse could not long be borne. The load would prove greater than any community could sustain. For economic, as well as for practical sanitary reasons, we shall have to change the policies devised for the immediate future, and adopt instead some method of checking, at the very source, the increasing annual crop of consumptives. Those afflicted must, of course, be cared for; but an increase in the number of hospitals will not stamp out the disease. We reap what we sow; let us cease to sow the seeds of consumption, and there will be no harvest to store, in sickly human form, in the numerons and expensively projected, special hospitals. We must reconsider our plans, for they are built on sands, and devote more of our time and attention to stamping out the disease at its source, by methods that have hitherto never been considered.

Optimists who claim to know, are forever making the assertion, in vague, undefined ways, that tuberculosis will be stamped out completely within ten years. And it should be. But not one of them seems to think it necessary to take the public into his confidence long enough to so much as hint at any definite method by which this much desired consummation is to be accomplished. Most of them do go so far, however, as to be loud in their continuous demands for more money. It would be a pleasure, and perhaps a revelation to those who are accustomed to contribute, to know exactly, by itemization, what these medical prophets do, and intend to do, with the many munificent contributions. But, any money is useless for the purpose intended, unless some sane, definite, logical method be presented, with the sole object of combating the disease at its very fountain-head. Who of the great public has ever heard of such a plan? One man, at the head of the health department of one of our foremost cities, thinks that an appropriation by the city, of about $22,000,000, would be about the right amount as a beginning in the extermination of the disease, to be followed, by appropriations of like amount for the next fifteen years. This makes a total of $330,000,000. Rather big figures for a modest health-officer to deal with! Yet he presents no definite plan of campaign, nor states in any detail whatever how this huge sum is to be expended. These figures apply to his one city alone. With the present lack-of-method style of campaign against the disease, ten times that, or any other sum, would be useless. However, if the expenditure suggested should bring the result predicted, the price paid would not be too high. But why follow vague prophecies, when the desired end should be attained by an expenditure of $100,000, or less, annually, in the instance cited, by adopting a practicable, common-sense method, with the probability of completely exterminating the disease in less than five years?

It is generally conceded that if consumption can be "caught early," discovered at the beginning and "taken in time," the consumptive stands a very good chance of being cured. This statement should pass unchallenged. But there are two great difficulties in the way of discovering the disease "at the very beginning." The first pertains to the physician. Not one physician in ten can diagnose the disease in its earliest stages. This is no reflection on the average medical man, for even the eleventh physician, who is probably an "expert," is sometimes mistaken. The other difficulty is "in the very nature of things," and pertains to the patient himself. Not one person in fifty so much as even thinks of consulting a physician, until the disease becomes troublesome to himself, and fairly apparent to his friends. As a result of these two difficulties, pertaining alike to physician and patient, the disease is usually pretty well established by the time it is discovered, and often past the stage of probable cure.

But granted that the disease is discovered in time, what then? Brown, for instance, having been told that he has tuberculosis, takes a sensible view of the situation, and packs off at once for Arizona, where he pitches a tent in the desert, as a more or less permanent abode. One would imagine the conditions under which he lives to be ideal for his purpose. The air is dry and warm; the sky always blue, and the only time he spends in his tent is during the heat of mid-day, and when he retires to his blanket for the night. For a time he improves, and makes no change in

No Harm, But Much Good Will Be Accomplished by Sleeping Out Like This.
In the Grand Canyon of the Colorado, Arizona.

the location of his tent for months. Then as time rolls on, he takes a turn for the worse, and in less than a year is dead. Why? Jones is another victim of the disease, who also makes up his mind to go to Arizona. He has an idea of his own that he can get along without any tent, and sleeps with only the stars above, rolled up in his blanket. Having no tent as a fixed abode, he naturally moves from place to place each day, sleeping on new and different ground each night. That is an important point. Jones ends by being cured. Why? Just one more instance, after which these "whys" will be explained. Smith has the disease, and goes to the West. He makes a rapid gain from the start, and feels and looks in perfect health long before a year is gone. He returns home, satisfied that he is cured. His friends congratulate him, and life looks sweeter than ever before. In less than four months he is once more in the tenacious clutches of the disease. It is time to consider, at this point, some reason for these different terminations, as an explanation of these three instances will throw much needed light on the cure and prevention of tuberculosis.

In any discussion of tuberculosis, one important fact must be constantly kept in mind: consumption is contagious. It is useless to dodge this statement. Yet it is the most difficult fact to drive into the public mind. Owing to the slow development of the disease, it is difficult for its victims to understand how or where they contracted it. This slow development is unfortunate. If tuberculosis developed its symptoms in a few days, like cholera or yellow-fever, it would have been stamped out in all communities long since. Further, it is seldom, or never, "caught" on the highways or by-ways, from some consumptive passer-by; nor from occasional travel on railways or street-cars; nor from the casual wind or dust of the streets. One does not have to go so far from home to find the real source of the contagion. It is safe to say that nine persons out of ten who have the disease, contracted it in their own homes, or, more specifically, in the very rooms in which they are accustomed to live and breathe. In short, tuberculosis is first, last and all the time, a "house" disease. A realization of the vast importance of this one fact, simplifies the problem of the prevention and cure of tuberculosis to such an extent, that the mind of a child should be able to solve it. Any physician who has had any experience worth considering, can call to memory innumerable instances of houses which he knows to be nothing less than veritable breeding-places for tuberculosis,—houses in which family after family, healthy enough when they moved into one of these plague-ridden dwellings, has sacrificed victim after victim, too often in the name of heredity, to the devastating ravages of this most treacherous of plagues.

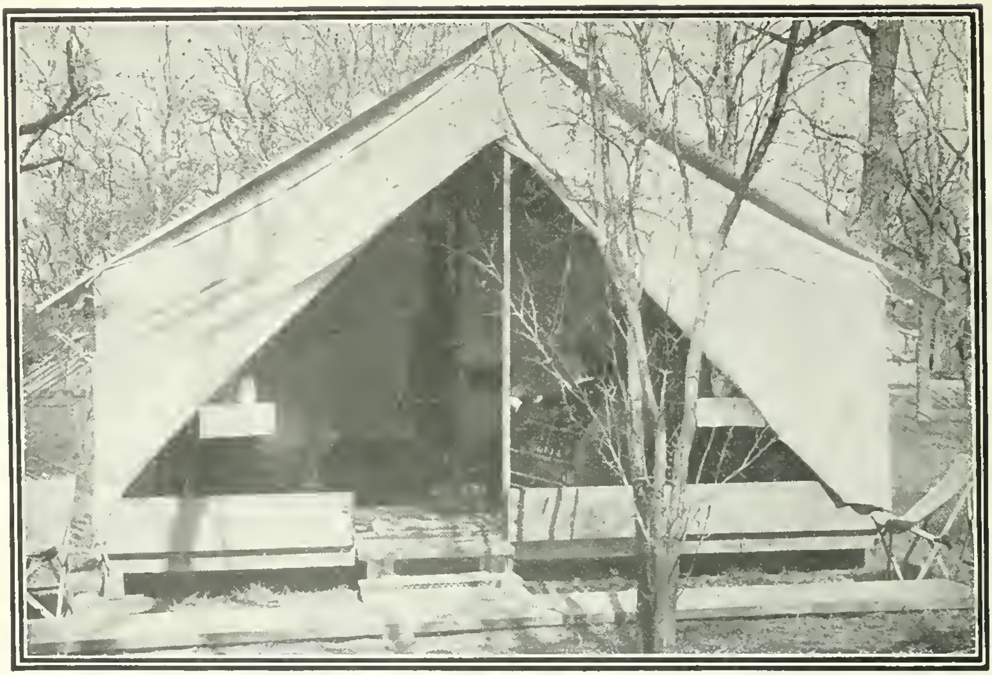
With this hint as a key to the problem, let us try to answer the three "whys" which arose in the typical instances of Brown, Jones and Smith. In the first place, not one of these three should ever have contracted the disease. Secondly, the three of them could have been cured at home, and Brown should never have died. Let us explain.

Before Brown had contracted the disease, he had moved in the month of May, into a house in another part of the town where he had always lived. By fall, he had contracted tuberculosis. It was discovered later, that several different families, who had occupied this same house in succession, had lost in turn several members from tuberculosis. No attempt had ever been made to disinfect the house. As already stated, Brown went to Arizona, pitched his tent on a certain spot, and never made any change from that one spot until his death. Note that fact. As a result, the soil over which he slept, night after night, became saturated with the accumulated germs which he expelled in coughing, so that he was continually, at night, re-breathing into his system, the very "seeds" which cause the disease. He was re-poisoning himself nightly, and didn't know it. His system would have been able to throw off the original "germ-poison" which it contracted, but it was not strong enough to withstand a new dose of the poison every night. Had he changed the location of his tent daily, he could have slept each night in an atmosphere practically germ-free. There is a new lesson

AN OUTDOOR SLEEPING ARRANGEMENT AT HOME.

in this. The open-air treatment is all right, but it must be carried out by right methods. All early cases of consumption which have failed to recover by outdoor treatment, must lay the blame to faulty, incomplete methods in carrying out the details of the treatment. Jones, who recovered, you will remember, did change his location every day, having no tent to bother him, and in doing so, avoided the fatal mistake of Brown. How about Smith? The case of Smith is of the greatest importance. He had recovered, you will remember, and returned to his home feeling fine,—back to what? To the very same plague-ridden room in which he had first contracted the disease,—a room reeking with tubercular germ-life, and which had been occupied, it was learned later, by five different consumptives at various times. The disease got a hold on him a second time, for the simple reason that he came back to the original source of his disease. He should have sought new quarters; or else the house, and particularly the room he occupied, should have been disinfected, before being occupied by him or any one else. These three cases cited are but typical instances. There are thousands upon thousands of Browns, and Joneses, and Smiths, living and dying this very day, whose story, if told in its true light, would match exactly the simple, but pathetic history, of these three men.

Before taking up the important matter of prevention and cure, the temptation is strong to give some detailed criticism as to what has been thus far accomplished as a result of legislative enactment in its specific bearing on tuberculosis. Much could be said on the mooted question of the "tuberculin test" of dairy herds, but lack of space forbids. Aside from that, any legislation enacted, or even so much as suggested, has pertained almost exclusively to the "spitting nuisance," and the use of the public drinking cup. These crusades are certainly harmless enough, and do good in the way of inculcating good manners and etiquette, but how about their utility as regards actual results?

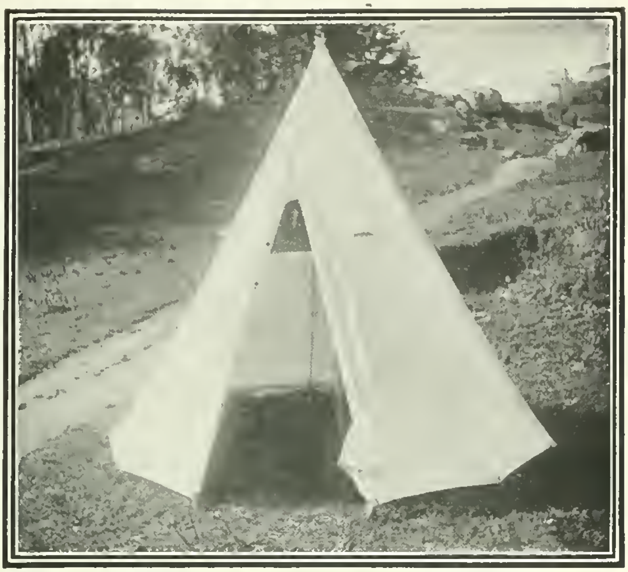


THE CONSUMPTIVE SHOULD NOT PITCH HIS TENT FOR MORE THAN A NIGHT OR TWO IN ONE SPOT.
Permanent quarters like this militate against recovery.

Any one, after a moment's thought, can answer that question, but we wish to consider it in the light of information derived from existing conditions in other countries. In the cities of the most enlightened of European countries, anti-spitting ordinances are unnecessary, because the people there are not addicted to the habit. This is true of London, Paris, Berlin and Vienna. Another thing, no European in the cities mentioned ever thinks of using any but his own drinking cup. This is not said for the purpose of praising Europeans at the expense of our own belittlement, but merely as a prelude to the statement that the European mortality from tuberculosis is as great as ours, and in some instances, greater. The conclusion drawn is, if all legislation thus far enacted against the spread of tuberculosis were stringently enforced to the very letter, we would note little or no diminution in the ravages of the disease.

The simpler the method for the prevention or cure of a disease, the better,—but the more difficult it is to secure its adoption. The extreme simplicity of a method is often against it. People are so accustomed to "taking something" for all ills of the flesh, that it is not easy for them to change their habits of thought on the subject. Besides, the public is so used to having something mysteriously complicated thrust at it, at so much per "thrust," that it is almost impossible to bring this same public to the realization that any one is sufficiently interested in the welfare of the people, to offer them something for nothing. And too often they are quite right. Fortunately, the idea here presented offers no opportunity for any material gain.

No one would move into a house which had not been disinfected, in which the very last occupants had just gone through a siege of small-pox. It is important to bear this in mind, whenever one moves into new quarters. Did the last occupants have consumption, or did they not? Nobody knows, or takes the trouble to learn. It is of vast importance to the family about to move in. The only way for the latter to be on the safe side is to act just the same as if the house were reeking with the germs of consumption. What is one to do as a safe-guard? Simply this: Fumigate every room in the house with the vapor given off by heating formaldehyde; wash all floors, windows and wood-work with mild solutions of corrosive sublimate and water. Only after such a chemical cleansing, can the new quarters be considered safe for human habitation.



A Portable Tent of This Sort Makes a New Daily Camping Ground Exceedingly Practicable.

Is there anything new that can be done for those already afflicted with the disease? By all means. Let these poor sufferers ask themselves, What are the real benefits of "fresh air"? Ideal "fresh air" is that which has its proper proportion of oxygen, and is germ-free. If one afflicted with consumption can possibly have air of this kind in his own home, there is not the shadow of an excuse for leaving it in search of "climate." Let us illustrate. Suppose a man is overcome by illuminating gas, while in his room. The very first thing for his rescuers to do, is to take him out of the room, or let out all the gas. Bearing in mind this comparison and applying it to the consumptive in his own home, there are just two things to do: Either take the consumptive away from the germ-ridden air of his room, or let out the germs. Unfortunately, the latter refuse to go. Sleeping with open windows will not suffice; the air which comes in is not sufficient to drive them from their lodgings on the floors, walls and carpets, not to mention the bed-coverings; nor are the germs kind enough to take a hint and leave by the open window. In order to make the air of such a room germ-free, there remains just one thing to do: kill the germs by frequent fumigation. How often should this fumigation be done? Daily, if possible, but at least once or twice a week. A very good plan for a consumptive to follow is that of living in alternate rooms on alternate days. By so doing, each room can be fumigated and rendered germ-free on alternate days, as a result of which the consumptive will have the benefits of an absolutely pure air both day and night. Such a course, followed in conjunction with what is already known in the way of good nutrition and hygiene, should afford a home cure for every case of consumption that can be so treated from its earliest discovery. There is no individual who cannot act on the two suggestions here given,—first for prevention, and second for cure.

The Newest in "CONCRETE HOMES"

By F. C. Perkins

GREAT attention is being paid at the present time to the erection of thoroughly sanitary and fire-proof residences, railway stations and other buildings and it is maintained that such buildings may be constructed at less cost than with wood; concrete is used as the material and a number of houses are cast from one set of molds.

An accompanying illustration shows the design and construction of a small concrete house built along the lines of the model home, which received the first gold medal at the International Congress on Tuberculosis held in Washington, D. C. A remarkable feature of this house is that a hose may be used for cleaning, after the furniture, pictures and rugs have been removed, a stream of water being applied to the walls, ceilings and composition floors, which are drained to tile spouts discharging on the lawn. All fixtures are of concrete material, bracketed from

A House That Received a Gold Medal.
An admiral 'e style of concrete dwelling.

the wall, for convenience in sweeping the floors.

There is no wood to shrink or rot, no shelter for vermin or insects, no corners for dirt, all corners being rounded. There is no insurance to pay, no painting required and little or no expense for repairs.

The building is so constructed that the waste heat from the cooking-range is utilized in winter for warming the house. There is no handling of coal or ashes. The coal is hoisted by a simple chain block and dumped through a coal hole on the roof into a large pocket. It is then fed automatically by gravity to the stove which combines, in one concrete fixture, the range, house heater, gas stove and hot water heater. The ashes drop from the fire box into cans which are removed from the outside.

The ice box is arranged for use as a fresh air closet, using no ice in cold weather and designed also to flush out with hose. The garbage system, too, is unique, a cast iron chamber being provided in the smoke flue, where the waste is dried, then dumped by the use of a damper into the fire box, its fuel value being saved.

The windows are unit size cast iron, of casement type, with transoms over them to regulate ventilation easily. The walls are hollow to prevent dampness, and there are air circulation openings under the roof slab. Fire places are provided in all the rooms and the flues connect around the smoke pipe for natural ventilation.

In this concrete building, construction standard unit collapsible steel forms are used, which are designed to allow change of arrangement and variety in plants, and the entire house is cast, with walls, floor and partitions, of reinforced concrete. The molds may also be used for any number of duplications of the original building that may be desired.

In the Rosemont railway station, shown at the head of the article, an interesting treatment has been made by the inlay of small marble blocks.

A PRETTY—AND SANITARY—CONCRETE RESIDENCE OF FIREPROOF CONSTRUCTION.

NIGHT CAMP OF TRAPPERS IN SOUTHERN LABRADOR.

A CONTINENTAL FUR FARM

(PART II—CONCLUSION)

By

AGNES C. LAUT

REMEMBER it was not the hunter who exterminated the buffalo and the beaver and the seal and the otter. The poacher destroyed one group of sea furs, the railway and the farm supplanted the other. West of Mackenzie River north of British Columbia is a game region almost similar to Labrador in its furred habitat, with the exception that the Western preserve is warmer and more wooded. Northward from Ontario is another hinterland which from its very nature must always be a great hunting ground. Minerals exist—as the old French traders well knew and the latter day discoveries of Cobalt prove—and there is also heavy timber; but north of the Great Clay Belt, between the Clay Belt and the Bay lies the impenetrable and—I think—indestructible game ground. Swamp and rock will prevent agricultural settlement, but will provide an ideal fur preserve similar in climate to Labrador.

Traveling with Indian guides, it is always a matter of marvel and admiration to me how the Company have bred into the very blood for generations the careful nurture of all game. At one place we heard of a huge black bear that had been molesting some new ranches. "No take now," said the Indian. "Him fur no good now." Though we might camp on bare rocks and the fire lay dead ash, it was the extra Indian paddler who invariably went back to spatter it out. You know the white's innate love for a roaring log fire in front of the camp at night? The Indian calls that "a-no-good-whiteman-fire-scare-away-game."

Now take another look at the map. Where the Saskatchewan takes a great bend 300 miles northeast of Prince Albert, it is no longer a river—it is a vast muskeg of countless still amber water channels not twice the width of your canoe and quaking silt islands of sand and goose grass—ideal hidden and almost impenetrable for small game. Always muskeg marks the limit of big game and the beginning of the ground of the little fellows—waupoos the rabbit and musquash the muskrat and sakwasew the mink and nukik the otter and wuchak or pekan the fisher. It is a safe wager that the profits on the millions upon millions of little pelts—hundreds of thousands of muskrat are taken out of this muskeg alone—exceed by a hundred fold the profits on the larger furs of beaver and silver fox and bear and wolf and cross fox and marten.

Look at the map again. North of Cumberland lake to the next fur post is a trifling run of 250 to 300 miles by dog train to Lac du Brochet or Reindeer Lake—more muskeg cut by limestone and granite ridges. Here you can measure 400 miles east or west and not get out of the muskeg till you reach Athabasca on the West and Hudson's Bay on the East. North of Lac du Brochet is a straight stretch of 1,000 miles—nothing but rocks and cataracts and stunted woods, "little sticks" the Indians call them—and sky colored waters in links and chains and lakes with the quaking muskeg goose grass and muskrat reed, cut and chiselled and trenched by the amber water ways.

If you think there is any danger of settlement ever encroaching on the muskegs and barrens, come with me on a trip of some weeks to the south end of this field.

We had been pulling against slack water all day, water so slack you could dip your hand down and fail to tell which way the current ran. Where the high banks dropped suddenly to such a dank tangle of reeds, brush wood, windfall and timbers drifted 1,500 miles down from the forests of the Rocky Mountains—such a tangle as I have never seen in any swamp of the South—the skeleton of a moose, come to its death by a jump among the wind fall, marked the eastern limit of big game; and presently the river was lost—not in a lake—but in a swamp. A red fox came scurrying through the goose grass, sniffed the air, looked at us and ran along abreast of our canoe for about a mile, evidently scent-

A SUMMER CAMP OF BIG GAME HUNTERS NORTH OF THE SASKATCHEWAN.

FEEDING THE FAITHFUL PACK DOGS—A SCENE ON ATHABASCA LAKE.

ing the bacon of the tin "grub box." Muskrats feed on the bulb of the tufted "reed like a tree," 16 feet high on each side; and again and again little kits came out and swam in the ripple of our canoe. Once an old duck performed the acrobatic feat over which the nature and anti-nature writers have been giving each other the lie. We had come out of one long amber channel to be confronted by three openings exactly alike, not much wider than the length of our Klondike canoe, all lined by the high tufted reed. MacKenzie, the half-breed rapids man, had been telling us the endless Cree legends of Wa-sa-kee-chaulk, the Cree Hiawatha, and his Indian lore of stagnant waters now lured him into steering us to one of the side channels. We were not expected. An old mother duck was directly across our path teaching some twenty-two little black bobbling downy babies how to swim. With a cry that shrieked "leg it—leg it" plain as a quack could speak and which sent the little fellows scuttling, half swim, half run, the old mother flung herself over on her back not a paddle's length ahead of us, dipped, dived, came up again just at our bow and flopped broken-winged over the water ahead of us near enough almost to be caught by hand; but when you stretched out your hand, the crafty lady dipped and dived and came up broken-winged again.

"You old fool," said Sexsmith, our head man, "your wing is no more broken than mine is. We're not going to hurt your babies. Shut up there and stop that lying."

Spite of which the old duck kept up her pantomime of deceit for more than a mile; when she suddenly sailed up over our heads back to her hidden babies, a very Boadicea of an old duck girl. When we drew in for nooning, wild geese honked over our heads near enough to be hit by the butt of a gun. Drift chips, lodged in the goose grass, kindled fire for kettle; but oilcloth had to be spread before you could get footing ashore. I began to wonder what happened as to repairs when canoes ripped over a snag in this kind of region; and that brought up the story of a fur trader's wife in another muskeg region north of Lac La Ronge up towards Churchill River, who was in a canoe

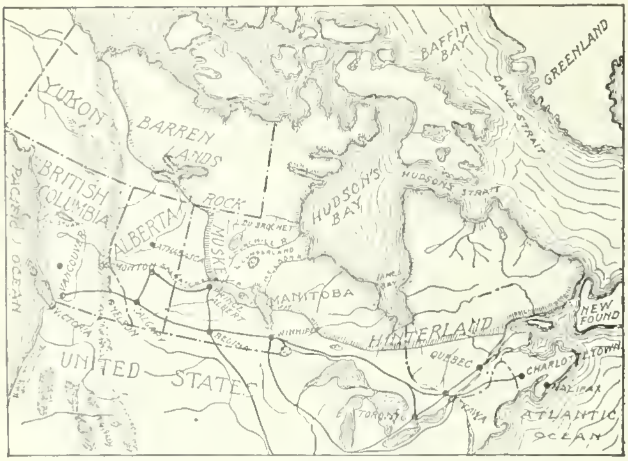
A TYPICAL BAKE OVEN USED BY THE HUDSON'S BAY COMPANY AT THE NORTHERN POSTS.

that ripped a clean hole the size of a man's fist. Quick as a flash, the head man was into the tin grub box and had planked on a cake of butter. The cold water hardened it; and that repair carried them along to the first birch tree affording a new strip of bark.

Where an occasional ridge of limestone cut the swamp, we could hear the laughter and the glee of the Indian children playing "wild goose" among the trembling black poplars and whispering birches; and where we landed at the Indian camps we found the missionaries out with the hunters. In fact, even the nuns go haying and moose hunting with the Indian families to prevent lapses to barbarism. On one of these moose hunts for pemmican supply in the rock region north of this muskeg, the Revillons' manager succeeded in snap-shotting a sister rifle in hand. The good lady was panicky at thought of this representation of a peaceful missionary going out to the world. "Oh, by Gar, Sister," consoled one of the hunters, "you convert us all lot faster—me, I t'ink—wit' y'r rifle than y'r beads."

Again and again we passed cached canoes, provisions stuck up on sticks above the reach of animal marauders—testimony to the honesty of the passing Indian hunters, which the best policed civilized Eastern city cannot boast of its denizens.

"I've gone to the Rockies by way of Peace River dozens of times," declared the Revillon man, "and left $500 worth of provisions cached in trees to feed us on our way out, and when we came that



The Home of the Fur-Bearers.
North of the shaded line they are most abundant.

same way six months afterwards we never found one pound stolen, though I remember one winter when the Indians who were passing and repassing under the food in those trees were starving owing to the rabbit famine."

In winter, this region is traversed by dog train along the ice—a matter of 500 miles to Lac du Brochet and back, or 600 to Prince Albert and back. "Oh, no, we're not far," said a lonely faced Cambridge graduate fur trader to me. "When my little boy took sick last winter, I had to go only 55 miles. There happened to be a doctor in the lumber camp back on the Ridge."

But even winter travel is not all easy in a 50 below zero climate where you can't find sticks any larger than your finger to kindle night fire. I know the story of one fur trader, who was running along behind his dog sleigh in this section. He had become over-heated running, and had thrown his coat and cap across the sleigh, wearing only flannel shirt, fur gauntlets, corduroy trousers and moccasins. At a bend in the iced channel he came on a pack of mangy coyotes. Before he had thought, he had sicked the dogs on at them. With a yell they were off out of sight amid the goose grass and reeds. Those reeds, remember, are sixteen feet high, stiff as broom corn and hard on moccasins as stubble would be on bare feet. To make matters worse, a heavy snow storm came on. The wind was against the direction the dogs had taken and the man hollooed himself hoarse without an answering sound. It was two o'clock in the morning before the wind sank and the trader found his dogs; and by that time between sweat and cold, his shirt had frozen to a board.

Such a thing as an out and out pagan hardly exists among the Indians of the North. They are all more or less Christian with a curious mingling of pagan superstition with the new faith. The Indian voyageurs may laugh but they all do it—make offerings of tobacco to the Granny Goddess of the River before setting out. In vain we threw biscuit and orange peel and nuts to the perverse tempered deity supposed to preside at the bottom of those amber waters. The winds were contrary—the water slack, sluggish, dead, no responsive gurgle and flap of laughter and life to the slow keel.

One channel but opened on another. Even the limestone ridges had vanished far to rear; and the stillness of night fell with such a flood of sunset light as Turner never dreamed in his wildest intoxications. There would be the wedge shaped line of the wild geese against a flaming sky—a far honk—then stillness. Then the flackering quacking call of a covey of ducks with a hum of wings right over our shoulders—then no sound but the dip of our paddles and the drip and ripple of the dead waters among the reeds. Suddenly, there lifted against the lonely red sunset sky—a lob stick—a dark evergreen stripped below the tip to mark some Indian camping place, or vow, or sacred memory. We steered for it. A little flutter of leaves like a clapping of hands marked land enough to support black poplars; and we rounded a crumbly sand bank just in time to see the seven-banded birch canoe of a little old hunter—Sam Ba'tiste Buck—80 years old he was—squatting in the bottom of the birch canoe, ragged almost to nakedness, bare of feet, gray headed, nearly toothless but happier than an emperor—the first living being we had seen for a week in the muskegs. We camped together that night on the sand bars—trading Sam Ba'tiste flour and matches for a couple of ducks. He had been storm stead camped in the goose grass for three days. Do you think he was to be pitied? Don't! Three days hunting will lay up enough meat for Sam for the winter. In the winter, he will snare some small game, mink, and otter and muskrat; and these will earn him flour and clothes from the fur trader. Each of Sam's sons is earning $700 a year hunting big game on the rock ridge farther north—more than illiterate, unskilled men earn net in Eastern lands. Then in spring, Sam will emerge from his cabin—wood is free—and build another birch canoe, and paddle away in freedom and peace to the duck and wild geese haunts. When we paddled off in the morning, Sam still camped on the sand bank. He sat squat whittling away at kin-a-kin-ic, or the bark of the red willow, the hunter's free tobacco. In town, Sam would be poverty stricken, hungry, a beggar. Here, he is a lord of his lonely watery domain, more independent and care-free than you are—peace to his aged bones!

THE TRAVELING DRESS OF A MISSIONARY'S WIFE.
Mrs. Bompas, wife of Archbishop Bompas.

Another night coming through the muskegs, we lost ourselves. We had left our Indian at the fur post and trusted to follow southwest 200 miles to the next fur post by the sun; but there was no sun, only heavy lead-colored clouds with a rolling wind that whipped the amber waters to froth and flooded the sand banks. If there was any current, it was reversed by the wind. We should have thwarted the main muskeg by a long narrow channel, but mistook our way thinking to follow the main river by taking the broadest opening. It led us into a lake seven miles across; not deep, for every paddle stroke tangled into the long water weed known as mermaid's hair but deep enough for trouble when you consider the width of the lake, the lack of dry footing the width of one's hand, and the fact that you can't offer the gun'l of a canoe to the broadside of a big wave. We scattered our dunnage and all three squatted in the bottom to prevent the rocking of the big canoe. Then we thwarted and tacked and quartered to the billows for a half day.

Nightfall found us back in the channel again scudding before thunder and hurricane wind looking for camping place. It had been a back-breaking pace all day. We had tried to find relief by the Indian's choppy strokes changing every third dip from side to side; and we had tried the white man's deep long pulling strokes; and at seven in the evening with the thunder rolling behind and not a spot of dry land visible the size of one's foot, backs began to feel as if they might break in the middle. Our canoe and dunnage weighed close on 700 pounds. Suddenly we shot out of the amber channel into a shallow lagoon lined on each side by the high tufted reeds; but the reeds were so thin we could see through them to lakes on each side. A whirr above our heads and a flock of teal almost touched us with their wings. Simultaneously, all three dropped paddles—all three were speechless. The air was full of voices. You could not hear yourself think. We lapped the canoe close in hiding to the thin lining of reeds.

"Sexsmith," I asked, "have those little sticks drifted down 1500 miles to this lagoon of dead water?"

"Sticks," he repeated, "it isn't sticks—it isn't drifts—it's birds—it's duck and geese—I have never seen anything like it—I have lived West more than twenty years and I never heard tell of anything—of anything like it."

Anything like it? I had lived all my

CAMP OF A CHAMPION BIG GAME HUNTER OF THE NORTHWEST.

life in the West and I had never heard or dreamed any oldest timer tell anything like it! For seven miles, you could not have laid your paddle on the water without disturbing coveys of geese and duck, geese and duck of such variety as I have never seen classified or named in any book on birds. We sat very still behind the hiding of reed and watched and watched. We couldn't talk. We had lost ourselves in one of the secluded breeding places of wild fowl in the North. I counted dozens and dozens of moult nests where the duck had congregated before their long flight south. That was the night we could find camping ground only by building a foundation of reeds and willows, then spreading oil cloth on top; and all night our big tent rocked to the wind; for we had roped it to the thwarts of the canoe. How the guide held his taut, I don't know. Next day when we reached the fur post, the chief trader told us any good hunter could fill his canoe—the big white banded gray canoe of The Company, not the little seven banded birch craft—with birds to the gun'l in two hours' shooting on that lake.

That muskeg is only one of hundreds of thousands, when you go seventy miles north of the Saskatchewan, sixty miles east of Athabasca Lake. That muskeg and its like, covering an area two-thirds of all Europe, is the home of all the little furs—mink and muskrat and fisher and otter and rabbit and ermine, the furs that clothe—not princes and millionaire, who buy silver fox and sea otter—but you and me and the rest of us, whose object is to keep warm, not to show how much we can spend. Out of that one muskeg, hundreds of thousands of little pelts have been taken since 1754 when Anthony Hendry, the smuggler, first led the fur trader inland from the Bay. Yet the game—save in the year of the unexplained rabbit pest—shows no sign of diminishing.

Does it sound very much to you like a region where the settler would ultimately drive out the fur trade? What would he settle on? That is the point. Nature has taken good care that climate and swamp shall erect an everlasting barrier to encroachment on her game preserves.

Nuns, Aided by Indians, Shot These Moose.

To be sure, if you ask a fur trader "how are furs?" he will answer "poor—poorer every year." So would you if you were a fur trader and wanted to keep out rivals. I have never known a fur trader who did not make that answer.

To be sure, seal and sea otter, beaver and buffalo have been almost exterminated; but the extermination in one case has been the poacher, in the other the farm. Even today if the governments of the world, especially Canada and the United States would pass a law prohibiting the killing of a single buffalo or beaver, seal or sea otter for fifty years—these species would replenish themselves.

"The last chapter of the fur trade has been written?" Never! The oldest industry of mankind will last as long as mankind lasts.

I read also that "the last chapter of the fur romance has been written." That is the point of view of the man who spends fifty weeks in town and two weeks in the wilds. It is not the point of view of the man who spends two weeks in town and fifty in the wilds; of the man who goes out beyond the reach of law into strange realms the size of Russia with no law but his own right arm, no defense but his own wit. Though I have written an 800 page history of the Hudson's Bay Company straight from their own Minutes in Hudson's Bay House, London, I could write more of the romance of the fur trade right in the year 1911 than has ever been penned of the Company since it was established away back in the year 1670.

Space permits only two examples. You recall the Cambridge man, who thought it a short distance to go only fifty-five miles by dog train for a doctor. A more cultured, scholarly, perfect gentleman I have never met in London or New York. Yet when I met his wife, I found her a shy little, part-Indian girl, who had almost to be dragged in to

LABRADOR INDIANS BUILDING A BARK CANOE.

meet us. That spiritual face—such a face as you might see among the preachers of Westminster or Oxford—and the little shy Indian girl-wife and the children, plainly a throw-back to their red-skin ancestors, not to the Cambridge paternity. What was the explanation? Where was the story of heartache and tragedy —I asked myself, as we stood in our tent door watching the York boat come in with provisions for the year under a sky of such diaphanous northern lights as leave you dumb before their beauty and their splendor? How often he must have stood beneath those northern lights thinking out the heartbreak that has no end.

I did not learn the story till I had come on down to civilization and town again. That Cambridge man had come out from England flush with the zeal of the saint to work among the Indians. In the Indian school where he taught he had met his Fate—the thing he probably scouted—that fragile type of Indian beauty almost fawn-like in its elusiveness, pure spirit from the very prosaic fact that the seeds of mortal disease are already snapping the ties to life. It is a type you never see near the fur posts. You have to go to the far outer encampments, where white vices have not polluted the very air. He fell in love. What was he to do? If he left her to her fate, she would go back to the inclement roughness of tepee life mated to some Indian hunter, or fall victim to the brutal admiration of some of those white sots, who ever seek hiding in the far wilderness. He married her, and had of course to resign his position as teacher in the school. He took a position with The Company and lived no doubt in such happiness as only such a spiritual nature could know; but the seeds of the disease which gave her such unearthly beauty, ripened. She died. What was to become of the children? If he sent them back to England, they would be wretched and their presence would be misunderstood. If he left them with her relatives, they would grow up Indians. If he kept them he must have a mother for them, so he married another trader's daughter — the little half-breed girl—and chained himself to his rock of Fate as fast as ever martyr was bound in Grecian myth; and there he lives today. The mail comes in only once in three months in summer, only once in six in winter. He is the only white man on a watery island 200 miles from anywhere except when the lumbermen come to the Ridge, or the Indian agent arrives with the treaty money once a year.

And "the last chapter of the fur romance has been written?"

"The last chapter of the fur romance" will not have been written as long as frost and muskeg provide a habitat for furtive game, and strong men set forth to traverse lone places with no defence but their own valiant spirit.

Space permits only one more example, and it is of a man known to every fur buyer of St. Louis and Chicago and St. Paul—Mr. Hall, the chief commissioner of furs for the Hudson's Bay Company. I wish I could give it in Mr. Hall's own words—in the slow quiet recital of the man who has spent his life amid the great silent verities, up next to primordial facts, not theorizing and professionalizing and discretionizing and generally darkening counsel by words without knowledge. He was a youth somewhere around his early twenties; and he was serving The Company at Stuart Lake in British Columbia—a sort of American Trossachs on a colossal scale. He had been sent with a party to bring some furs across from MacLeod Lake east in the most heavily wooded mountains. It was mid winter. Fort MacLeod was short of provisions. On their way back, travel proved very heavy and slow. Snow buried the beaten trail; and travel aside plunged men and horses through snow crust into a criss cross tangle of underbrush and windfall. The party ran out of food. It was thought if Hall, the youngest and lightest, could push ahead on snowshoes to Stuart Lake, he could bring out a rescue party with food.

He set off without horse or gun and only a lump of tallow in his pocket as food. The distance was seventy-five miles. At first he ran on winged feet—feet winged with hunger; but it began to snow heavily with a wind that beat in his face and blew great gusts of snow pack down from the evergreen branches overhead; and even feet winged with hunger and snowshoes clog from soft snow and catch derelict branches sticking up through the drifts. By the time you have run half a day beating against the wind, reversing your own tracks to find the chipped mark on the bark of the trees to keep you on the blazed trail—you are hungry. Hall began to nibble at his tallow as he ran and to snatch handfuls of snow to quench his thirst. At night he kindled a roaring big white-man-fire against the wolves, dried out the thawed snow from his back and front, dozed between times, sang to keep the loneliness off, heard the muffled echo come back to him in smothered voice, and at first streak of dawn ran on and on and on.

By the second night, Hall had eaten all his tallow. He had also reefed in his belt so that his stomach and spine seemed to be camping together. The snow continued to fall. The trees swam past him as he ran. And the snow drifts lifted and fell as he jogged heavily forward. Of course, he was not dizzy. It was the snow blindness or the drifts. He was well aware the second night that if he would have let himself, he would have dug down a sleeping hole in the snow and wrapped himself in a snow blanket and slept and slept; but he thrashed himself awake, and set out again, dead heavy with sleep, weak from fatigue, staggering from hunger; and the wings on his feet had become weighted with lead.

He knew it was all up with him when he fell. He knew if he could get only a half hour's sleep, it would freshen him up so he could go on. Lots of winter travelers have known that in the North; and they have taken the half hour's sleep; and another half hour's; and have never wakened. Anyway, something wakened Hall. He heard the crackle of a branch. That was nothing. Branches break to every storm; but this was like branches breaking under a moccasin. It was unbelievable; there was not the slightest odor of smoke, unless the dream odor of his own delirious hunger; but not twenty paces ahead crackled an Indian fire, surrounded by buckskin tepees, Indians warming themselves by the fire.

With an unspeakable revulsion of hope and hunger, Hall flung to his feet and dashed into the middle of the encampment. Then a tingling went over his body like the wakening from death, of frost to life—blind stabbing terror obsessed his body and soul; for the fire was smokeless, the figures were speechless, transparent, unaware of his presence, very terribly still. His first thought was that he had come on some camp hopeless from the disaster of massacre or starvation. Then he knew this was no earthly camp. He could not tell how the figures were clothed or what they were. Only he knew they were not men. He did not even think of ghosts. All he knew was it was a death fire, a death silence, death tepees, death figures. He fled through the woods knowing only death was behind him—running and running, and never stopping till he dropped exhausted across the fort doorstep at two in the morning. He blurted out why he had come. Then he lapsed unconscious. They filled him with rum. It was twenty-four hours before he could speak.

"I don't know these modern theories about hallucination and delusions and things," concluded Mr. Hall gazing reflectively on the memories of that night. "I'm not much on romance and that kind of thing! I don't believe in ghosts. I don't know what it was. All I know is it scared me so it saved my life; and it saved the lives of the rest, too; for the relief party got out in time, though they didn't see a sign of any Indian camp. I don't know what to make of it, unless years ago some Indian camp had been starved or massacred there, and owing to my unusual condition I got into some clairvoyant connection with that past. However, there it is; and it would take a pretty strong argument to persuade me I didn't see anything. All the other things I thought I saw on that trip certainly existed; and it would be a queer thing if the one thing which saved my life did not exist. That's all I know; and you can make anything you like of it."

INDIANS IN SUMMER CAMP NORTH OF PRINCE ALBERT.

COAL HEATERS WHICH SAVED A CROP OF PEARS FROM A TEMPERATURE OF TWENTY DEGREES ON THE DAY FOLLOWING THE TAKING OF THIS PHOTOGRAPH.

IN THE TIN PAN TROPICS

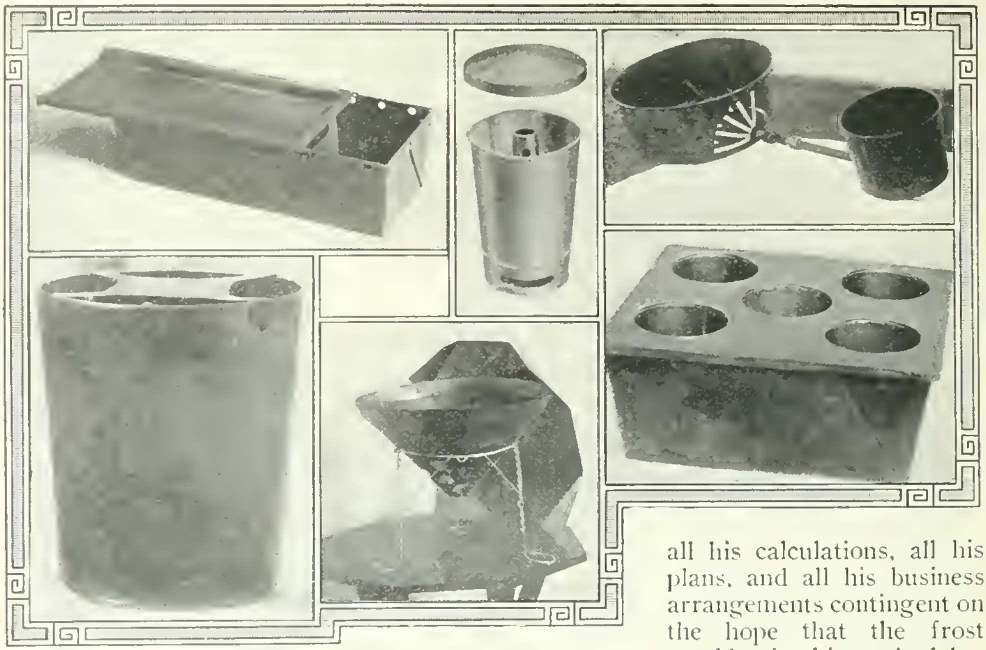
By

OMAR H. SAMPLE

WITHIN the past two years another and a greater triumph of scientific horticulture has arrived; another natural enemy of the things that grow and bring forth fruit has been vanquished. Jack Frost, long King of the Fruit Crop, has been dethroned. Fruit growers have literally built millions of fires under him, and burned him out.

Scientific orchard heating has made it possible to raise the temperature of a two hundred acre orchard ten to fifteen degrees with as much certainty as the janitor can heat the city man's flat. It takes somewhat more labor than the last mentioned process, but the satisfaction and the profits of "heating all outdoors" are surpassingly greater. Frost insurance for the fruit crop is now just as practicable, just as certain, and vastly more profitable for the money expended than either fire or life insurance.

Insurance by fire for the fruit grower makes vastly greater profits at a much smaller expense than insurance against fire does for the merchant or manufacturer. The little outdoor oil stoves and coal furnaces that have been sold by the



WHAT CREATE THE "TROPICS."

From left to right, row one: 1, graduated burner type of oil heater; 2, single burner type of oil heater, with center draft; 3, reservoir heater that may be set to burn any desired length of time. Row two: 1, the original California oil heater that started orchard heating; 2, an orchard coal heater, 3, pan type of reservoir heater, the size of the flame being regulated by closing the holes.

millions to orchard owners in the last year and a half have banished from the fruit grower that annual early spring nervous prostration from fear of frost; that periodic, paralyzing fear that he may go to bed at night and awaken to find his whole year's labor chilled to death by a sudden frost. The cumulative despair of losing three or four fruit crops in succession that has put fruit growers out of business and made them dependent on charity or day labor is past. An orchard with a reasonably industrious and provident owner can be made to yield an average crop every season so far as the frost is concerned. Scientific frost fighting with fire is as much a fact as seed testing, irrigation, fertilizing, spraying or pruning. It is the last and greatest advance in systematic horticulture, and has placed the fruit grower abreast of the scientific farmer.

Since the beginning of commercial horticulture, the fruit grower has been at the mercy of the elements. He made all his calculations, all his plans, and all his business arrangements contingent on the hope that the frost would miss him. And before the development of orchard heating the chances against him were getting worse and worse in the frost belt. In the modern commercial orchard, the land, machinery, labor, spraying equipment and cultivation total as heavy an investment as many manufacturing enterprises. And when two or three crops in succession were wiped out by frost, the average grower was completely bankrupt.

It was in the nature of a revelation when in 1908 some experimenting growers in Colorado began what was characterized as a theoretical attempt to heat all out-doors. There was much jesting and skepticism about the ridiculous idea of warming up a whole orchard with little fire-pots, but the experimenters were not to be discouraged. The frost came, one of the worst in the history of the state, and the only crops produced were those on the small experimental areas that had been heated. There was an immediate rush to get on the "smudging wagon." All through the West, in Oregon, California, Montana, Iowa, Missouri, and Florida, heaters are being shipped as fast as they can be manufactured. Frost fighting has been developed into a genuine insurance. Heating a large part of the outdoors of a community has been proved eminently practical. The advanced fruit grower now knows that even a heavy freeze such as destroyed millions in fruit, cotton, grain and other growing things can be neutralized so as to insure practically full crops every year. The fruit growers of the Grand River Valley learned their lesson after the loss of millions in successive frost attacks, but they learned it well. The twenty-five hundred carloads of fruit that went out of Mesa County alone last fall testify to the thoroughness with which they operated this gigantic system of crop protection in one of the severest of late springs. It is estimated by government authorities that from $75,000,000 to $100,000,000 has been lost annually to the fruit growers by reason of frost and freezing weather. Careful and methodical orchard heating has saved a large percentage of this in the fruit areas where heating has been generally adopted. The orchard heating committee of the Colorado fruit growers estimates that $4,000,000 was saved to the growers of that state alone in 1909. For as many as five years in succession in many fruit growing communities the crop has been either totally or partially destroyed.

Smudging, or the formation of a dense blanket of smoke over the orchard, had been practiced with varying degrees of success in some parts of Europe. Orchard heating proper, was first used in California, and the original California smudge pot is still successfully used in many orchards. In the spring of 1908 several growers in the Grand Valley of Colorado experimented with the burning of oil in simple pots of the "lard pail" type, with the result that they saved their entire crop on the heated areas and lost it on the unheated tracts. The spring of 1909 saw the adoption of smudge pots in every fruit section of the state, and they reached the experimental stage in several other states. In the spring of 1910 there was not a fruit growing state without them, and many sections of several states were as fully equipped as Colorado.

The thrilling and successful frost fights in Colorado were an inspiring object lesson to the growers. At Canon City they organized and appointed an orchard heating committee, the first in existence. With an appropriation of $1,000, its members set zealously to work on a series of experiments to determine just what could be accomplished in raising the temperature of entire orchards, and what the cost and the conditions of work would be. For six months they worked with every kind of fuel and all the various devices for producing fires. At the end of this time they unanimously recommended oil as the most practicable fuel owing to the ease and rapidity with which heat could be generated. The experiments of the orchard heating committee had showed that the temperature of an orchard could be raised fourteen degrees with one hundred small oil pots to the acre. The record of that historic spring fight of 1909 fully bore out this conclusion. The last night of April the temperature in the Canon City district fell to seventeen degrees above zero. The orchardists with heaters kept the temperature up to twenty-eight or thirty degrees, which they considered the safety point. On the preceding night there was a terrific blizzard. The wind blew a gale and there was a snow fall of over eight inches, weather that made very trying conditions for the free burning of oil. In spite of this unusually severe test, the temperature was kept up to the safety point for over five hours. As an experiment, several acres of the test orchard were left unprotected. On the heated part there was a banner crop, more than 15,000 boxes, while on the several acres not heated, with one hundred ten year old trees in full bearing condition, there was not a box of apples.

Frost fighting is not an easy job. It is necessary to have a force of men, industrious, careful, and observing to the last degree. And it is no pleasant task to rush out into the still, cold darkness to drudge the better part of the night to save your own or your neighbor's orchard. In the early days of orchard heating, a man was detailed to watch the tested thermometers that were hung in different parts of the orchard and at the farm house some distance away from the fruit trees. If the temperature was not sinking fast, perhaps the rancher went to bed for a brief nap, setting his alarm clock to wake him at intervals through the night. Nowadays he can go to bed with a feeling of security, leaving the frost alarm thermometer to watch for him. This electric watchman has for its business end in the orchard a specially made thermometer, with a fine platinum wire fused into the mercury at the freezing point or at whatever is considered the danger point. As soon as the mercury sinks below this wire, the circuit is broken and the alarm at the head of the orchard boss' bed rings out its warning. Any interruption of the current causes the bell to ring so that if the apparatus should be out of order it automatically tells on itself.

But the orchardist is usually forewarned, even before he goes to bed, and makes ready for the fray. Late in the afternoon he notices great fleecy clouds hurrying from the northwest, chased by a bitter wind which seems to have been intended for January rather than this April night. He goes to the post office for the day's mail and in every window sees the warning of the diligent local government weather forecast: "Freezing temperature tonight." By seven o'clock the government thermometer is at thirty-seven and falling fast. At seven-thirty he telephones the weather man and gets the reply: "Bitter cold all over the country; temperature is already down to twenty-seven in many parts of the valley and will drop to twenty degrees on the Western Slope of Colorado tonight." By eight o'clock it has fallen to thirty-two, his alarm begins to ring, and he knows that King Frost with his icy-fingered warriors is marching on the camp. Steam whistles are beginning to shriek all through the Valley to warn the growers of the all-night siege. Farm wagons laden with coal and oil rattle past, giving evidence that the laggards who have been hoping to the last, are beginning to get their heating machinery into action. Already the early ones are firing heavily. Clouds of smoke hang low over the trees, and the little spots of fire beneath punctuate the blackness with rays of hope.

The orchard firemen dash for the trees, a torch in one hand, and a gasoline can to aid in quick lighting in the other. Dashing a few drops of gasoline on the oil, they apply the torch, and the blaze is at work. The lighting is done as fast as the men can walk through the orchard, leaving a trail of smoke and fire behind them. In fifteen minutes each man has his tract of orchard transformed into a sea of flame under a cloud of smoke.

Then comes the first period of rest. The men gather in the packing house or barn, for lunch or smoke, making occasional trips to the thermometers to see that the fire is doing its work. By nine-thirty the thermometers outside the orchard register twenty-eight, and those in the area of heat show a comfortable thirty-seven. Then the frost fighters know that the battle is half won, for keeping up the temperature is a good deal easier than raising it when it has once reached the limit. The rest is a matter of vigilance. If the heater is of the regulated type, with enough fuel to burn through the night or longer, a few men are left to watch and open the burners wider if a later sudden fall of temperature shows that more fire is needed. If the heaters are of the uniform single burner type, they may need to be refilled when they are nearly burned out, if the frost battalion should come back for another charge. The outside thermometers drop to twenty-four, and those in the orchards stand at thirty, the danger mark of the orchard frost fighter. The heaters are opened wider, or refilled if burning low, and the mercury shoots up to thirty-three. The eight degrees of frost has been driven away, and if the oil supply is plentiful, and the labor unflagging, the orchardist may now consider the battle won. When the sun has shed his rays over the trees long enough to make the outside temperature more nearly that of the orchard, the heaters are shut off by merely putting on the covers.

Heating in the spring of 1910 was much easier than that of the year before, and proved more conclusively than ever the effectiveness of the fires. The crop in the Colorado fruit area for 1910 averaged about fifty-five per cent. The unheated orchards yielded from twenty to seventy-five per cent of a crop, while the yield of the protected orchards was from ninety-five to a hundred per cent,

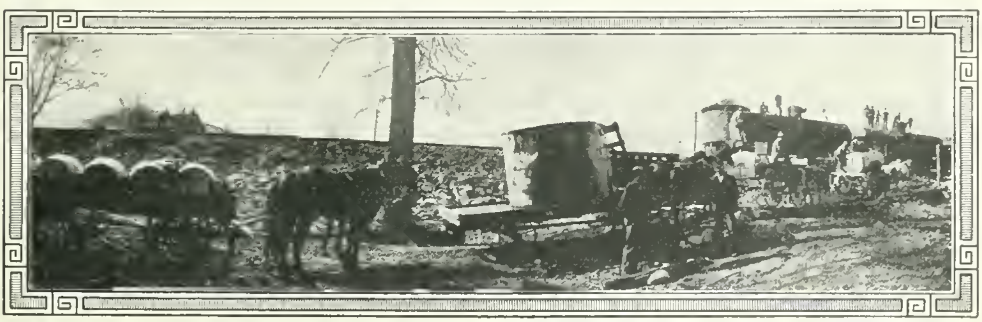
"HEATING ALL OUT-OF-DOORS" IN THE GRAND RIVER VALLEY OF COLORADO.
Panoramic night photograph overlooking an expanse of fifty square miles, wherein was waged a most spectacular battle against frost.

so heavy that thinning was necessary in many of them.

Individual testimony to the efficiency of orchard heating in every fruit growing state could be multiplied indefinitely. Fruit crops valued at $250 to $750 an acre were frequently saved at a cost of seven to ten dollars an acre. A few striking examples are typical of general results. A Colorado grower with fifty heaters to the acre raised the temperature of his forty-acre orchard from eighteen to twenty-eight degrees and produced forty-one carloads of apples.

Another one in the Grand River Valley, who was one of the pioneer orchard heaters, holds some world's records for heavy apple production. He produced this season 4,150 boxes of apples from 2.6 acres, an average of 1,600 boxes an acre, valued at one dollar a box. A block of two-thirds of an acre in this orchard produced at the rate of 2,200 boxes an acre, the largest yield on record. This orchard was carefully pruned, heated, sprayed and thinned and proves what can be done with care and cultivation. The entire orchard this year gave the largest crop in its history, while adjoining tracts, not heated, got only thirty-five per cent of a crop.

An Iowa grower who had lost several crops from frost, came to the conclusion that he must do something to save his crop or go out of business. By experimenting with the burning of brush, he saved a peach crop of 6,000 bushels, and was induced to go into the heating business in earnest. In his orchard of 900 bearing trees he placed 1,000 of the small single burning oil pots. The temperature was held to thirty-three degrees in the orchard while it was twenty-three outside, and accompanied by the most adverse weather conditions that could be experienced. The wind was blowing so hard that it was difficult to pour oil into the pots. It was snowing heavily, causing the oil to sputter and pop from the pots, wasting a good part of the fuel supply. He fired up nine nights during the season. He harvested this fall a full



GETTING READY FOR A NIGHT FIGHT WITH FROST.
Fruit growers filling wagon tanks and barrels, from oil cars, with the season's full supply for the heaters.

crop of apples, the only one in the state, at a cost of only seven cents a bushel for heating. This figure includes the storage tank, wagons, and all necessary equipment, including labor. With the plant established, his next season's expense will, of course, be much smaller.

There is seldom necessity for firing more than two or three nights in a season. A grower in the Rogue River Valley of Oregon, saved ten acres of apples valued at $6,000, at a cost of $6 an acre, where one freeze on May 5 of the previous year had destroyed his entire crop. In a neighboring apple orchard which has yielded as high as $1,000 an acre, a full crop was saved at about the same cost. Many acres of crops in this territory valued at $500 to $1,000 an acre were saved at a total expense for the season's firing of $15 to $20 an acre. There were frequent object lessons of unheated orchards, with the entire crop killed, adjoining heated tracts that had full yields.

One of the most remarkable stories of heater successes comes from Missouri. A 240 acre orchard located in a deep valley had suffered severely from frost every year and had not produced a full crop for fourteen years. Against the advice of all the wise-acres, two brothers from Kansas City bought it, and equipped it with 5,000 heaters of the controlled or graduated fire type. With thirty-five or forty pots to the acre, the firing was done for four nights at the time the apples were in bloom. They harvested a crop of 15,000 barrels, valued at $45,000, and it was the only crop in that fruit growing territory. The net profit on each acre approximated $200. This valley is an excellent fruit growing country, but on account of regular frost damage for many years the industry has almost died. Land has depreciated in value till good orchard tracts are often sold at $40 to $100 an acre. The successful experience of this one orchard will revive a whole fruit growing community.

Modern orchard warming is the effective combination of smudging and actual heating. The principle of air drainage underlies successful frost fighting. Cold air settles, and hot air rises. Heating warms the air; smudging prevents the warmed air from rising, and keeps out the cold currents from above. Frost injury is greatest where there is poor air drainage and the radiation is consequently uninterrupted by clouds or moisture. This is why fruit growers located in valleys had much harder fights against the common enemy in the early history of smudging than their neighbors on higher ground. The cold air settled in the valleys and chilled the life out of their fruit for many years before they discovered the reason.

The definite system of building a multitude of small fires and actually heating "all outdoors" was a long time developing, but when once the idea was born its growth was like a forest fire. When it finally seemed inevitable that the fruit grower must build a fire big enough to heat his orchard, naturally the first fuel thought of was wood, as a result of the burning of smudging materials. It is still successfully used in some sections of the West where cord wood is cheap. The labor of handling it, however, and of keeping the fires going, with the added uncertainty of getting quick enough action to get ahead of the frost, has militated against the general use of wood for large orchards and for all sections of the country. The sticks of cord wood are usually piled along the sides of the orchard at odd times during the winter months when little else could be done. One Oregon grower saved seven acres of Bartlett pears two years in succession by burning old fence rails. Fires of about six pieces of good cord-wood last four or five hours. Constant attention is necessary, for the sticks must be moved forward into the crater of the flame to keep the fire going. With wood plentiful and labor cheap, the cost of maintaining forty fires on an acre may be as low as two to four dollars a night.

Coal was the second fuel to be used, and is still employed with success in the little coal furnaces on stilts or the conical, perforated coal pails. Here again, however, difficulty of firing and handling the coal operate against its use in severe weather. Where the supply is plentiful, and prices low, where the orchard is small and labor easy to get, coal makes a very successful heat if amazing zeal is

THE TWO BUSINESS ENDS OF THE FROST ALARM.
When the thermometer drops to the danger mark, a bell rings at the orchardist's bedside.

used in handling it. It has certain advantages that appeal to many users, in spite of the trouble of handling it. Next to wood it is the commonest and best known fuel, and every one understands its action in combustion. It requires less expensive storage equipment, and the cost of the first outfit is less than for an oil burning plant. The little sheet iron coal furnaces hold about twenty-five or thirty pounds of coal and will burn four to six hours. The cost of heating an acre with about sixty furnaces of this description will average five or six dollars, including labor, interest on the cost of the pots and about 250 pounds of coal.

The little outdoor oil stove has come to be recognized as the dreadnaught of all heaters when it comes to making fires easily and quickly with a minimum of labor and the greatest economy of material. The oil pots can be lighted as fast as a man can walk through the orchard, can be regulated to burn any length of time or any quantity of fuel and at any strength demanded by the weather. When the necessity of fire is past, they can be extinguished and the rest of the fuel saved.

The development of the machinery of orchard heating has been an amazing industrial growth. It has sprung within three years from nothing to an industry employing a score of firms that supply fruit growers with upwards of a million heaters a year. The manufacturers estimate that some two million are now in use. and the next few years will see millions more installed. The value of the heaters now in use is estimated at $300,000. The two leading factories alone have put out in the neighborhood of a million. One of them has a capacity of 10,000 a day and has turned out a half million heaters. There are now some two thousand orchards equipped with these small furnaces. It must be understood that these figures represent an industry that is but in its infancy. When orchard heating has been as generally adopted as spraying they will be many times multiplied.

The first cost of installing an oil heating plant is higher than for a coal or wood outfit, but the results in time saved and efficiency gained have made it the most popular fuel. Oil can be obtained in quantity at prices ranging from four to six and a half cents a gallon, and it makes a quick, strong and easily controlled heat. One man can care for from three to five acres of orchard for four or five hours and this is about as long as it will be necessary to burn under ordinary frost conditions. The prices of the oil heaters range from twelve cents for a simple "lard pail" type to forty-five cents for one of the controlled fire area type, holding three gallons and burning at full capacity for ten or twelve hours, or even longer if regulated for a smaller blaze. Heaters with larger reservoir attachments holding a supply of oil that will burn from thirty-six to fifty-six hours are also manufactured this season, and will be tested out in next spring's frosts.

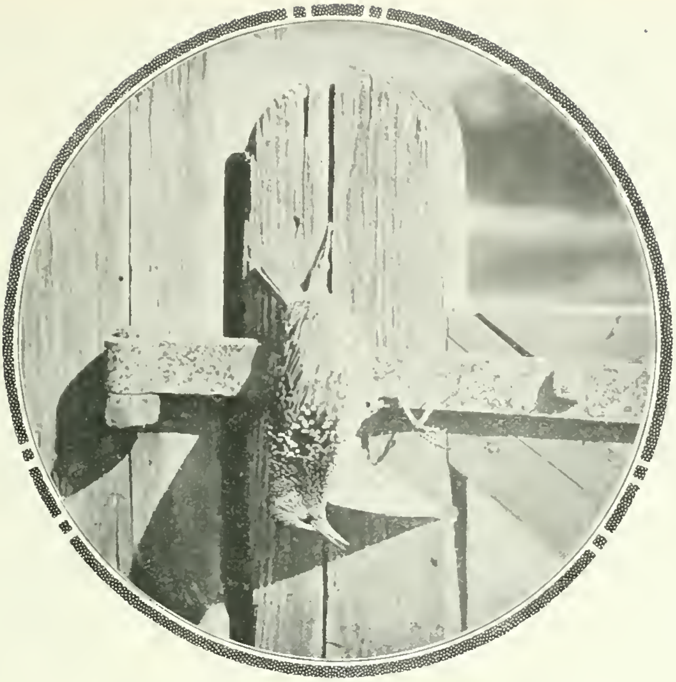
The complete oil heating plant includes a storage tank holding from a thousand to three thousand gallons, and one or two tank wagons from which the heaters are filled. The best of these storage tanks are built of concrete, and are usually placed on a hillside so that the entire handling of the oil is accomplished by gravity. The wagon gets the oil from the tank cars on the nearest side track by gravity, and delivers it through a hose to an opening in the top of the storage tank. An opening on the down hill side of the tank lets it run out into the wagon again when ready for use, and a hose carries it from the wagon tank to the heaters as the wagon is driven through the orchard. A good estimate of the average cost of installing an outfit on an orchard of ten acres is as follows:

Heaters	$200 to $250
One 3,000 gallon cement tank	70 to 75
200 gallon tank for wagon	20 to 22
Four gasoline lighting cans	6 to 6
Three good thermometers	3 to 3
Frost alarm thermometer	20 to 25
Total	$319 to $381

The cost of labor and other items of maintenance and the quantity of oil incident to the operation of the plant will of course vary with the severity of the weather and the number of nights it is necessary to keep up the fires. Generally, however, not more than a few days or a week of lighting is necessary.

The time of greatest danger to the fruit is when the buds are opening and the process of blossoming is under way. Peaches especially have a foolish way of blooming before the leaves come out to protect the tender blossoms. Usually they are in bloom in the last days of March, and our late spring last season would have been particularly disastrous if it had not been for the protection of orchard heating. There are four stages in the life of the fruit bud when the crop may be lost by injury from the cold. The first is that of the fully dormant buds as we find them in early winter. At this time they may safely stand a temperature of eight or nine degrees below zero, Fahrenheit, though there might even be injury at nine degrees if maintained long enough. The second stage is when the growth of the buds begins until they are fully open. This is a very critical period and the buds are even more tender than when fully dormant. The third stage is the time between the opening of the flowers and the falling of the petals. This is the time of the late frosts, and the danger point lies somewhere between twenty-six and thirty degrees above zero. The fourth and last stage begins after the fruit has set and lasts till all danger of cold weather is past. Just after the fruit has formed, when the calyx is beginning to fall, the young fruit can safely endure thirty-two degrees. Beyond this stage the larger the peaches are the less cold they can withstand.

Growers are firm and unanimous in the belief that orchard heating is the greatest advance ever made in battling with the natural elements. By heating all out-doors in the fruit belt, scientific horticulture takes its place abreast of scientific agriculture.



A STARLING WITH ITS FOOT WEDGED IN A CRACK.

TRAGEDIES OF THE BIRD WORLD

By

PAUL GRISWOLD HOWES

Curator of Ornithology and Entomology at the Maplewood Museum of Natural Science, Stamford, Connecticut.

PHOTOGRAPHS BY THE AUTHOR

LITTLE do we realize how many tragedies take place among the birds, for in summer they are hidden from our sight, happily enough, by one or another of nature's kindly screens. But later when the leaves are dropping with that sad rustle of autumn; when the whole country side seems querulous of approaching winter, then if we carefully search among the trees, an occasional victim of the summer's death roll may be found, swaying to and fro with the branches and harmonizing, to be sure, with the sadness of summer's aftermath.

During the early part of last September, during a tramp through the country, I stumbled across a lifeless starling which was hanging from a gate-post with one of its legs tightly held in a large deep crack. The unfortunate bird had evidently alighted upon the rounded top of the post and its foot had slipped into the crevice. Panic-stricken it had made vain efforts to free itself, succeeding only in wedging its limb more firmly into the crack. Here it perished more

CAUGHT BY A KITE STRING.
The untoward end of a purple grackle.

from exhaustion than its internal injuries.

While removing this bird from its death trap, a drop of opaque greenish liquid dropped from its mouth to the ground. Fortunately it landed upon a leaf below and I was thus enabled to remove it to the laboratory for closer examination. Tiny black dots had already been noticed within the greenish fluid, and when placed under the microscope these proved to be great numbers of minute living creatures! Among them a tiny form of water insect, named Cyclops, was recognized which had often been found inhabiting Algae, a slimy fresh water plant. It was evident then, that as the bird had been found close to a small pond, the Cyclops insects had probably been obtained there. A small amount of Algae from the above mentioned pond was immediately collected, and upon examination the same tiny creatures that dropped from the unfortunate starling's mouth were found in it. These facts led to the recovery of the bird which had already been buried. The stomach was carefully taken out, cut open and the entire cavity found to be filled with partly digested vegetable matter which proved to be Algae when placed under the microscope! Why this particular bird chose a vegetable diet at a season when its natural food was so abundant is one of nature's deepest mysteries. Whether or not this had anything to do with the starling's death is left to the imagination of the reader.

Many of our feathered friends accidentally hang themselves while carrying bits of string, horse-hair and sometimes even wire to their nests. As the bird flies into the nesting tree, the string or wire becomes entangled among the branches and in its wild efforts to free the coveted article, the bird is also caught by the foot or sometimes by the neck. In this position it soon expires, perhaps within sight of its own nest, either from exhaustion and lack of food or from strangulation.

A pitiful case of a slow and torturous bird death is shown in the illustration of the purple grackle who caught its foot in the string of a kite, which in its descent had unfortunately landed within a few inches of the bird's nest. Perhaps on coming to its home among the branches, the unsuspecting grackle placed its foot upon the fateful cord which became looped about its leg unnoticed by the bird. Terrified out of its senses at finding itself in the grip of some unknown, invisible power, the bird was soon overcome by exhaustion from its frantic struggles for freedom. Hanging thus in a helpless position, the poor grackle was turned round and round by the wind, each circuit binding its toes more firmly together, and each turn wrenching harder upon the victim's muscles until finally its leg was torn, flesh and bone, from the strained and battered socket. Once a shining, glossy blackbird, but now a twitching mass of clotted blood and feathers, it hung, still alive and writhing; perhaps for days, hidden from us only by the "peaceful" foliage of the countryside in May!

A Myrtle Warbler Spiked on a Laurel Twig.
The work of the butcher bird.

Small birds who occasionally vary their insect diet by eating a certain amount of grain are not infrequently choked to death in attempting to swallow morsels too large for their throats. A starling killed in this manner came to my notice one autumn not many years ago. The bird was found suspended by the neck in a large sycamore, from a crotch some forty feet above the ground. From all appearances, the slight resistance on the part of the bird would have set it free as the neck was not firmly wedged into the crotch and for this reason it did not seem probable that the bird could have perished simply from hanging. However, other causes for its death were sought in vain until as a final effort to clear up the mystery, the bird was recovered and dissected. Upon opening the throat, two large kernels of corn were found, lodged in such a manner as to have shut off the entire air supply to the lungs. After attempting to swallow the corn, the bird may have flown to any branch in the tree, then in its death fall, it might have been caught in a hundred different ways. In this case, only the neck became wedged, giving it the appearance of having been caught and killed in this manner.

Hundreds of thousands of birds lose their lives when the first warm days of spring send them hurrying homeward from the Southland, when the "Storm of Wings" is at its height. For our own safety at least, we have dotted our coast lines and river mouths with tall stone towers and in the top of each we have placed a light which sends its blinding rays, friendly to mankind, but hostile to the bird world, in great sweeping gestures into the night. During migrations, birds follow the coast, commencing their inland journeys from the

The Fate of a Starling, Choked to Death by Field Corn

Always must birds be on the alert, for danger is ever hovering near. Their lives are filled with horrors which we cannot realize. In spring and summer there are a thousand enemies to be reckoned with. Snakes and animals prey upon their eggs and young, cattle trample upon their nests, men destroy their chosen haunts, and even the elements play their part in bird destruction, when heavy rains flood the fields and swamps in which so many build their homes.

The dangers which winter brings are few, but the deaths that occur at this season are merciless. December brings the murderous butcher-bird from the north to spend a part of his worthless life in killing and feeding upon other winter birds. An hour of sunshine after a night of snow brings the partridge from his shelter among the cedars. Off he starts to search for food, leaving the sheltering trees far behind and paying little heed to the fresh snow clouds which are moving rapidly towards the sun. Soon the sky is grey again, the branches sway angrily as if startled by the suddenness of the wind; sleet begins to fall and the partridge is now in danger. Driven by instinct of ages he burrows deep into the snow for shelter. All day and all night the storm rages through the whining trees, twigs and bark come rattling down, then a large dead branch unable to stand the strain any longer, snaps at its base. As it hurtles to earth it blocks the entrance of the partridge's burrow. By morning the bird is trapped: the sleet has frozen and upon the surface of the sheltering snow a hard crust has formed. If a south wind should come bearing a long melting rain, perhaps all would be well, but seldom does a thing come when most needed and the partridge dies a lingering death.

mouths of the larger river valleys, and as they travel for the most part by night, these land marks are reached only at times when the light-houses are sending their warning beacons to sea. These vivid flashes have an irresistible attraction for the feathered travelers of the air. Following up the rays of light they go crashing headlong into the walls of stone. With skulls crushed and bones broken they flutter down, either to the kindly water which soon ends their misery, or to the land where they fall perhaps upon the tortured victims of another hour.

Here they lie, these innocent birds, maimed and wounded in pitiful little heaps, gazing at you from their big clear eyes, seldom uttering a cry; never giving up; but hoping, always hoping, perhaps to be back in their old haunts among the trees and meadows which they will never see again.

TRACING THE CANCER GERM

By

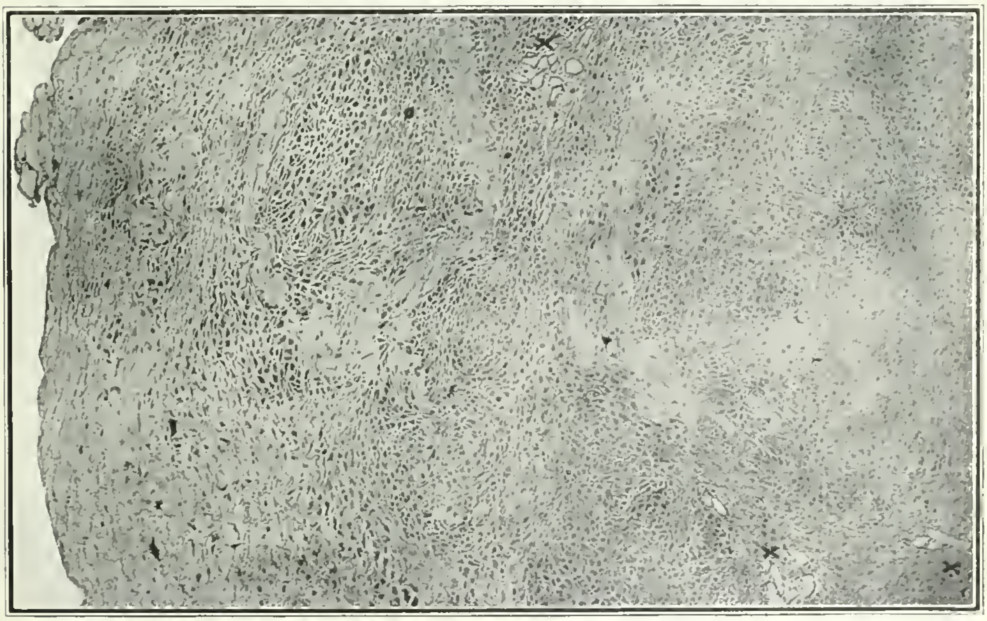
RENÉ BACHE

AT all events, it is the germ of plant cancer. So much is absolutely certain, and the discovery is of great scientific and practical value. But the chief importance of the "find" lies in the hope that it will point the way to a solution of the dreadful problem of cancer in human beings.

Plant cancer is the disease commonly known as "root tumor," "black knot," or "crown gall"—the last of these names referring to the fact that the morbid growths concerned often appear at the top, or crown, of the root. But they frequently occur on the stems, above ground, or even on the leaves.

The malady attacks many kinds of plants. It does a great deal of damage to fruits and vegetables, and has long been known to be highly infectious—so much so, indeed, as to be readily communicable to a healthy plant by the simple process of binding a scrap of tumor tissue upon a fresh wound. Hence it was to be inferred that a specific germ must be accountable for the mischief. But, if so, what kind of germ? That was the puzzle. For a long time all efforts to discover the organism were unsuccessful, and the experts almost made up their minds that none such existed.

This was the state of affairs when, in February, 1904, a New Jersey florist, engaged in growing daisies on a large scale, sent to the Department of Agriculture, for examination, a number of plants of hothouse daisies, both yellow and white varieties. All of them bore



PHOTOMICROGRAPH OF SECTION SHOWING A RAPID SPREADING OF CANCER ON TOBACCO.

The Hothouse Daisy, Which Gave the First Clue to the Plant Cancer Mystery.

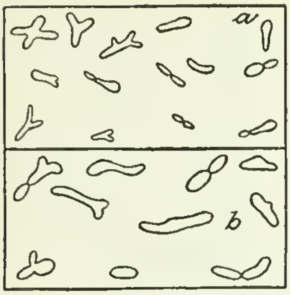
tumor-like growths on one part or another of the stems and leaves. The smaller tumors were green in color, rather smooth, and soft and spongy in texture. As they became older and bigger, they darkened to brown, and grew hard, rough, and corky.

Some of the plants, at the Department, were set out in the "pathologic hothouse"—a sort of vegetable hospital, in which the potted patients are inoculated with various diseases and watched for symptoms—and, while under observation, many new tumors appeared on them. It was decided that the morbid growths could not be due to injury by insects; and there was no sign of any fungus enemy. It seemed reasonable, then, to infer that some kind of bacterial germ was responsible for the trouble.

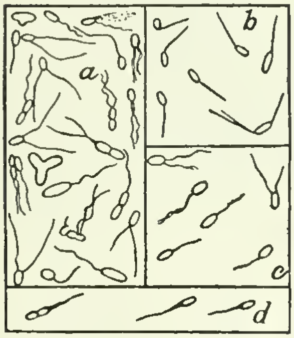
Accordingly, in the hope of finding such an organism, fresh daisy tumors were crushed in beef broth, and small quantities of the latter were used for making gelatin "cultures." The gelatin (poured into glass saucers) afforded a suitable food for bacteria to grow upon, and, as a result, colonies of four different species developed. Three of these were yellow in color, and one was white. The next thing to find out was whether one of these was the tumor-making microbe.

To decide this all-important point, healthy daisy plants were separately inoculated with each one of the four kinds of bacteria. In each case part of the stem was first sterilized (i. e., made germ-free) by washing it with a mild solution of corrosive sublimate. Then the tumor-germ stuff was smeared upon it with a sterile platinum needle, and was thereupon pricked into the tissues with a sterile sewing needle. As a result, nothing happened to any of the plants

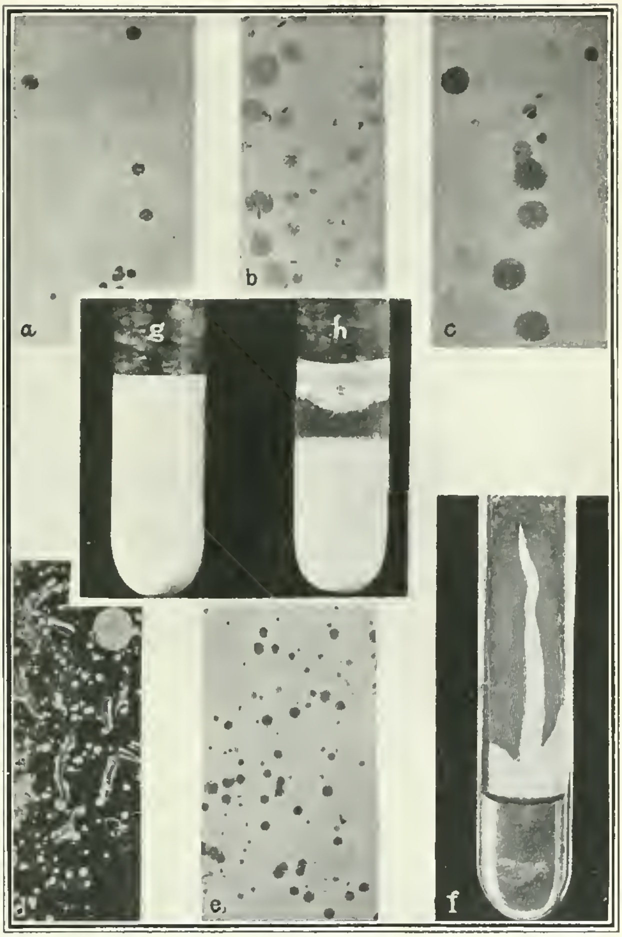
Two Infections of Close Identity.
1, occurs in hothouses, supposed, at first, to be crown-gall; 2, crown-gall infection of young rose.



One Form of Daisy Cancer Germ.



Another Form of the Daisy Cancer Germ.



Cultures of the Cancer Germ.

A, on daisy four days old; b, on daisy eight days old c, peach-gall; d, hard-gall of apple at end of five days, after being used for inoculation; e, same as a; f, daisy organism after a number of days; g, old tube of sterile milk; h, similar tube inoculated for two months with the daisy cancer.

inoculated from the yellow colonies, but those treated with the white culture promptly showed signs of infection. In less than three weeks knotty growths appeared at every point where a white-culture puncture had been made.

Thus it was that the discovery of the germ of the disease which causes tumors in plants was finally made. It was afterwards confirmed by a long series of experiments, the results of which will be summed up later on. Incidentally it was proved that the organism in question—called by the finders, Dr. Erwin F. Smith and Dr. C. O. Townsend, Bacterium tumefaciens—is the same for all plants which the malady attacks. But, in the meantime, it is appropriate to ask why the tumors are called cancers, and what relation they have to the malignant growths so designated in human beings and the lower animals.

Well, in the first place, the plant tumor is in structure so like a cancer that there is really not very much difference between the two. In both cases there is the same enormous proliferation of cellular tissue, often forming nest-like masses. Under normal conditions, in plant or animal, cells of each class have their own particular work to do—the making of secretions, or what not—but in a cancer, or a plant tumor, they are no longer attending to their business, and seem actually to have gone crazy. Even when viewed under the microscope, the structure of a plant tumor is found to differ in no important respect from cancer in a human being.

Just as the tumor disease attacks plants of many species, so does cancer

SUGAR BEETS INOCULATED WITH DAISY CANCER.
Time, four months.

assail all kinds of animals—even fishes. Some plants are exceptionally liable to the malady—the beets, for instance—while others, such as the onion, appear to be immune. It is the same way with animals, and even with families of human beings, some of which develop cases of cancer generation after generation.

Plant tumors, after being removed by excision, have a marked tendency to return. So likewise have cancers in

CANCER CULTURE FROM THE HOP ON SUGAR BEETS.
Time, two months.

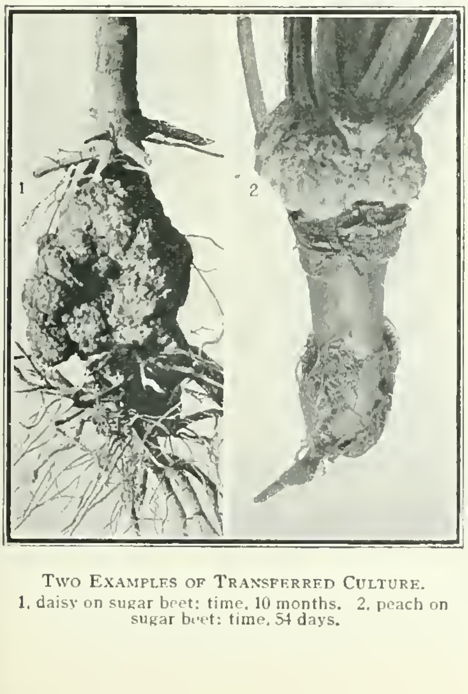
human beings, when they have been cut out. Another, and even more striking, phenomenon is the appearance of later and secondary tumors in plants, some distance away from the first seat of infection—such secondary growths being produced seemingly by the migration of cells from the part originally diseased to other portions of the structure. They are probably carried by the water current flowing through the tissues of the plant. In the same way, cancer cells in man travel through the blood vessels and lymph channels, and start fresh growths in the vital organs—this being the last, and soon fatal, stage of the malady.

In either case the trouble is a malignant overgrowth, due to a vastly rapid multiplication of cells. This growth, in the plant, proliferates indefinitely, and, assuming a parasitic character—just as in man—becomes a wasting disease. It does not seem to be able to obtain enough water and nourishment to carry it beyond a certain stage of development, and portions of the morbid tissue soon slough off, necrosis—death of the part affected—following.

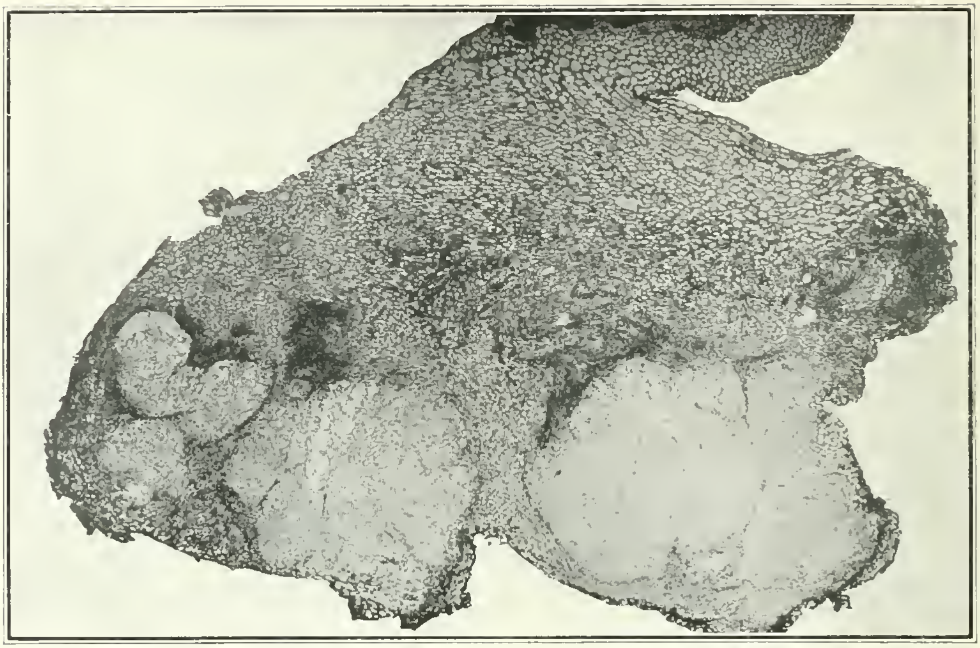
The knowledge, gained as long ago as 1900, that healthy plants could be inoculated with the tumor disease by grafting tumor tissue upon them, placed the vegetable pathologists ten years ago in exactly the same position, in relation to plant cancer, as the animal pathologists find themselves in today with regard to cancer of human beings and other animals. The animal pathologists are able, at the present time, to produce cancer artificially in mice and other animals by introducing pieces of cancer tissue beneath the skin of healthy individuals. But this is as far as they go; they don't know the reason why.

Less than ten years ago the vegetable pathologists imagined that there was no germ of plant cancer, because they could not find it. Today most of the animal pathologists assert that there is no microbe of animal cancer, for exactly the same reason. Yet, it is now known, at last, that there is a specific germ of plant cancer, and the responsible bacterium itself is at this moment imprisoned in bottles at the Department of Agriculture. Does it not, then, seem likely that sooner or later an organism responsible for human cancer will be successfully isolated and identified?

Infection from Peach on Geranium.
Time of development, three months.



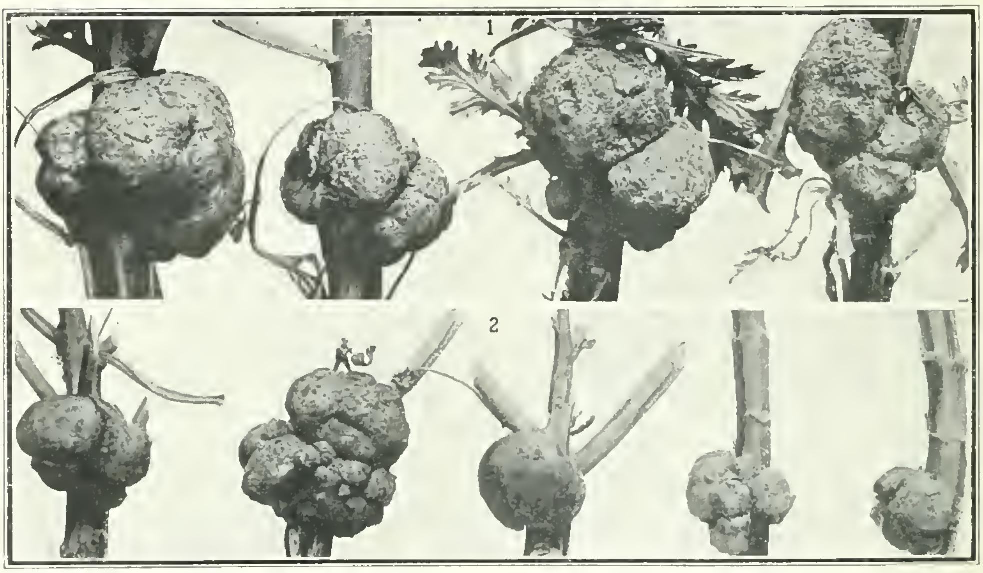
Two Examples of Transferred Culture.
1, daisy on sugar beet: time, 10 months. 2, peach on sugar beet: time, 54 days.



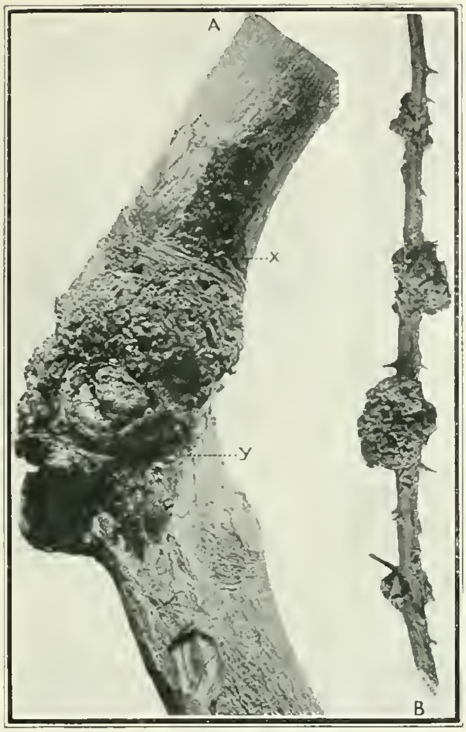
PHOTOMICROGRAPH OF CROSS SECTION OF A DAISY STEM SHOWING CANCEROUS GROWTH.

Taking into view the extraordinary similarity between human cancer and plant cancer, the proved discovery of a microbe accountable for the latter is reasonably good evidence of the existence of an animal cancer organism, even though sought, as yet, in vain.

The germ of plant cancer escaped



PEACH CULTURE ON DAISY.
1, time of inoculation, 5 months, 12 days; 2, time of inoculation 4 months.



A: Limb of Spitzenburg Apple from Oregon Attacked by Hard Gall; B: Destructive Galls on Blackberry.
X, y, blighting areas covered by the bacterial exudate.

Cancer by Needle Prick.
Willow gall was introduced into *salix babylonica*—at left—by this method of transferring germs. Galled quince stem at right.

recognition for so long because, as now fully understood, it is not abundant, and often even rare, in the affected tissues. It is extremely minute, and always hard to see. It multiplies only inside of living cells, which are stimulated by its presence to divide—thereby multiplying—with great rapidity. When attempts are made to breed it, on gelatin or in some other culture medium, it is liable to elude observation, owing to the fact that other species of germs get ahead of it in forming colonies, its own development being remarkably slow.

The Bacterium tumefaciens, or microbe of plant cancer, is described by Drs. Smith and Townsend as a small rod-shaped organism which multiplies by a process of dividing or splitting. By reason of this latter habit, it is technically known as a "schizomycete." It has power of movement, thanks to an appendage called a "flagellum," which it can wiggle.

Dr. Smith is inclined to think that perhaps there may be several races of the plant cancer germ, varying in virulence and in adaptability to different hosts. Sometimes it forms soft, rapidly-developing, spongy excrescences; in other cases, hard and slow-growing tumors. But, apparently, the organism is always one and the same. The microbe of daisy tumor is not different in species from that which attacks the grape, the rose, the carnation, or the carrot. By inoculation with soft tumor of the peach, Dr. Smith was able to produce hard tumors on the apple.

In young, soft, and sensitive plant tissues the effect of artificial infection makes itself manifest almost immediately, and can be seen as a slight swelling about the punctures—made with the inoculating needle—as early as the fourth or fifth day. A few days later small, but well developed, tumors are recognizable.

By the use of infection material from the hothouse daisy, Dr. Smith in nearly every instance produced tumors on the field daisy, the tomato, the chrysanthemum, the potato, the peach, the almond, the oleander, the raspberry, the cabbage, the carnation, the sugar beet, the hop, the grape, clover, alfalfa, and tobacco.

Most important, however, were his experiments of a mixed kind, to show that the organism concerned was always the same organism. This he proved by using tumor cultures from all sorts of plants for inoculating other plants with the malady, indiscriminately, as it were. Having infected the potato with cancer from the daisy, he successfully employed the resulting potato tumors to reproduce the disease in healthy daisy plants. He infected healthy grapevines from sick grapevines, and utilized peach tumors for inoculating the peach, the daisy, the red raspberry, the black raspberry, the sugar beet, the hop, and the rose. Again, he inoculated healthy tomatoes from afflicted hop vines, and, in like manner, imposed the complaint of the rose upon the daisy.

The losses caused by plant cancer are in the aggregate very large. In California, almond orchards are sometimes ruined by the disease, and trees of the so-called English walnut suffer severely. It is also a deadly enemy of grapevines, destroying many a vineyard. In Mississippi, Alabama, and Georgia it does great damage to peaches. On roots of roses grown in hothouses it is prevalent, dwarfing the plants and reducing the number of flowers borne. Beet tumors are sometimes as big as the head of a child, weighing as much as two or three pounds.

Says Dr. Smith: "The best method of dealing with the trouble is the old one of strict inspection of nursery stock, and condemnation of all trees and shrubs found diseased. The nurseryman's remedy lies in careful methods and the prompt abandonment of infected soils."

This is merely the plant end of the problem. But its human interest, obviously, lies mainly in the prospect that this new discovery may lead to a solution of the cancer mystery. Cancer, at the present time, is the only disease that is increasing. It is increasing not only in this country, but all over the world, at a rate which may well cause consternation. After the age of thirty-five, one man out of every seventeen, and one woman out of nine, dies of this dreadful malady, which, if no means be found to check it, bids fair to wipe out those human beings that tuberculosis and pneumonia seem to have overlooked.

Observation seems to show, almost unmistakably, that certain places are infected with cancer. Certain districts, such as the township of Brookfield, close to the center of New York State, are veritable hotbeds of the malady. Certain towns, such as Luckau, in Germany, are similarly afflicted. Certain dwellings have earned for themselves the name of "cancer houses" because of the number of cancer victims they have furnished. These, as well as many other circumstances, point to the existence of a specific cancer germ. If it does exist, the finding of it is a life-and-death problem for humanity.

Most important light upon the matter seems to be shed by the proved discovery of the germ of plant cancer. So much having been accomplished, it seems to be a reasonable expectation that before very long the organism accountable for cancer in men and animals will be identified. Then the cure for this most dreadful of human maladies will soon arrive; for, once secured, the abominable microbe will surely be compelled, through the employment of means already well understood by medical science, to furnish an agent, in the shape of a serum or a "vaccine," for its own destruction.

DUMPING THE PICKED-OVER DEBRIS OF A DIAMOND MINE.

PLANTED DIAMONDS

By

ROBERT FRANKLIN

IN all the history of mining there has been no attempt at "salting" so bold, so ingenious, or so picturesque as the celebrated diamond swindle of 1872, which was exposed by the late Clarence King, at that time in charge of the great geological exploration known as the Fortieth Parallel Survey.

Early in that year reports began to get abroad in regard to a wonderful discovery of diamonds and other precious stones somewhere in the far West—public curiosity on the subject being whetted by concealment of the precise locality. It was understood, however, to be in Arizona. Considerable quantities of the gems, already obtained from the new "field," were exhibited, some of them cut, and others in the rough, in New York City, where certain capitalists were induced to advance large sums of money toward the purchase of the area so rich in a glittering promise of wealth.

In order that every reasonable precaution might be taken, the services of a mining engineer of distinction and undoubted probity were engaged, to visit the new diamond field and make a thorough examination of it. His favorable report, supplemented by the statements of other less-qualified experts, all endorsing the highest estimates of the values of the discovery, seemed to clinch the matter.

Indeed, only the fixing of the exact locality was needed to precipitate a rush of prospectors and adventurers such as might have been comparable to that of the great gold excitement of California in 1849 and 1850. Capital in unlimited amounts was only too ready to embark in so attractive an enterprise, which was of such a character as to appeal strongly to the imagination of the public at large.

Naturally, Mr. Clarence King was in a better position than almost anybody else to obtain definite information on the subject, and it soon came to his knowledge that the wonderful new gem-bearing area was located not in Arizona at all, but in Wyoming, at and about a somewhat conspicuous bluff which, appropriately enough, had been named the Diamond Mesa.

This was within the limits of the transcontinental belt covered by the Fortieth Parallel Survey, which at that time had been practically finished. Accordingly, Mr. King made up his mind to look over the "diamond field"—not with the slightest notion that there was anything wrong about the business, but simply with the idea that a discovery likely to add so importantly to the national wealth was deserving of careful study close at hand. Without delay—fortunately, as it afterward proved—he took two or three of his assistants, and started for the scene.

This was in October, 1872. He left the Union Pacific Railroad at Bridger, Wyoming, and started out on the trail for Diamond Mesa. Arriving there on the second day of November, he began by making a superficial inspection, the result of which was so favorable that afterwards, in his report, he said, "Had our critical work ended with the close of this one day, we should have left the ground confident believers in the genuineness and value of the field." In fact, he and his assistants picked up a very considerable number of gems of unquestionable genuineness, and at the head of a water-worn channel, called Ruby Gulch, which drained the bluff, he gathered from one sieveful of gravel no fewer than forty-two rubies.

On the second morning, however, he began to be suspicious—the circumstances most adversely suggestive being that the diamonds and rubies were all found on the surface of hard rock or hard soil, none of them being procurable from deeper sources. Wherever they occurred in crevices, there seemed always to be signs of recent disturbance, as if by human agency. The most productive gem-bearing area was on and about a place designated as Table Rock, which was literally strewn with precious stones, mostly small. A portion of this area having been marked out, the surface layer of gravel was carefully shoveled off to the depth of an inch, and the material beneath was examined by passing it through sieves and washing it in pans, down to bed rock. Thirty such tests were made without bringing to light a single ruby or diamond.

The head of Ruby Gulch, near Table Rock, was extremely rich in rubies. It was to be expected, then, that they would occur in still greater numbers further down; but examination showed that there were none at all. Four pits were sunk down the gulch at intervals, a couple of tons of material being excavated, and not a diamond nor a ruby was disclosed to view. In the crevices of Table Rock rubies and small diamonds were plentifully found, but invariably with evidence of tampering. Apparently, the gems had been sprinkled upon and about the Rock, with a subsequent smoothing over to disguise the artificial treatment.

The attention of Mr. King was particularly called to certain ant-hills in the ravines on the sides of the mesa, which, interestingly enough, bore rubies. Holes, which had seemingly been punched with a small stick, penetrated these hills—easily distinguishable from the natural avenues made by the insects—and near the opening of each such hole were one or more gems—in some cases diamonds. This was quite remarkable; but it was noticed that in the immediate neighborhood of such ant-hills there were traces of human footprints. There were many other ant-hills which showed no footprints, nor artificial holes, nor precious stones.

On and about Table Rock Mr. King found three small emeralds, four distinct types of diamonds, and quite a number of Oriental rubies, garnets, spinels, sapphires and amethysts—"an association of minerals which"—he said in his subsequent report—"I believe of impossible occurrence in nature."

Having thus satisfied himself that Table Rock and its vicinity had been "salted"—a term familiar in the lexicon of mining frauds—the geologist proceeded to make a series of outside prospects, which were carried out all over the mesa and flanking canyons, until the absolute valuelessness of the property was finally demonstrated.

It was undoubtedly the cleverest and most elaborate swindle of the kind ever attempted. Mr. King, in his report, said: "This was the work of no common swindler. The selection of the geological situation was astonishingly well considered, and the 'salting' itself was most cunning and artful." Indeed, no pains were spared by the organizers of the fraud to make it convincing, and it must have cost them a good many thousands of dollars. Evidence afterwards obtained showed that the diamonds, rubies, and other stones used had been bought in large quantities in London and Paris during the preceding winter. The cheat all but proved an immense success. Had it remained undiscovered until the following spring, great sums would have been wasted in the purchase of the supposed gem-bearing field, and in fruitless prospecting by a small army of disappointed fortune-hunters.

Clarence King, Who Exposed One of the Most Sensational Diamond Swindles on Record.

One of the cleverest features of the whole affair was the successful deception of the engineer already mentioned, Mr. Henry Janin, who, by the adoption of certain ingenious expedients, was prevented, while on the ground, from carrying out his examination of the "diamond field" with the thoroughness he desired. Another man, named Roberts, who had much to do with setting the fraudulent enterprise on foot, though himself honestly persuaded of its genuineness, was an old and well-known Californian, one of the earliest gold seekers, and a mining operator of long experience. Curiously enough, he, who blew the bubble, and King, who punctured it, died on the same day and at nearly the same hour, twenty-nine years later. Their death announcements, with obituary notices, will be found side by side, in parallel and adjoining columns of the New York Times of Wednesday, Christmas Day, 1901.

The whole business reflected the greatest credit upon Mr. King. Those who engineered the swindle—their identity was never positively ascertained—knew his character too well to try to bribe him. An agent of theirs, however, did approach him with an offer of $1,000,000 to hold back his report on the subject for two days—a proposition which, needless to say, he indignantly rejected.

WASHING LAND TO MAKE NEW FARMS

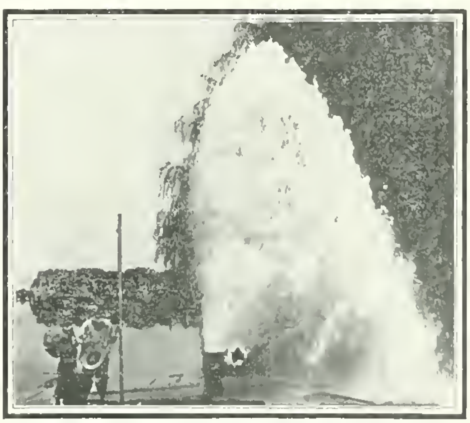
By

LEONARD McKEE

IT sounds queer to say that a drainage engineer is needed down in the Southwest country of these United States where they have to drink the water from the cactus plants, but there is where he is proving the most useful.

These engineers were put on the government payroll along in 1901 when Uncle Sam decided to drain the Florida Everglades. Then Florida thought that she could do the job herself and proceeded to hire about half of the government engineers. About this time somebody decided that a whole lot of land in Arkansas would be good farming country if the water could be drained from it, so the remaining engineers were sent there. Then the irrigation farmers of Colorado discovered that while a little water is a blessing, too much is otherwise, and in their enthusiasm they had been a little lavish with their manufactured rain, so an engineer was sent to them. He made a discovery and several more men were sent to help him experiment. The discovery was simply this: That the great river bottoms and lowlands of the West, which had hitherto been regarded as worth less than nothing on account of the alkali in them could be reclaimed, and that by the very simple process of washing them. The farmers, or ranchmen, for any land is a ranch West of the Colorado-Kansas line, laughed and hooted at the idea of ever farming these alkalied flats. They would admit that a man could even farm without water but for a man to try to farm any of that salt-grass country—that was a joke. Nevertheless the engineers persuaded some men at Fort Collins, Colorado, to try it and the experiment was successful. In two weeks the land was washed clear of the deadly white chemical and now raises its crops the same as the land higher up.

The drainage engineer comes when he is called and not before. If a district sends for him he goes and gives his advice and supervision freely, but he does not go of his own free will and try to induce men to use him. He is too busy now. New Mexico and Arizona are alkalied over practically their entire area, but as there is water only in the river bottoms and artesian belts, the washing has progressed very slowly as yet. The Rio Grande Valley has thousands of acres of land that was farmed for hundreds of years but is now snowy white with the alkali. The Pecos Valley, New Mexico's great artesian belt, has miles and miles of alkali flats, which until recently were fit only for duck-hunting. Much of the land along the Rio Grande is held by big land grants but the land on the



THIS WELL SPOUTS OUT 1,500 GALLONS A MINUTE.
An excellent source of supply for washing alkali off land.

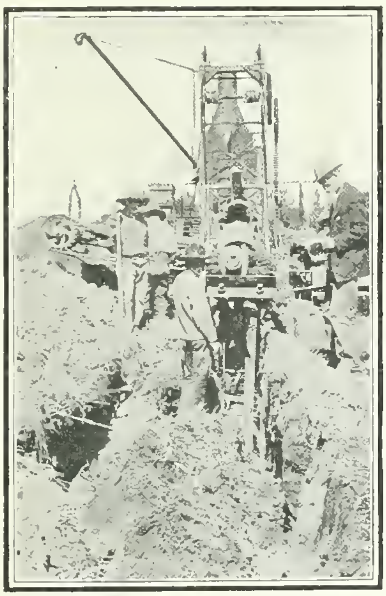
Row of Trees Dead from Alkali.
The others are healthy.

A Paradise of Green Trees.
A few years ago this land was alkali flat.

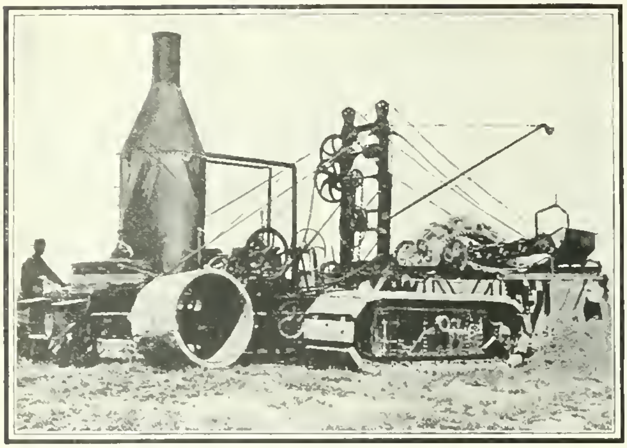
Pecos is owned by individuals and is therefore becoming rapidly developed. There is a drainage engineer on the ground there and he is doing much to aid in the development of this district. A brief description of his work will be of interest.

Many men who have bought land in the irrigated portions of the Southwest now wonder why their crops are dying where last year they grew nicely. In desperation they water them, but the more water they get the faster they die. In the middle of a cornfield is a spot that will not bear, yet the land all around is heavily cropped. One row of trees in an orchard may die for apparently no reason while the trees all about it are perfectly healthy. One side of an alfalfa field may be scraggly and poor while the other bears a heavy stand.

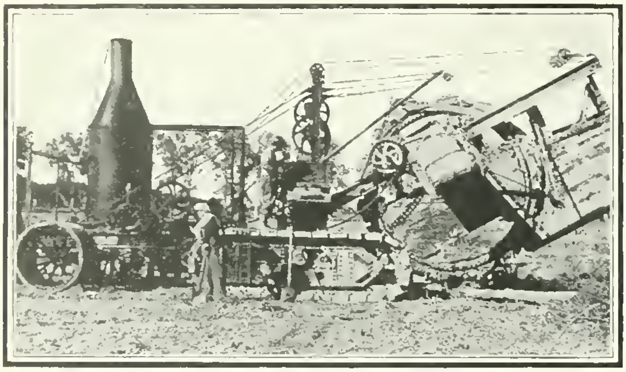
It is alkali. In the fall after the land has been allowed to become thoroughly dry, these spots will be covered with a fine white crust, which will gradually dry and distintegrate and be blown here and there by the wind. About that time the owner of the field will seek the drainage engineer for advice, and he will get it. He will be told that alkali may be calcium sulphate, calcium chloride—occasionally—and even plain Epsom salts. It is taken from its native state far down in the earth and carried in solution by the water that passes over the deposit. In the dry parts of this country the water is being continually drawn toward the surface of the earth by the constant evaporation of the surface water. Now when this alkaline solution reaches the surface of the earth the water is carried off by evaporation, leaving the alkali in its raw state as a crust on the surface. As more water comes up and is carried off more of the white crust is deposited until there may be so much of it that the land will appear to be covered as with snow. Then a rain comes and dissolves a certain amount of the chemical into solution again. Part of this solution is carried away, by the natural drainage facilities, to the nearest stream and so passes out of our story. That which remains sinks into the earth temporarily but



Waiting for the Water to Drain Away.
A bad cave-in, one of the difficulties in digging trenches for land washing.



Side View of the Ditcher at Work.



Side View of the Ditcher as It Stands Idle.

reach the roots of the crops. But in these bottom lands the constant water level is sometimes only a few inches from the top of the ground, which is usually a thick white crust, because of the constant deposit of alkali from below.

A flat like this is meat for the drainage engineer. Any man can buy, or at least he could do it a few months ago, this land for next to nothing. He takes out the laundryman, as we may call the drainage man, and has an estimate of cost of washing and the plans for it made. The engineer, clad in khaki and high-top boots runs levels here and there across the land and decides on the most economical plan of washing. The ditching machine is sent for and the ditch is dug and the tile laid. If the ground is very hard it is roughed up with a disk harrow so that the water will not run over the surface, but will sink in. Then the water is turned on and the laundering begins. The whole area is thoroughly flooded until the water stands on the surface. It is then left to drain. When the flow of water from the outlet of the tile indicates that the land is drained it is flooded again and again. Then it is planted to some shallow-rooted crop such as milo maize for the first year. An orchard may be set out at once but it is the better plan to wait a year. After the first crop the land may be said to be rid of alkali sufficiently for all practical purposes. This land is now worth whatever good irrigated land is worth in that community. The plan is so childishly simple, and yet there are thousands of acres lying along the river valleys of the Southwest that may yet be reclaimed.

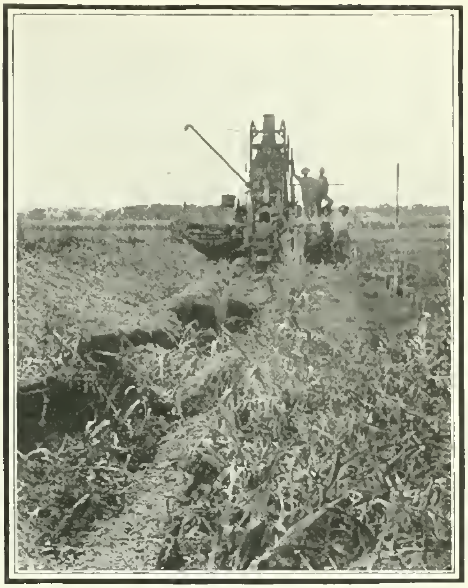
The ditching machine used in the Southwest is a monstrous affair weighing over twenty tons. It is an immense

is gradually drawn out again by the sun.

Now in an irrigated country no alkali may show on the surface for many years. Indeed, the nature of the soil may be such that the water from the surface is carried away by a natural system of subsurface drainage, but in most sections the constant irrigation gradually fills the land up with moisture until the alkalied water coming up meets the surface water coming down and the whole is impregnated with the deadly chemical. The solution at first is weak, but gradually the water from below brings up so much of the alkali that at last the whole is nothing less than a strong solution of calcium sulphate. Even now it may not do any harm, because the natural drainage facilities may be such that the water flow is from above and the alkali may never traction engine carrying behind an arm, from which is suspended a wheel. Attached to this wheel are buckets. As the wheel rotates, each bucket takes a little earth from the ditch, and when the bucket arrives at its highest point the contents are deposited on a belt conveyor and carried to one side. Directly behind the wheel and slightly under it is the shoe in which the tilelayer stands at his work. The machine will dig a ditch eight feet deep at the rate of a thousand feet an hour if everything runs smoothly. On account of the nature of the ground in which it generally works the machine seldom makes over three thousand feet a day. The tile is laid as the machine progresses to prevent the delay that would be occasioned by the continual cave-ins in the wet ground. One or more shovelers follow closely behind the machine and keep the tile well covered so that if the sides of the ditch do cave in the tile will not be displaced. In ground where the constant water level is very close to the surface the tile layer will sometimes be forced to leave the shoe because of the rapid rise of water in it. Operations must then be suspended until the surplus water is carried off by the tile already laid. The total cost per foot of laying tile with this machine is from eighteen to twenty-five cents. The cost of operating the machine is from four to ten cents per linear foot. The total cost of ditching a field amounts to from six to ten dollars an acre as a rule, although on some work it will run as high as thirty and forty dollars per acre.

A few years ago a man bought a section of salt-grass land on the Pecos River. He ditched and tiled it by hand and bored a shallow artesian well. People called him foolish to try to do anything with that land but he spent one summer washing it and today has the most beautiful place in the valley. The land next adjoining his is a barren alkali flat while his farm is a paradise of green trees and alfalfa fields.

Another man, a land speculator, bought eighty acres of creek bottom, heavily alkalied and with the water level but six inches from the surface. It required 8,500 feet of six and eight inch tile to drain it and the ditching company charged him twenty-five cents a foot for



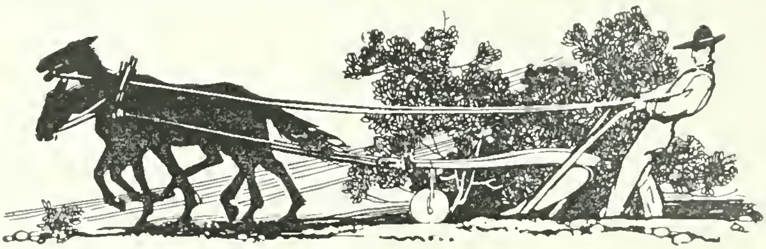
"LIKE DIGGING IN SOUP."
Showing how the sides will cave in now and then.

A BARREN ALKALI FLAT SUITABLE FOR WASHING.

DESTITUTE OF VEGETATION.
An alkalied spot in the middle of a cornfield.

the work because of the treacherous nature of the earth which caved in continually. It was like digging in thick soup, and the tilelayer was forced from the shoe many times a day while the whole crew waited for the water to drain away. The cost was over $2,500 but the job was a success. The land cost the speculator a little over a thousand dollars and, planted to milo maize, it sold for $15,500.

As is usual with anything new, the legitimate farmers who really need the benefit of his knowledge seldom apply to the engineer. The greater part of his work has been done for men like this speculator, who are harvesting the dollars while they may. Now, however, that some one else has shown the way, the land owners are beginning to realize what a big proposition they have. Their alkalied flats and salt-grass bottoms are likely to make them rich. At no cost to the ranchman the government will show him how to raise crops where he thought crops would never grow, and more than that the government will detail a competent man to boss the job and see that the washing is properly and thoroughly done. And the ranchman forgets about state's rights and public domain and shouts for "new nationalism" and the development of our natural resources. His point of view is changed.



Poor Richard's Philosophy

Light Purse, Heavy Heart.

Ne'er take a wife till thou hast a house (and a fire) to put her in.

He's gone and forgot nothing but to say farewell to his creditors.

Great Talkers, Little Doers.

Fools make feasts, and wise men eat them.

To lengthen thy life, lessen thy meals.

Many estates are spent in the getting.

He that lieth down with dogs, shall rise up with fleas.

Tongue double, brings trouble.

MYSTERY OF THE GLACIER

By

EDWIN WALTERS

WHY is the glacier?

It is a question that has been asked ever since men first stood at the face of one of the great ice-fields, that claws its irresistible furrow across the earth's tortured surface, and wondered. Most overwhelming of the agents that change the face of things terrestrial from age to age, it has been least understood by humans because its secrets have lain hidden beneath the immensity of Nature's own endless patience, and our observation has been unable to grasp them from the century-slow signs that have come to the surface.

What causes glacial epochs or ice ages? How often do they occur? What sets a glacier in motion? What causes a glacier to cease to move? What causes a glacier to travel up an incline? What are the relations of glaciers to ice-bergs in a glaciated area? What are the relations of glaciers to stationary ice-fields? How is loess deposited? Why the irregular distribution of bowlders or "lost rocks"? Why are these bowlders more abundant along certain lines?

These and scores of similar questions occur to the inquiring mind. And the answers to some of these questions are not to be found in any text-book, encyclopedia or other publication.

The writer has spent weeks on the glaciers—and months in the ice-fields—of Alaska. Observations were made in that country that will enable us to add a few facts to the world's stock of information on these and kindred subjects.

The cause of glacial epochs is undoubtedly the change in the inclination of the axis of the earth to the plane of its ecliptic, or pathway through space. At the end of an astronomical year the

AN ICEBERG IN TAKU INLET ALASKAN WATERS.

center of the earth is at the same point in space that it occupied at the end of each preceding year. But the angle described by the earth's axis and its ecliptic has increased in one hemisphere and decreased in the other. This change in the direction described by the earth's axis brings one hemisphere towards the sun, and gives it a warmer climate. This change also turns the opposite hemisphere away from the sun, and causes it to have a colder climate—to become more or less glaciated. Thus one hemisphere is constantly passing through a glacial epoch, or ice age. At the present time the Southern hemisphere is much more highly glaciated than is the Northern hemisphere. But let it be remembered that there is always at least some ice near the poles—inside the Arctic and Antarctic Circles.

During these glacial epochs the ice travels about one-half of the way from the poles to the equator—in some instances six-tenths of the distance, or to the thirty-sixth parallel of north and south latitude. How often do glacial epochs occur?

Astronomers have calculated the annual change of the inclination of the earth's axis to be a little less than three-tenths of one second, circular measure.

This change of inclination continues until the described angle increases to twenty-three and one-half degrees—or to the Arctic and Antarctic Circles—and then the change is in the opposite direction. Twenty-three and one-half degrees equal 84,600 seconds. And 84,600 divided by three-tenths equal 282,000. The glacial epochs, on this hypothesis, can not be closer together than 282,000 years. The last glacial epoch in the Northern hemisphere commenced about 241,000 years ago—and ended about 80,000 years ago, an estimated cycle of about 321,000 years.

The change in this angle of inclination is sufficient to change the location of the poles between thirty and thirty-one feet in one year. There is a corresponding change in the location of the equator and the other great circles of the earth.

What sets a glacier in motion?

Snow under pressure becomes ice. A mountain of ice accumulates bulk and height until the pressure at its bottom generates heat. Calculating ice at eight-tenths the weight of water, the pressures at the bottoms of glaciers would be as follows: a glacier 2,000 feet high, 695 pounds to the square inch; 3,000 feet high, 1,043 pounds; 4,000 feet high, 1,390 pounds, and 5,000 feet high, 1,738 pounds to the square inch.

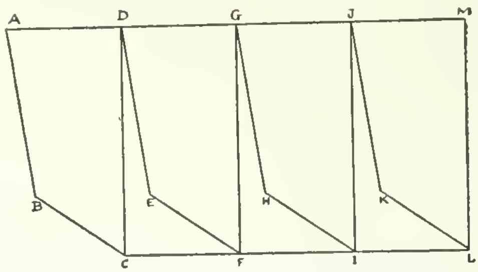


Diagram Illustrating Why Glaciers Move.
The key to letters will be found in the text, page 315.

Whenever a mountain becomes high enough, from the accumulation of snow on its top, to cause the pressure at its base to generate heat sufficient to raise the temperature to the melting point, water then commences to accumulate beneath the huge mass.

This water must escape—have vent. How? Where? On the side next the sun—for the opposite side is much colder, and is closed by frosts.

A number of small streams originate under an ice-mountain. But they gradually merge, and form one large stream. The erosion of the outflowing water on the sunny side of an ice-mountain lowers the surface of the earth on that side. The mountain topples in that direction. Naturally the melting on the sunny side is much more rapid than on the opposite side. So the melting assists in inclining the mountain in that direction. Finally it commences to move down this eroded incline, and becomes an active glacier.

As soon as motion is set up the earth on the sides bulges or buckles up, from the immense pressure and momentum, and forms lateral moraines, or longitudinal ridges, that are outside of the base of the glacier and that parallel its axis. These lateral moraines form a trough which confines the water under the glacier in a continuous stream that

LOOKING ACROSS GLACIER BAY, ALASKA.
Muir Glacier in the distance.

flows in the direction towards which the glacier travels.

Once in motion a glacier will continue to travel until conditions change. Of course if it travels down an incline, its motion may be largely from force of gravity. It is probable that all of the glaciers of Europe, at the present time, are gravity glaciers.

What causes a glacier to cease its motion?

There are at least three causes: (a) the underflowing stream may break through a lateral moraine and escape at one side instead of in front of the glacier. This change in the underflowing stream will leave the glacier "dead"; (b) the glacier may encounter a mountain wall or other obstacle that it can not surmount nor break down, or (c) the immense weight of the glacier, with the rapid lowering in front, as already described, may cause its nose to plow into the earth deep enough to prevent motion. When this last cause operates, motion is usually but temporarily arrested; for the underflowing stream may erode the terminal, or front, moraine until the glacier is enabled to pursue its original course.

When the underflowing stream breaks through a lateral moraine, and the glacier above ceases to move, the erosion ceases in front and increases under the body of the glacier. This under erosion will finally cause the glacier to break in two. By this time the escaping stream has eroded an incline on the side of the glacier down which one piece, or section, of the glacier may take motion at an angle of from forty to ninety degrees from the original line of motion.

What causes a glacier to move up an incline?

Glaciers have traveled from the far North to near the thirty-sixth parallel of North Latitude. They have crossed hills —even mountains. Sometimes they have plowed through mountain ranges, as has the Muir glacier in Alaska. It has cut through a mountain that is at least 3,000 feet high.

Leaving out of consideration a discussion of the explanation of gravity, we may regard the phenomenon from the side of effects only. And so far as effects are concerned, the motion, or cause of motion, of a gravity glacier is easily understood. But what causes operate to propel a glacier up an incline?

When water is at a temperature of

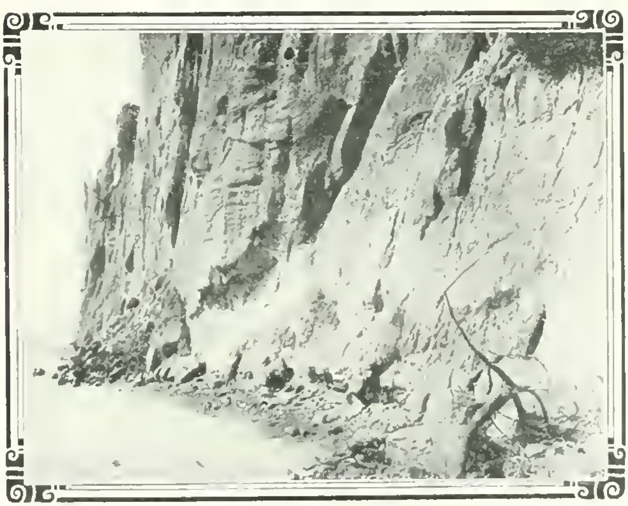
about thirty-nine degrees above zero, Fahrenheit, it is at its greatest density—occupies the least space. The higher it is heated the more it expands; and a piece of ice is much larger at a temperature of 60 degrees below zero than is a piece of the same weight at a temperature of thirty degrees above zero.

The bases of all active glaciers have a temperature of about thirty-four degrees—or two degrees above the freezing point. This is why there is always an underflowing stream. With a temperature of thirty-four degrees above zero at the base and sixty degrees below zero on top, there would be a difference in temperature of ninety-four degrees—sufficient to cause a top expansion of fourteen per cent, or 280 feet in a glacier 2,000 feet high; 420 feet in a glacier 3,000 feet high; 560 in one 4,000 feet high, and 700 feet in a glacier 5,000 feet high. It is evident that a face of ice will not stand at this angle of projection; so a large, prismatic, or rhomboidal, section breaks off and falls forward.

The underflowing stream is confined by the lateral moraines on the sides, by the glacier above and the earth beneath it. When the rear end of the glacier is higher than the front this stream works under hydraulic pressure. But, at all times, the action of hydrostatic pressure is persistently driving the water forward with great force—from beneath the glacier.

When the water rushes from beneath a glacier it encounters the detritus of ice that has fallen from its front face. The pressure forces the water forward and upward between the face of the glacier and the detached pieces. Thus is the lower front of the glacier altered by three processes: by the attrition of the outrushing water; by melting which is caused by the higher temperature created by the water, and by the absorption of water which raises the temperature, and thus contracts the mass—reduces the size—of all the ice penetrated by this extraneous moisture. So these three processes augment the force of expansion in the work of causing the front face of a glacier to project forward.

When a large section of ice falls forward, as already described, it is quickly submerged—or partly submerged—by the outrushing water. The portion under water rises in temperature while the portion in the air remains much colder. This difference in temperature causes a secondary breaking and falling forward of pieces that constituted the original, large detached section. These secondary fragments freeze together at, and immediately below, the water line. So when a piece drops forward it draws or drags the piece immediately behind it until the frozen bond at the water line is severed. This constant dropping forward, and dragging of pieces from behind, enables a glacier to move piecemeal up an incline. As soon as a glacier, that has thus reached a summit, starts down an incline again the immense pressure from behind soon unites the parts into a comparatively solid mass once more.


Where the Prehistoric Glaciers Apparently Stopped, Scarboro Cliffs, near Toronto, Canada.

Of course the element of expansion is indirectly attributable to the sun—the source of all terrestrial heat. But a second cause of motion in glaciers is the direct force of the sun. Place a piece of ice on a hot stove or sheet of hot

A RECORD OF THE COMING AND PASSING OF GLACIERS.
Scarboro Cliffs, showing glacial and inter-glacial strata.

metal. The center of heat is the highest point on the metal; but free the ice and it will start and travel to that high point. Why? (a) The ice will melt much more rapidly on the side next the center of heat, and thus cause the ice to topple in that direction. (b) There is a current of air—a regular upward draft—from the center of heat. The steam generated under the ice "kicks" backward beneath the mass, rebounds against the colder air, rises along the rear side of the ice and immediately presses forward toward the center of heat. This pressing forward of the escaped steam assists in propelling the piece of ice forward.

This first cause—more rapid melting on the sunny side—has a tendency to topple and propel glaciers to that side.

Another cause of motion is capillary attraction. The melting on the equatorial side frees much moisture. Capillary attraction carries this moisture into the body of the glacier. This raises the temperature of the ice on that side, and thus contracts all that portion of it through which the moisture percolates. This contraction on the side next the sun also assists in toppling the glacier in that direction.

Let the diagram represent the front of a glacier. A B C will represent the face. A B indicates the angle of expansion—about fourteen per cent from a vertical plane. B C represents the angle caused by attrition, melting and absorption. Now a fracture occurs along the vertical line C D, and the section A B C D drops forward. After a time C D is altered to D E F. Then comes a break along the line F G and D E F G drops forward. So the succeeding sections are modified, broken loose and fall forward.

What are the relations of glaciers to ice-bergs in a glaciated area?

Sometimes glaciers are in series. The first series moves toward the equator in the manner already described. Some, or all, of the causes herein mentioned reduce these glaciers to stationary ice-fields. A second series, hundreds or thousands of years later, follow over the same lines. Finally the secondaries plow into the ice-fields—the remnants of the first glaciers. They cannot climb over the ice because ice is not plastic enough to form moraines. So the immense masses constituting these second glaciers are added to the remnants of the first ones. Now the ice-field is an immense barrier or dam behind which water accumulates and forms a large lake or inland sea. A third, fourth, or still later, series starts for the equator. When these reach the margin of the lake their sections float in the water and become newly-born ice-bergs. In the last glacial epoch, or Ice Age, such a barrier seems to have extended from somewhere in the vicinity of Sioux Falls, South Dakota, into south central Iowa; thence east northeasterly to a point a few miles south of Chicago, and thence to the Catskill Mountains in New York.

North of this barrier floated thousands of ice-bergs. Many of them ran aground. When the water subsided the final resting place of each ice-berg became a lake. It is a well-known fact that there are hundreds of such lakes in Minnesota, Wisconsin and northern Iowa. These lakes have moraines around their margins except on the side where the ice-berg plowed in—usually on the northwest side.

Extending southward from this barrier was, for thousands of years, an ice-field which was formed from the remnants of older glaciers—i. e., older than those that formed the ice barrier.

The Missouri River, from the mouth of the Platte to the junction of the Missouri and Mississippi rivers, ran under the south edge of this ice-field.

There were numerous ice-streams on this ice-field.

One very important stream seems to have headed in the great inland sea back of the barrier—probably near the location of Indianola, Iowa. This stream flowed southerly to a point near Kansas City.

Along this latter stream were numerous holes through the ice sheet into which water poured. The water, falling from such great heights, bored deep holes in the earth below. One hole at Chillicothe, Missouri, is more than 1,100 feet deep. It reaches from the middle of carboniferous rocks, on the surface, down through the lower carboniferous, the Devonian and probably reaches the Niagara limestone—a member of the upper Silurian. This hole is, of course, now filled with glacial materials. Deep borings around the town prove that the strata are elsewhere undisturbed.

Such holes are not uncommon in what were once glaciated fields.

A stream of water falling through a hole in a moving glacier cuts a slotted or elongated hole, or pit, that may be scores of miles long. But if the ice-field is stationary the water will fall in one spot and make a very deep hole in the earth. I saw a stream that flowed about 40,000 gallons per minute falling through a hole in the Valdez glacier in Alaska, where the ice is about 4,000 feet

FAIRWEATHER RANGE FROM GLACIER BAY, ALASKA.

THE FACE OF DAVIDSON GLACIER, ALASKA.
This is really only a tongue of the Muir Glacier.

thick. This waterfall would generate about 41,000 horse-power! And this energy was expended on a few square yards at the base of the glacier! Would it not bore a hole at a terrific rate?

How is loess or bluff formation formed and deposited?

Probably you have seen the thick deposits of loess along the bluffs of the upper Mississippi, the entire length of the Ohio and Missouri rivers, as well as in other parts of the United States north of the thirty-eighth parallel of north latitude. In Manchuria and other parts of north China this formation is said to be, in some localities, 2,000 feet thick!

To the ordinary observer these deposits appear to be of sandy clay of a yellowish or brownish yellow color. But they are not of clay. A face or escarpment of loess will stand for generations at an angle of from five to eight degrees from a vertical plane, while clay will weather down to an angle of about sixty degrees from that plane. Another peculiarity of loess is its manner of weathering. Its exposed faces weather into semi-cylindrical buttresses that simulate the pipes of an immense pipe organ. These deposits in the United States vary from a few feet to 300 or 400 feet in thickness. It is well known that these deposits were laid down at about the close of the last Ice Age or Glacial Epoch. But what are their relations to glaciers?

There has been much discussion on the subject of loess. Some authors tell us that loess deposits were formed by the agency of wind—as are sand dunes. But there are several objections to the wind theory. One is that shells, pieces of wood, large fragments of rock and other large substances are found in them. These could not have been deposited by the wind. Another objection is the manner in which the grains and particles that compose loess are placed—laid down. The particles that compose a wind deposit are arranged in vortices—each large group forms a vortex or spiral. Now the particles that compose loess are not so arranged; but their large ends are usually all pointing in one direction. This condition indicates the agency of water. But the objections to the water theory have been (a) that they show no regular lines of deposition, and (b) deposits in one place vary much in elevation from other deposits in the same vicinity. It is evident that loess deposits were not laid down in water exactly as were ordinary flood plains.

Loess forms at the mouths of streams that flow across large glaciers or ice-fields. Take the Valdez glacier in Alaska. There are several streams on top, and rushing down the sides of it. As these streams pour off the sides of the glacier they cut deep canyons in the ice. At the mouth of each long stream is a deposit of loess. Sometimes the mouths of these canyons and streams vary several hundred feet in elevation. This explains why loess is found at so many different elevations in the same vicinity. But in order to grind the materials—the earthy and organic matter—in an ice stream to a sufficient fineness to form loess the stream must be long. Short streams that flow down steep ice canyons form deposits of gravel, sand and bowlders—such as are found throughout the United States north of the thirty-eighth parallel. The irregular distribution of bowlders and other glacial deposits is caused by the irregularity of the occurrence of ice streams and crevasses that extended through the ice sheets to the earth below them.

But why are bowlders sometimes more abundant along certain lines? Let us imagine an immense ice sheet scores or hundreds of miles in extent. It is not in motion; but it has an occasional crevasse that reaches to the earth below. It is melting on top—i. e., in the summer seasons. Many streams flow across it and carry bowlders, gravel, sand and other detritus into these crevasses. When these materials fall to the earth the water beneath the ice carries all of the precipitated matter away—all except the heavy bowlders. If the ice above never moves enough to disturb them, but finally melts away, the bowlders will lie on the surface in such lines, or zones, as will describe the location of the crevasse that once existed above them.

The Valdez glacier—near Cook's Inlet, Alaska—is probably the largest glacier in the world. It is seventeen miles wide, one mile high and of unknown length.

The writer spent seventeen days at one time, and four days at another, on this glacier.

A study of the Valdez, Muir, Taku and other glaciers affords data for the following conclusions, with reference to formation, movement, etc.:

1. A body of ice must be very thick before it can become a glacier. It must be so thick, or high, that the pressure at the base of it will generate enough heat to melt ice. Probably not less than 1,500 feet in height would be necessary to create the required pressure.

2. When a glacier, from melting or other causes, becomes too thin to generate sufficient heat at its base to melt ice it ceases to move, and becomes a stationary ice-field.

3. A gravity glacier may be an exception to the two foregoing conclusions.

4. A stream of considerable length on a glacier or ice-field, deposits earthy matter at its mouth. If the earthy materials gathered by the stream are of suitable composition, the matter deposited at the mouth of the stream will be loess.

5. The elevation of a bed of loess corresponds to the elevation of the mouth of the stream or canyon around which it was deposited.

SAN PEDRO, DESPITE ITS HARBOR, DID NOT SECURE LOS ANGELES' LOW TERMINAL RATES UNTIL THE TWO CITIES WERE CONSOLIDATED.

SQUEEZING THE LITTLE TOWNS

By

WALTER V. WOEHLKE

THE eating of an apple without losing possession of the fruit is said to be a very difficult feat. To enjoy the flavor and taste of an apple which the eater does not have at all seems to be even more difficult, except under hypnotic influence. That it can be done, that a diet of non-existent apples can increase the girth and cause the body to grow mightily, was demonstrated by the city of Los Angeles.

Until very recently Los Angeles neither touched the ocean nor the bank of a navigable stream. It was landlocked, twenty miles from tidewater; it had no harbor, and yet it was given low terminal rates on goods shipped from Eastern manufacturing centers, building up a thriving jobbing business by virtue of these low freight rates. Los Angeles was given terminal rates because San Pedro, a little town on the ocean twenty miles south, had a harbor and water competition, but San Pedro did not enjoy the benefit of its own harbor and had to get along without terminal rates. Los Angeles paid less freight on shipments from the East than Tucson or Phoenix, five hundred miles nearer Chicago, because of the water competition at San Pedro, but San Pedro itself had to pay

A Town That Got Justice.
But for a strong and active traffic bureau, Stockton could not have used its water competition to force a reduction of its freight rates into the San Joaquin Valley.

the full rate to Los Angeles plus the high local rate from Los Angeles to San Pedro. Big Los Angeles picked and ate the fruit from San Pedro's tree, and little San Pedro, unable to shin up, had to be satisfied with a windfall now and then. Not until San Pedro gave up its individuality and became a part of the larger city did Los Angeles step aside, and allow San Pedro to taste of its own fruit and obtain terminal rates.

"Unto everyone which hath, shall be given; from him that hath not shall be taken even that which he hath." Were these words aimed at Vested Rights, at the fate of the small towns and their freight rates? Surely, they fit the condition. Throughout the country the largest centers of trade and manufacturing, made large by natural advantages of location and artificially stimulated in their growth by arbitrary concessions in the toll levied upon freight going to or coming from them, are preying incessantly upon the freight rates of their smaller rivals. These secondary centers, in turn, prey upon the still smaller ones, the greatest gain accruing to those communities which have equipped themselves with traffic bureaus, with the weapons necessary to defend and enlarge the freight-rate advantages which lie at the bottom of their prosperity.

Take the case of Los Angeles. When the place ceased to be a border cow town twenty-five years ago and attracted the hordes of climate-seekers, jobbing houses started up, but when they attempted to make connection with the trade in the Southwest, they ran full tilt into the ancient and honorable rate advantages enjoyed by San Francisco. Though Yuma, Phoenix, Tucson and other places were 500 miles nearer Los Angeles, San Francisco wholesalers paid no more freight than the firms of the smaller city and in some cases even less, despite a longer haul.

It is useless and of no purpose to blame the railroads for all the ills the human body, physical and social, is heir of. Like the shippers and the consumers, the railroads are the victims of the radically individualistic, fiercely competitive method by which the freight-rate structure of the country was built years ago. Always the railroads tried to get as much and the shippers to pay as little as possible. Naturally the shipper with the biggest tonnage, taking advantage of competition among the carriers, was able to get his particular rate down to rock bottom and often below. Nowhere else in the world do railroads undertake to move bulk freight, coal, iron ore, pig iron, cotton, lumber, as cheaply as do the American lines. In fact, abroad it is considered economic waste to move ore, coal and other bulk freight by rail when water will carry the burden at one-third the cost. But the Trusts had the big tonnage the railroads wanted, and to get it the carriers had to pare the freight rates down to the bone.

Like the big corporations, so the big cities, having much freight to offer competing lines, obtained for themselves rate concessions that were denied the smaller towns. The law of competition ordained that always the big shipper and the big center should get the first reduction, that the small shipper and the small town, being the least able to resist,

TERMINAL CHARGES IN THE BIG CITIES ARE COSTLY.
Freight yards along the water front of Chicago, the railroad center of America.

should be the first to see their rates go up. For many years the big Trusts and the traffic associations of the big cities have been employing "rate-sharks," freight rate experts, to see that the railroads came through with all the reductions lying around loose in the general offices, but it is only within the last year or two that the smaller towns have begun to fight the devil of high freight rates with the fire of expert advice. How important this self-help is in the development of any community was shown by the long fight of the Los Angeles jobbers through their traffic bureau for a share of the San Joaquin Valley wholesale trade, practically monopolized in San Francisco's hands through lower freight rates.

The San Joaquin Valley lies between San Francisco and Los Angeles, the latter city maintaining that, on account of a shorter haul, it was entitled to lower rates than San Francisco into the valley's southern end. But San Francisco claimed the trade of the entire valley for its own —and made good through lower freight rates. From Los Angeles to Tulare, for instance, the distance is 231 miles; from San Francisco it is 240 miles. On a ton of sugar to Tulare, Los Angeles had to pay $12.80: San Francisco, with a slightly longer haul, got off with a charge of $11. Therefore it could underbid Los Angeles nearly two dollars a ton. The same handicap against Los Angeles prevailed right through the list, from hats, shoes and clothing to hardware and groceries, thus insuring San Francisco's control of the valley's trade.

For ten years the traffic bureau of the Los Angeles jobbers fought for an equalization. In 1907 victory at last was in sight. Like Barkis, the railroads were willin'. They made the changes, lowered the rates out of Los Angeles and had the new tariffs printed when the watchful traffic men of the San Francisco wholesalers got wind of the action. Immediately they sounded the tocsin, the shippers put the screws on the railroads, protested vociferously, threatened reprisals and—presto, the railroads yielded to the pressure and suspended the proposed new tariffs. San Francisco remained master of the situation.

In 1910 the traffic bureau of the Los Angeles jobbers brought suit before the State Railroad Commission to force the carriers to grant the desired reduction. Despite San Francisco's desperate resistance Los Angeles won out. Freight rates into the valley were readjusted on a mileage basis, giving Los Angeles an advantage of forty cents on a ton of sugar into Tulare, midway between the warring cities, similar reductions applying to all other classes of freight to points south of Tulare. Though the reductions amounted to only a few cents per hundred pounds, they were of sufficient influence upon jobbers' profits to make Los Angeles firms paramount in a territory with a trade estimated at fifteen millions a year.

In the great rate game Los Angeles, like every up-start center eager for business, had to fight its older and larger rival for every inch of territory. In turn, Los Angeles did its best to absorb the wholesale trade of the smaller towns in its vicinity by unobtrusive rate juggling. One instance will be sufficient to show the method of benevolently assimilating smaller towns' trade, a method in favor among large cities the country over.

Since the days when the town was a station on the overland stage line, San Bernardino, sixty miles inland from Los Angeles, had been doing a modest wholesale business with the irrigated and mining districts surrounding it. San Bernardino had no terminal rates. It had to pay the full transcontinental rate to Los Angeles plus the local rate from Los Angeles to San Bernardino. On iron pipe, for example, Los Angeles paid 65 cents a hundred from Eastern mills. San Bernardino, sixty miles nearer to the mills but eighty miles from tidewater, paid 85 cents, the Los Angeles rate plus the local rate of 20 cents for the imaginary back-haul. Nevertheless, within narrow limits San Bernardino could compete with Los Angeles because it had a local rate to nearby points 20 cents cheaper than the rate out of Los Angeles to these points.

A few years ago a fuel dealer who had built up a nice little wholesale business in blacksmith's coal with the mining towns on the desert fifty to a hundred and fifty miles east, suddenly saw the trade slip from his fingers. No matter how close to actual cost he offered his coal, Los Angeles dealers always underbid him. Hunting for the cause of this fierce and successful competition, the dealer stumbled upon a new tariff issued by the railroads, and this tariff furnished the reason.

To Daggett, ninety miles from San Bernardino, the dealer had been paying 57 cents a hundred pounds on blacksmith's coal; under the old tariff Los Angeles had been paying 80 cents for a haul sixty miles longer. The new tariff "equalized" the two rivals by raising San Bernardino's rate to the Los Angeles charge, 80 cents. Outbound local rates being equal, the San Bernardino dealer was frozen out of the field by the inbound through-rate from the East, having to pay $4.60 per ton more than his Los Angeles competitors. Los Angeles, its freight rate expert smiling contentedly, fell heir to the small town's jobbing trade, the "equalization" having been general all along the line.

The sudden withdrawal of anything, be it a baby's rattle, a chair about to be occupied or a favorable freight rate, has an irritating effect upon the temper of the loser. Though it seems barely believable, the railroad men who make the freight rates are almost human. Like the general run of humanity, they resent cussing and roasting if they can afford resentment, and the harder the little fellow's kicks, the less they feel inclined to accede to the demands of the kicker. The hotter the protests of the individual San Bernardino merchants, the less satisfaction they received. Finally they turned to the State Railroad Commission for relief, but the Commission, finding state and interstate matters mixed in the complaint, referred the plaintiffs back to the railroads and advised them to hire a rate expert to straighten out their troubles.

Never before had a small town of only 10,000 inhabitants attempted to maintain a fully equipped traffic bureau, but the San Bernardino Merchants' Protective Association, seeing no other way out, plunged boldly into the venture, hired an experienced traffic man of long railroad service and set him to work. The maintenance of the traffic bureau cost about $4,000 a year. Did it pay? In less than a year the expert, without costly law suits or expensive hearings before the Commission, without threats or bluster, had checkmated the aggression of Los Angeles, had regained and in a few cases increased San Bernardino's advantage over the larger city in out-bound local class rates on all three railroads, had obtained favorable readjustment of a score of commodity rates affecting the budding industries of the town and had saved the fuel users of the city $25,000 a year by bringing about a reduction of the fuel oil rate from $1.70 to 80 cents per ton. Redlands, ten miles from San Bernardino, is still paying $1.60 per ton on its fuel oil, not having an expert traffic man to play in the rate game.

The value of the freight-rate expert to the larger cities is conceded. Few of the big business centers get along without a traffic organization and several of them, like St. Louis, consider traffic bureaus of such advantage that they maintain two full-fledged ones. A traffic bureau pays, in increased trade as well as in increased harmony between the railroads and the shippers. Having had experience on both sides of the fence, the rate expert acts as a buffer between the contending parties, moderating and deflecting the shocks coming from either side. And if expert knowledge in traffic matters is of value to the favored large center, it is of still greater benefit to the aspiring small city. Being continually on the defensive against the aggression of its grown-up, greedy rivals, the small city needs all the technical rate knowl-

SEATTLE IS ADVANTAGEOUSLY SITUATED FOR WORLD-WIDE COMMERCE.
Water competition ordinarily compels the railroads to give a city so located more favorable rates

THE FREIGHT YARDS AND SHIPPING OF SAN PEDRO.

edge it can get to hold its own, to make the most of its resources and opportunities.

It was a strong and active traffic bureau that enabled Stockton, a city of 30,000 inhabitants seventy miles inland of San Francisco on the San Joaquin river, to take advantage of the opening left by San Francisco and Los Angeles in their squabble over the San Joaquin Valley trade. Stockton was nearer to the valley than either of the contending parties. On the broad and deep San Joaquin there was water competition, but without a traffic bureau to play the trumps in the hand of Stockton it would have been left out in the cold while the two big cities divided the spoils. By intervening in the quarrel, by making its voice heard and by cleverly leading its high cards, Stockton pulled out an advantage, a differential over San Francisco that it could not have obtained had it relied upon the individual jobbers to take expensive action. In the meantime the fight of the big cities—and the success of the small ones in gaining rate advantages—stimulated Fresno and Bakersfield, the two largest towns in the valley, into action. Both of them have organized traffic bureaus and are preparing to use the new weapon in carving out a slice of the trade for themselves.

The railroad world is deeply troubled these stirring days. Great, radical changes are impending in the complicated structure of the eighty billions of separate rates that clutter the tariffs of the carriers. During the past twenty years the primary object of governmental supervision has been the prevention of discrimination between shippers, an attempt to protect the small shipper against deviations from the published rates in favor of his more powerful competitor. In a measure, this object has been attained, at least so far as it is possible of accomplishment under present conditions. Just now a second era of regulation is beginning, an attempt to remedy some of the most glaring examples of discrimination between communities rather than between individual shippers.

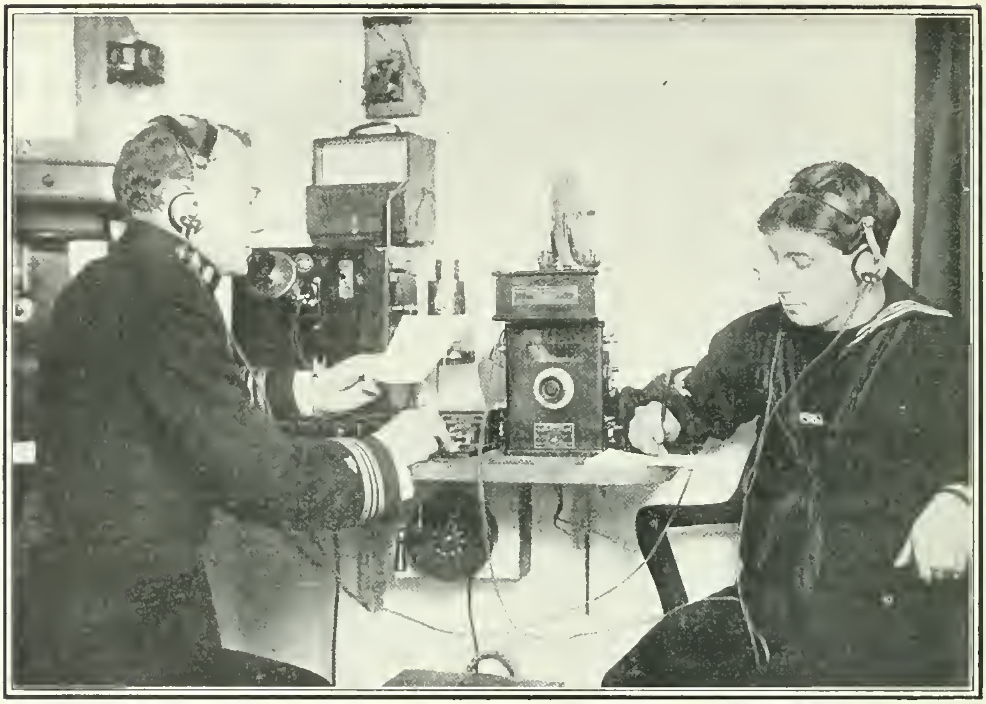
This new problem in regulation presents ten times the difficulties of the old rebate question, but it must be solved. Already the uprising of the communities discriminated against is beginning, especially in the West, from the Canadian line to Mexico. The traffic bureaus, all of them organized but recently, of half a dozen inland cities, of Reno, Spokane, Tucson, Phoenix, Boise, are busy following up the advantage gained by the reduction of freight rates ordered by the Interstate Commerce Commission in favor of Spokane. All of these cities, all the communities of the vast territory between the Rocky Mountains and the Pacific, have to pay higher freight charges for a shorter haul than the Coast cities whose terminal rates are lowered by water competition. The Coast cities, of course, are fighting against the reduction in favor of inland towns, fighting hard on the side of the railroads. They are fighting for their vested right, for a low freight rate, long continued, becomes a vested right. Upon it factories and warehouses are built. Shift it to some other point, and the factory or the warehouse is badly crippled.

Upon the Pacific Coast a sharp struggle between capital and labor is in progress, a struggle gaining in intensity and spreading from Mexico to Canada. At the bottom of this struggle lies the freight rate, or rather the readjustment of freight rates in favor of the smaller inland cities of the West. So long as the Coast cities enjoyed comparatively low freight rates caused by nominal water competition while the interior points were smothered by back-haul differentials, the Coast cities transacted a vast and lucrative wholesale business in goods manufactured in the East. Now this rate supremacy is vanishing. They begin to realize that a large share of the distributing business is bound to go to interior points, sooner or later, and they are preparing to regain the lost ground by shifting from the jobbing to the manufacturing business.

Hitherto the West has been too busy mining, grazing, felling timber, producing the raw material, to pay much attention to the manufacture of the goods, of the finished products it consumes. The market for these finished products is growing rapidly and the wholesalers of the Coast cities are preparing to supply this market with goods made at home instead of hauling the goods across the continent. What raw material cannot be had from the mountains, forests and plains, the Panama canal will furnish at low rates. But cheap raw material is only one factor in manufacturing. To compete successfully with goods sent from the East via the canal, the labor cost must be reduced. Through the Panama canal a flood of cheap European labor is expected, but to be sure of taking advantage of this flood, capital is engaged in a struggle with labor to assert its supremacy against the hour when ten times the present supply of labor will be needed.

It will be impossible to eradicate all the flagrant discrimination in freight rates between communities. An attempt to introduce a tariff based solely upon distances would ruin the industries of New England and of Pittsburg, would be a remedy worse than the evil it is to cure. But a readjustment within certain limits is coming, and this readjustment will be in favor of the smaller towns. Already the Texas Railroad Commission has been weeding out discrimination against small towns whenever brought to its attention, and many of the little Texas communities have taken advantage of the opportunity to attract new industries and enterprises. In Kansas, likewise, Governor W. R. Stubbs is championing the cause of the small town. As population follows the low freight rate, he is anxious to stimulate the growth of the commonwealth evenly, as opposed to the development of one or two large cities.

There is still another factor working in favor of decentralization, in favor of the smaller jobbing and manufacturing centers. In the large centers land values are increasing by leaps and bounds. Every year more room for terminal facilities, both freight and passenger, is needed, and every year it becomes more costly and more difficult to provide this additional room. The freight congestion in the yards of Pittsburg and other centers during the height of prosperity in 1906 gave warning. Every year the terminal charges at the big centers are growing, are eating a larger hole into the carriers' revenues. A point will be reached—and in some cities has almost been reached—where terminal costs will become prohibitive, forcing the carriers in self-defense to divert some of the business to smaller places where terminal charges are less expensive.


STAFF OFFICER—AT LEFT—ON AN AMERICAN BATTLESHIP SENDING A WIRELESS MESSAGE.
His assistant is receiving a message.

WORLD'S DEBT TO WIRELESS

By

CHARLES FREDERICK CARTER

By the law of the land no vessel carrying fifty or more persons, including passengers and crew, may leave any port in the United States on a voyage of more than two hundred miles after July 1, unless it is equipped with wireless telegraph apparatus capable of transmitting and receiving messages over a distance of at least one hundred miles, day or night, in charge of a competent operator.

No sleek and stealthy lobby, dispensing cigars, champagne and sophistries with lavish hand, accelerated the passage of this law. The statute was enacted because it provided a safeguard for travelers by sea so efficient and so obviously needed that even a congressman could not fail to perceive the wisdom of voting for it.

Even without the strong encouragement of the law, without any influence whatever beyond the cold logic of achievement, the world's installation of wireless telegraph apparatus had grown to a grand total of 1,520 stations on ship and shore, exclusive of foreign warships and amateur outfits, up to October 1, 1910, according to a directory compiled by the United States Navy Department. Of this total, 821 stations were on steamships, yachts and tugs throughout the world. Of the shore stations the United

States had 206, of which eighty-eight were on the Atlantic and Gulf coasts, forty-eight were on the Great Lakes, fifty-one on the Pacific coast, sixteen in Alaska, and three in the interior. The United States Navy had 344 ship and forty-seven shore stations, the army thirty shore and sixteen ship stations.

In 1909 the Marconi Company transmitted between ship and shore messages aggregating 519,000 words. The trans-Atlantic business ranges from 50,000 to 75,000 words a week. The British Post-office Department reported that in the three months ending October 1, 1910, twice as many wireless messages were sent and received as in any other corresponding period. As the first step toward establishing a ring of wireless stations completely encircling the United Kingdom, the government has purchased the stations already in operation. The New Zealand government recently asked for bids for erecting five wireless stations, while fifteen new wireless stations now being constructed along the Amazon and Paraguay rivers in Brazil will be in operation before the end of the year.

This staid and perfunctory catalogue by no means includes all the activities of the radio-telegraph. It is now used for such strange and widely different purposes as keeping trawlers in the North Sea posted on the state of the fish market and for giving the correct time to vessels within three thousand miles of the Eiffel Tower in Paris. On May 24, 1910, the French government began sending out time signals at midnight, at two minutes and again at four minutes past the hour. These time signals are expected to be of value to navigators by enabling them to correct daily any possible variations in their chronometers. A still more important application of the radio-telegraph is rendered possible by the Bellini-Tosi wireless compass by means of which the direction from which a wireless signal comes and also the approximate distance may be determined. This is a most valuable invention, for by this means a vessel approaching land in a fog may be directed so as to avoid danger of running ashore.

Yet it is only ten years since Marconi installed the first wireless telegraph outfit on a merchant vessel for regular service. Such a growth could hardly have been attained in so short a time by any mere money-making device. The wireless telegraph has progressed so swiftly because to its solid commercial worth

WIRELESS SERVICE ON AN EXPRESS TRAIN.
An experiment that was made on the Lake Shore Railway.

GERMAN PORTABLE WIRELESS TELEGRAPH SYSTEM FOR MILITARY USE.

there has been added an extraordinary list of spectacular achievements in effecting the rescue of persons on sinking ships. It would probably be nearer the truth than such sweeping generalizations usually are to assert that within the ten years of its commercial career the wireless telegraph has saved more lives and more property than any other invention ever has in the same length of time; but to support the allegation by official statistics is out of the question for the sufficient reason that no one has ever thought it worth while to keep a record of the instances in which the wireless telegraph has played a part in rescuing disabled vessels or those on board of them from the merciless action of the seas.

All the government publications, yearbooks and almanacs, which are so overwhelmingly and minutely informative concerning things that no one really wants to know, are totally silent regarding the very important rescue work of the radio-telegraph. Ask any of the men in London or New York who ought to be primed with statistics on the subject and the best you can get is a guess. One such guess, which has received the indorsement of several men prominently identified with marine interests and which may, therefore, be given for what it is worth, was hazarded by Chief Engineer Frederick M. Sammis, of the Marconi Wireless Telegraph Company of America, who estimated the value of ships and their cargoes in all cases up to December 1, 1910, in which the wireless telegraph was used to summon assistance to vessels in distress, at one hundred million dollars, and the number of lives involved, which may thus be said to have been saved, at approximately ten thousand.

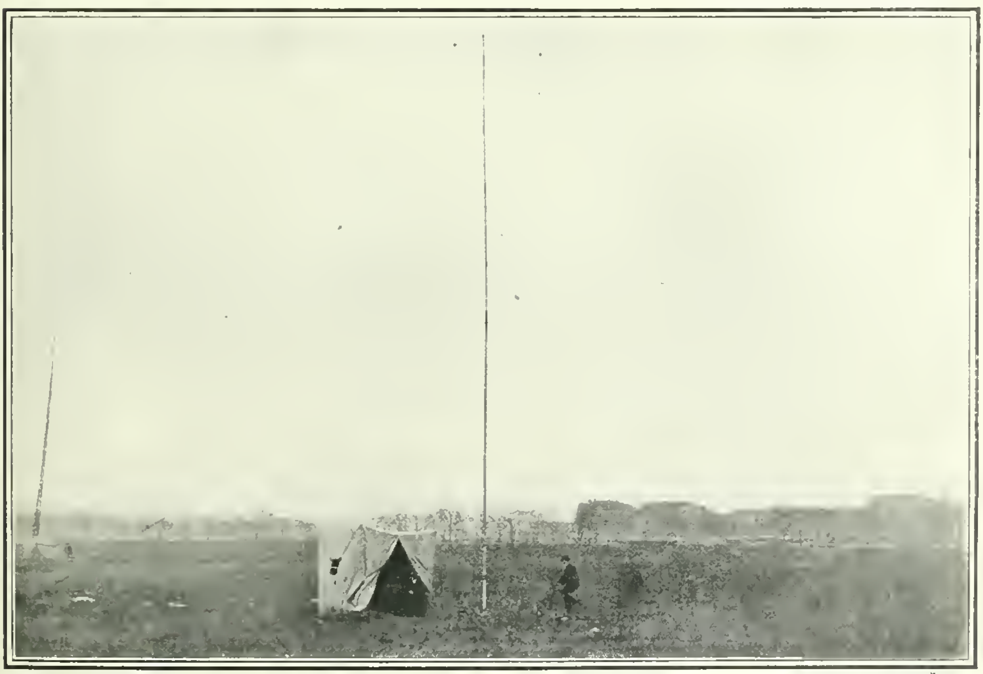
GUGLIELMO MARCONI.
His perfected apparatus made long distance wireless possible.

But there is one source which, while far from complete or satisfactory in many of the details we should like to know, is specific as far as it goes; and that is the daily newspaper file. From this source it is possible to learn that during the year 1909 at least twenty-four steamships, after accidents of various kinds, sent out appeals by wireless telegraph which brought assistance with admirable promptness. Taking the more conservative estimates, the aggregate value of the vessels and their cargoes saved from probable, and in some instances certain, loss was in the neighborhood of $11,775,000. Including six other cases in which the vessels were lost but their passengers and crews, or most of them, were rescued, no fewer than 5,215 persons may be said to owe their lives to the wireless telegraph in the year 1909. Here is the list so far as it is ascertainable, as explained above, with the estimated value of ship and cargo and the number of persons on board who may be said in all truth, to have been saved through the direct agency of this modern marvel, wireless:

VESSEL	Value of Ship and Cargo	Lives Saved
Colorado	$ 500,000	100
City of Racine	750,000	200
Walcott	60,000	*10
South Haven	750,000	100
Hamilton	600,000	150
Slavonia	1,500,000	*500
Frederick	350,000	90
Mackinaw	600,000	200
Henry S. Crosley	125,000	*15
The Helen	300,000	*70
Arapahoe	550,000	240
Carib	400,000	100
Antilles	1,000,000	165
City of Atlanta	250,000	*175
Zeaburg	290,000	*30
Iroquois	550,000	100
Excelsior	75,000	*30
Algonquin	650,000	*200
Arizona	300,000	40
Nueces	350,000	100
Puritan	500,000	150
Herida	750,000	150
Bertha	500,000	225
Scotland Lightship	75,000	25
VESSELS LOST.		
Republic	......	1,650
Ohio	......	70
Ocean Queen	......	250
Crown	......	23
George L. Drake	......	7
Horatio Hall	......	50
Totals	$11,775,000	5,215

*Estimated.

It may be that some folk whose knowledge of the sea and its perils is limited to what may be gleaned in the course of an annual voyage to Europe on a big modern liner may think shipwreck a rare thing, and the foregoing estimates of the service rendered by the radio-telegraph, therefore, exaggerated. To such skeptics it may be said that Lloyd's Register of British and Foreign Shipping, an unimpeachable authority, reports 557 steam and sailing vessels of one hundred tons or more totally lost during 1909. This gives a wreck at an average interval of fifteen hours and forty-three minutes throughout the year. The aggregate tonnage of these vessels was 588,063 tons. Valuations are not given in Lloyd's Register, but it may be ascertained that in 1909 contracts were taken by British shipyards to build good sized, well fitted tramp steamships at $24.58 per ton of dead weight capacity. The value of the *Republic*, lost in January of that year, figures out at $100 a ton. A fair average for the miscellaneous lot of vessels lost, therefore, would probably be $50 a ton, which would give a total loss of $29,403,000 for the ships exclusive of



A PORTABLE STATION IN OPERATION NEAR BERLIN.

cargo, and excluding vessels lost in the Great Lakes. It may be seen, therefore, that there is no lack of opportunities for the radio-telegraph to avert or mitigate disasters.

If it is not possible to quote authoritative totals in appraising the benefits conferred upon commerce by the radio-telegraph there is no lack of individual instances which may be cited to prove its worth. Perhaps, after all, that may be the better way of arriving at a true conception of the service the wireless telegraph has rendered to the world.

At the very outset of its career the wireless telegraph demonstrated its usefulness. An experimental outfit placed on the East Goodwin Lightship in the English Channel in December, 1898, was the means of saving several vessels and a number of lives. In the case of one steamer which went ashore on the Goodwin sands evidence introduced in an Admiralty court proved that by means of one short wireless message property worth $260,000 was saved.

One of the earliest merchant ships to be equipped with the Marconi apparatus was the Belgian Royal Mail steamship *Princess Clementine*, plying between Ostend and Dover, which received her installation in November, 1900. At the same time a land station was established at La Panne, near Ostend. On New Year's day, 1901, the *Princess Clementine* discovered the bark *Medora* stranded on the Ratel bank. A message was at once sent to La Panne, and before proceeding the *Princess Clementine* was able to tell the shipwrecked sailors that help was on the way. On the same trip the Roytengen Lightship, fifteen miles from Dunkirk, signalled the *Princess Clementine* that the lighting apparatus was out of order. A wireless message from the *Clementine* to La Panne enabled the lighthouse department to send out to the lightship and make repairs in time to have the lights in service that night.

From this promising beginning a steadily growing record of practical usefulness led up to a spectacular climax at 4 o'clock on the morning of January 23, 1909, when the Italian Steamship *Florida*, blundering through the fog sixty-five miles southeast of Nantucket, crashed into the White Star liner *Republic*. In a few minutes Operator Jack Binns had sent out from the *Republic* the "C. Q. D." call which has attracted more attention from the general public than all the other thrilling incidents in the history of the wireless telegraph combined. What was more to the purpose, it also attracted the attention of no fewer than five big liners within a comparatively short distance, not to mention two revenue cutters, all of which hastened to the rescue, arriving in time to take off the passengers and crew of the *Republic* and the passengers of the *Florida*, aggregating 1,650 souls. In this case the wireless telegraph not only gave the alarm but it played a vital part in guiding the rescuers through the fog, which was so dense that the *Baltic* had to grope about in circles for twelve hours before the *Republic* was finally reached. For thirty consecutive hours Binns sat with the telephone receivers which form part of the receiving apparatus strapped to his ears, keeping up communication with Siasconset Station and with other ships almost up to the time the *Republic* went down.

That was a fine exhibition of courage and devotion to duty, but Jack Binns has been surpassed in this respect by more than one wireless operator on sinking ships. When the steamer *Ohio* struck on a submerged rock in that marine graveyard off the Alaskan coast August 27, 1909, Operator George E. Eccles immediately began sending out signals of distress. He stuck to his key until the ship went down and he was drowned, though the steamships *Humboldt* and *Rupert City*, responding to his calls arrived in time to pick up the one hundred and forty passengers and most of the crew before the small boats were swamped.

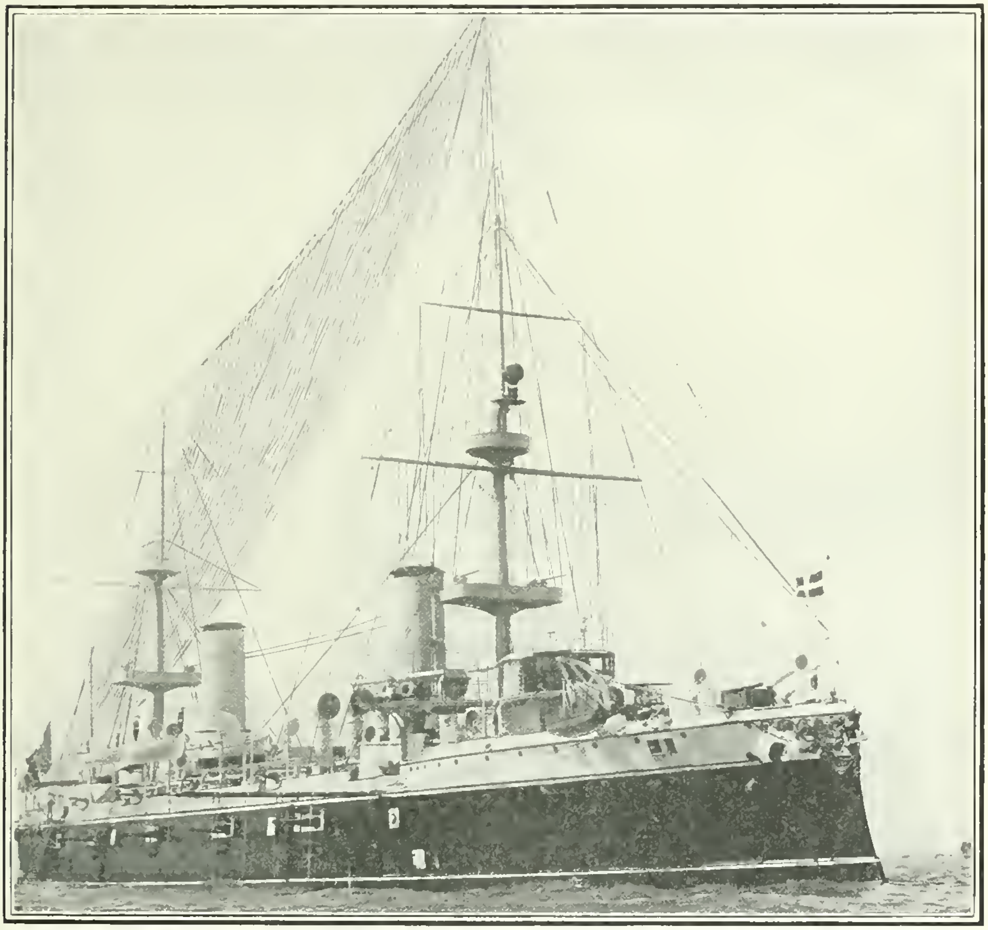
Another operator who stuck to his key trying to hurry help to a sinking ship until the waters closed over him was S. C. Sczepanek, of Car Ferry No. 18. This large steel transfer steamer belonging to the Flint and Pere Marquette Railroad, was bound diagonally across Lake Michigan from Ludington to Milwaukee on the night of September 9, 1910, when from some cause unknown she foundered in mid-lake. The first intimation of trouble came at dawn in this message from Sczepanek:

"S. O. S. 18 sinking off Sheboygan."

For the next ten minutes the message was repeated together with more accurate details of the vessel's location, then all was silence. Two hours later when No. 17, a sister ship, reached the spot from which these appeals had come, to which she had hurried as fast as her engines could drive her the moment the first call was heard, her operator announced the fate of No. 18 in this laconic message:

"No. 18 gone."

Not until No. 17 steamed into Ludington at 6 o'clock that evening with flag at half mast were the details of the tragedy known. The compression of the air between decks when No. 18 went down had blown off the hurricane deck, the fragments of which had served to keep thirty-three survivors afloat until they could be picked up by No. 17. Twenty-eight men, including all the officers and Operator Sczepanek, went down with the ship; and all hands surely would have perished had not help been summoned by wireless, for the water was icy cold.



METHOD OF STRINGING WIRES FOR LONG DISTANCE TRANSMISSION.
The Italian battleship *Carlo Alberto*.

The wireless telegraph is doing a great deal to lessen the perils of the Great Lakes. There was a fine chance for a disaster when the cylinder heads on the steamer *Arizona* blew out while the steamer was being crowded to make speed in the teeth of a gale while bound from Chicago to Muskegon January 7, 1909. The wireless operator, who was asleep at the time, bounded out of bed and as soon as he learned what was wrong, sent out a call for help. Two hours and a half later the steamer *Indiana* was alongside. The *City of South Haven*, with a hundred passengers on board lost her rudder while crossing Lake Michigan June 26, 1909, leaving her floundering helplessly in the waves with the passengers in a panic. A call for help was sent out by wireless and within ten minutes two tugs were on their way from Chicago to the assistance of the *City of South Haven*. Two days later the *City of Racine*, bound from Chicago to Milwaukee in rough weather lost her propeller. A call for help by wireless brought two steamers to the rescue, one of which took off the two hundred passengers while the other towed the disabled vessel to port. The wireless telegraph also brought help to the steamer *Georgia* in time to save her from going to the bottom when she lost her propeller in a storm on Lake Michigan on October 12, 1909.

It was a narrow escape that the passengers and crew of the Norwegian steamship *Ocean Queen* had in the lonely Pacific on September 16, 1909. Her engines broke down while the *Ocean Queen* was between Tahiti and Makatea. While thus helpless she was driven on a reef. The steamer *Mariposa* heard her call for help and arrived just in time to take off all hands before the *Ocean Queen* slid off the rocks and sank immediately in deep water.

The *Princess Irene* was one hundred and eighty miles away when, on June 12, 1909, her operator heard a call for help from the *Slavonia* which, with four hundred passengers on board, had gone on the rocks off Flores Island in the Azores. Changing her course immediately and hurrying to the scene under full steam the *Princess Irene* arrived in time to take off all hands in safety.

Apparatus for Sending—Reproducing—Pictures by Wireless.
The transmitting machine is at right, receiver at left of the inventor, Hans Knudsen.

Seven men bound from Seattle to Valdez, Alaska, had the remarkable experience in December, 1910, of being twice rescued from sinking ships, through the intervention of the radiotelegraph, in ten days. They sailed from Seattle December 1 on the steamer *Northwestern* which struck a reef and sunk a few hours later in False Bay. Steamers summoned by wireless conveyed them to Seattle from whence they took passage on the steamer *Olympia*. After calling at Cordova the *Olympia* ran into a fierce storm which drove her on a reef at the southeastern end of Bligh Island, four miles from shore. After striking the rock the *Olympia* slid down upon it tearing a large hole in her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LEE DEFOREST AND HIS WIRELESS PHONE.

side. The weather was intensely cold and the sea, driven by the terrific gale, was so high that the officers dared not launch a lifeboat. The sea battered the steamer so violently that it was feared she would not hold together until help could come; but Operator Hayes managed to send out an alarm before the engine room was flooded, rendering the wireless useless. Two steamers responded to the call in time to take off the one hundred and seventy-seven passengers and crew before the *Olympia* went to pieces.

At any moment the call for help is likely to come floating through the ether to the ear of the operator who, in the vernacular, is "listening on the job." This call may be the "C. Q. D." made famous by Jack Binns, an abbreviation for "Come Quick, Danger," devised by the Marconi Company but never officially recognized, or it may be "S. O. S." —Stop Other Service—the signal of distress formally adopted by the International Wireless Convention at Berlin in 1906. The ship that first hears the appeal may be too far away to be of any assistance herself, unless, perhaps, to pass the message along to some other craft that can lend a hand, for it is a curious thing, for which no satisfactory explanation has yet been found, that a ship may often be unable to communicate with another near by, yet readily keep in touch with distant stations. Sometimes apparatus with a normal range of two hundred miles is able to communicate with stations twelve hundred miles away. A notable instance of this peculiarity was the experience of the steamship *Caronia* in 1908. The *Caronia* while off the coast of Sicily was totally unable to pick up any of the Italian stations, but had no difficulty in communicating with England and Holland.

The steamship *Charles Nelson,* of San Francisco, which went ashore a few miles north of Point Arena, California, in a thick fog October 28, 1910, was a sufferer from this eccentricity of the wireless telegraph. Fortunately there were enough other vessels at the proper distances to pass her messages along like a bucket brigade at a fire until she was rescued from her predicament.

The first intimation that anything was wrong came to Operator C. F. King, of the steamship *Carlos,* who while standing in the door of the wireless room with the receivers on his ears talking to some passengers heard a station working. Suddenly King realized that the stranger said something about a ship being ashore. He listened for a moment after the message was finished, but the government stations around San Francisco were working and had not heard the message.

"I immediately sent out a long general call," said King, "and asked Mare Island if he had heard the message of distress, and told him to keep the stations in the vicinity of San Francisco quiet. Mare Island had heard no message of distress, but told everybody else to keep out. There was a short silence, after which came a message saying:

"'*Nelson* ashore about fifteen miles northwest Point Reyes. Send help at once. "'Hanson.'

"I copied this message as did the operator on the Farallone Islands and the San Francisco operator also gave his o. k. For quite awhile the *Nelson* operator continued to send out his distress message, not knowing that it had gone through. I gave him a number of calls, telling him the message was in all right but could not make him hear me. We started at once to look for the *Nelson* but I was unable to make her operator hear me although I called him a great many times. About 8:30 p. m. the operator on the steamer *Queen* came on duty, the *Queen* then being near Point Arena, and much to my surprise made the *Nelson* hear him right away."

Thereupon King gave the *Queen* a message he had just received from San Francisco for the *Nelson.* Thereafter the *Carlos* took messages from San Francisco which were passed on to the *Queen* which in turn handed them on to the *Nelson* and transmitted messages from the latter to the *Carlos,* relayed them to San Francisco until the distressed vessel was definitely located and assured that help would reach her promptly.

Not the least wonderful thing about the radio-telegraph is the distance its messages are conveyed. Last summer the wireless station near Hamburg kept up constant communication with a steamer all the way from Hamburg to Kamerun, German West Africa, a distance of four thousand miles. To reach their destination the wireless waves had to pass over the Alps, the Algerian tableland and the Adamana mountains. An exchange of messages between Key West and Norfolk November 22, 1910, was overheard at Mare Island Navy Yard, near San Francisco, a distance of 3,889 miles. On the thirteenth of the same month Marconi himself succeeded in establishing communication between Coltano, Italy, and Glace Bay, Nova Scotia, 4,500 miles distant. Early in October Marconi received messages at the wireless station at Punta del Este, near Buenos Ayres, from Glace Bay and from Clifden, Ireland, distances of approximately 5,600 miles. These long distance tests were preliminary to the opening of the great wireless station at Coltano, through which communication is to be maintained with Buenos Ayres, a distance of more than six thousand miles. This great distance has been bridged at an outlay of $500,000 for two wireless stations, which is but a fifth of what a cable between the same points would cost.

The usefulness of the wireless telegraph is still limited by some strange idiosyncrasies. One of these is recognized by the U. S. statute which requires that wireless telegraph apparatus on shipboard shall be capable of sending and receiving messages over a distance of at least a hundred miles by day as well as by night, for the radio-telegraph seems to be as fond of darkness as evil deeds are alleged to be. Only half as much power is required to send a message on the Atlantic after dark as is required during daylight hours, while on the Pacific only a fourth as much power is used in sending a night message as is needed while the sun is shining. This strange difference between atmospheric conditions on the two oceans is very marked, for it takes five kilowatts to do on the Atlantic that for which two kilowatts will suffice on the Pacific. Morning and evening are times that try the patience of the wireless operators, for when darkness extends only part way across the ocean it is sometimes impossible to get signals through at all.

Marconi explains the greater difficulty of telegraphing in daylight by saying that the electric waves are absorbed by the ionization of the gaseous molecules of the air by the ultra-violet rays which emanate from the sun and which are largely absorbed in the upper atmosphere. He thinks it probable that this atmosphere, which is facing the sun, contains more electrons than the portion in the dark, and therefore the illumined and ionized air absorbs some of the energy of the electric waves. Apparently the length of the waves and the amplitude of the electric oscillations have much to do with this phenomenon, long waves and small amplitudes being less influenced by daylight than short waves and larger amplitudes. For comparatively short waves, such as are used for ship telegraphs, clear sunlight and blue skies act as a kind of fog to these electric waves. Mountains are no impediment to the radio-telegraph at night, but in the day time they greatly reduce the range of communication.

It is unfortunate that so valuable an invention as the wireless telegraph should be adopted by the unscrupulous as a new lure in the world-old process of separating the fool and his money.

At the end of 1909, there were no fewer than thirty-six wireless telegraph companies with the preposterous capitalization of $132,560,000. The greater part of this vast issue of stock, much of which is worth no more than the prevailing rate for waste paper, has been exchanged for the hard earned savings of small investors. So successful were the operations of promoters of this kind of stocks that the postoffice department was obliged to interfere. One raid last November was upon the offices of a wireless combination capitalized at $14,000,000. The assets of the concern were so trifling that the stock of one constituent company was turned into the treasury at 20 cents a share. Yet this same stock was unloaded on the gullible at $10 a share. Within a radius of five hundred miles of Cincinnati half a million dollars had been invested in this kind of stock before the raid.

In this particular the wireless telegraph is but repeating the history of the railroad. About seventy years ago, after the railroad had given some indications of its capacity for future usefulness, England went stark, staring mad over speculation in railroad shares. Hundreds of wildly impracticable schemes together with quite as many downright frauds, were floated as fast as the printing presses could turn out the stocks. It seemed as if the savings of the entire nation were poured into these schemes. Certainly a great many million dollars were thus thrown away. Then the bubble burst and the ruined dupes went to work again to earn more money for the next plausible swindler that came along.

It is not likely that the operations of the dishonest will do any more real harm to the wireless telegraph than they did to the railroad. But at least the exposures of last summer should serve as a warning to all who long for sudden wealth to exercise self-denial in the purchase of temptingly offered wireless telegraph stock.

Song on May Morning

Now the bright morning star, day's harbinger,
Comes dancing from the East, and leads with her
The flowery May, who from her green lap throws
The yellow cowslip and the pale primrose.
Hail, bounteous May, that doth inspire
Mirth and youth and warm desire;
Woods and groves are of thy dressing,
Hill and dale doth boast thy blessing;
Thus we salute thee with our early song,
And welcome thee, and wish thee long.

—Milton.

REBUILDING QUEBEC'S FALLEN BRIDGE

By

CHESTER CARTON

CANADA is bent upon having the world's biggest bridge, no matter if it does come high. The Quebec bridge across the St. Lawrence, which collapsed when half completed, on August 28, 1907, carrying seventy-four of the eighty-six men on it down to death, cost the Dominion $7,154,987. Just as soon as the weary round of official investigations had been finished an international board of engineers was assembled and told to try to design a bridge that could stand alone, to be erected on the site of the failure. This board, consisting of H. Vautelet, of Montreal, Ralph Modjeski, of Chicago, and M. Fitzmaurice, of London, with Alfred Noble, of New York, and H. Holgate, of Montreal, as consulting engineers to help untangle the knotty problems, advanced far enough with their plans to allow preliminary work to be commenced a year ago on a structure which, when completed, is expected to cost somewhere near eleven million dollars, thus bringing the total outlay for a means of getting the trains of the new transcontinental railroad across the St. Lawrence, up to eighteen million dollars.

Still, it will be worth the money; for the Canadians will be able to boast the possession of a bridge the main span of which will be 48 feet longer than the

NINE THOUSAND TONS OF STEEL, BENT AND TWISTED INTO INDESCRIBABLE CONFUSION, WHICH HAD TO BE CLEARED AWAY.

THE QUEBEC BRIDGE AS IT LOOKED A MONTH BEFORE IT FELL.
The new bridge will be quite similar in appearance.

cantilever spans of the famous Firth of Forth bridge, and 162 feet longer than the Brooklyn bridge. Let them make the most of it, for when New York gets around to bridging the Hudson the Quebec affair will look like a mere culvert by comparison. Indeed, New York City already has bridges that cost a great deal more than the Quebec structure, thanks to the highly developed Tammany art of making three dollars do the work of one. In mere height above the water, too, the Quebec bridge is far excelled by a number of bridges scattered over the world. One of these is the St. Giustina bridge in the Tyrol, which is 460 feet above the water; that is, from the surface of the water to the top of the rail, as compared with a beggarly 150 feet at Quebec. The Fades bridge in France is 435 feet above the water, the Garabit bridge in France 406 feet, the Zambesi bridge in South Africa 420 feet, not to mention a number of others that are more than three hundred feet high. Mere height above the water and cost, or rather expenditure, however, do not count in bridges; it is the length of the span that confers distinction.

The new Quebec bridge is to be only 3,232 feet long over all as compared with a total length of 8,296 feet of the Firth of Forth bridge; but its central cantilever span is to be 1,758 feet long as compared with 1,710 feet, the length of each of the two cantilever spans of the Scotch bridge. Lest the Canadians should become unduly puffed up over this prodigious span they should remember that that is nothing at all to what the engineers could do if they wanted to, according to their own story. A commission of army engineers appointed by the Secretary of War in 1894 to investigate the practicability of bridging the Hudson at New York City with a span of 3,100 feet, reported that under certain conditions the practicable limit of length in a bridge span was 4,335 feet. Not to be outdone, Gustav Lindenthal, an American engineer who had not been consulted about it, in commenting upon this report declared in a magazine article, under his own signature, his firm conviction that a bridge with a span of 6,000 feet long could be built on which trains could run with safety at express speed. So far no one has ventured to outtalk Mr. Lindenthal on bridge building.

However, the Quebec structure will be a very fair sort of bridge, considering. The tops of the main posts will be 448 feet above the water as compared with 361 feet in the Forth bridge. The latter only carries two railroad tracks, while the Quebec bridge will have two railroad tracks, two street railway tracks,

SIDE VIEW OF THE BRIDGE THAT FELL, TAKEN FROM CHAUDIERE BRIDGE, ONE MILE DISTANT.

two horse and motor roadways and, finally, two sidewalks.

The new Quebec bridge is proportioned for a load twice as great as the one which collapsed was designed to carry, while its bottom chords will have five times the strength of those in the old one. Designed for a load 2.98 times that of the Forth bridge, or 13,340 pounds per lineal foot as compared to 4,480 pounds, it will weigh 2.3 times as much per lineal foot. The heaviest bottom chord will weigh 160 tons, the pedestals, upon which the main posts will rest will be 19 feet high and weigh 500 tons each, while the posts themselves will weigh 900 tons each. The total weight of the bridge according to the official plans, will be 145,000,000 pounds as compared with the Forth bridge's weight of 114,000,000 pounds.

One of the difficulties confronting the board of engineers was that the actual strength of steel members of great size is unknown. Such definite knowledge of steel as is available has been obtained by testing small pieces. Calculations for larger sections were based on these known facts. But evidently there is a big difference between the theoretical

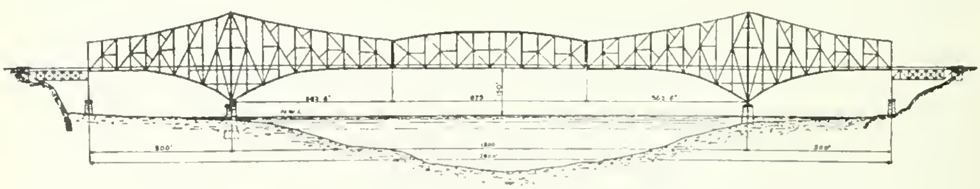
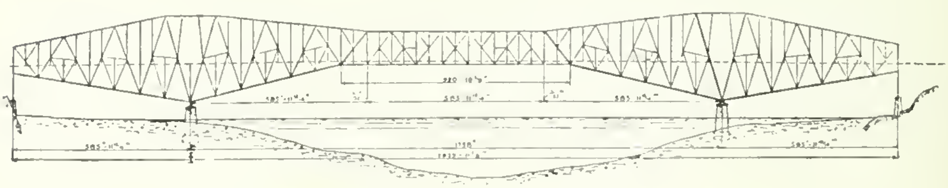
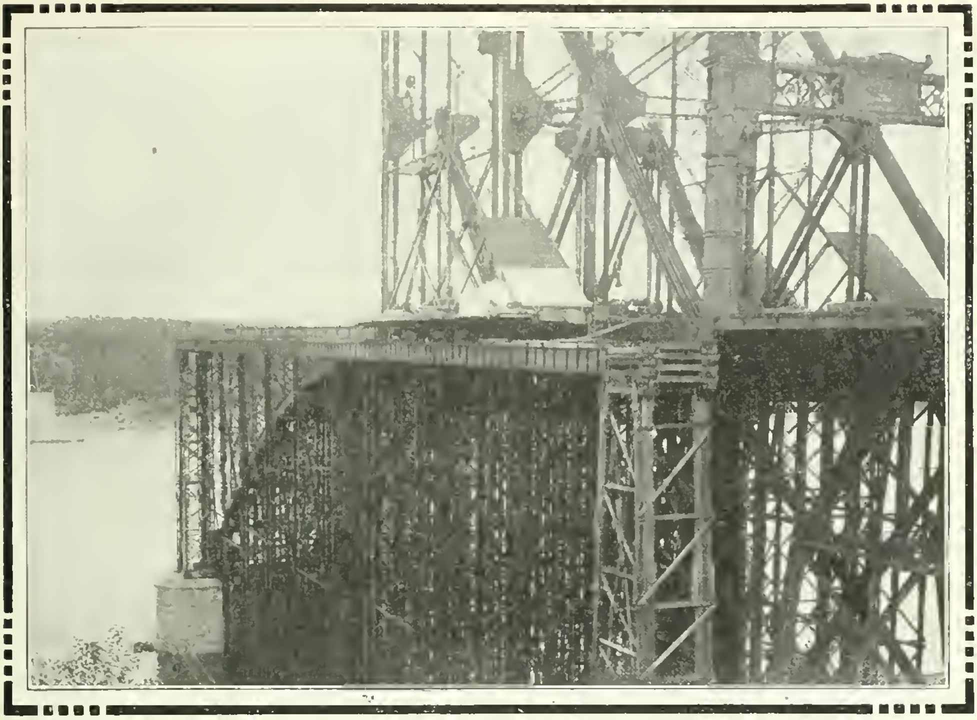


DIAGRAM OF THE BRIDGE WHICH COLLAPSED AUG. 28, 1907.



DESIGN OF THE NEW QUEBEC BRIDGE.



THE PIER, AND A PORTION OF THE BRIDGE ON THE NORTH SHORE—OPPOSITE.
This was the bridge that fell.

and the actual strength of large members, for otherwise the original structure would not have collapsed.

In order to afford the engineers a more substantial basis of facts upon which to build their calculations Parliament appropriated $30,000 to pay for a series of tests of models of columns and girders. These models, some of which weighed as much as 6,850 pounds, were placed in a testing machine, having a capacity of 2,800,000 pounds, at Phoenixville, Pennsylvania, in which they were slowly crushed while a squad of engineers looked on, took measurements and made notes. Armed with the data thus obtained the Board of Engineers worked out its design with some assurance that it would stand the test of time. The official plans call for a cantilever structure; but the contractors who submit bids are invited to offer suggestions for any changes they think will be improvements. If they meet the approval of the engineers the changes in the official plans can be made, but the contractors must take all the risks. Prospective bidders were warned that they must clearly understand that they must be prepared to undertake the entire responsibility, not only for the materials and construction, but also for the design, calculations, plans and specifications and for the sufficiency of the bridge for the loads specified.

It was a strange task which confronted the contractor who undertook to remove the wreckage of the collapsed bridge. Nine thousand tons of steel, bent and twisted into indescribable confusion, lay between the shore and deep water. There was no place to begin, for there were no loose ends. So well had the steel makers done their work that but a single eyebar was broken in the collapse. Starting in January, 1910, the contractor was allowed until May 1, 1911, a period of less than sixteen months, in which to clear away the wreckage, including all that showed in the river at low water.

Two months were spent in experimenting, trying to find a vulnerable spot in the wreck and some efficient method of cutting up the ponderous members of the bridge into bits that could be handled. These experiments brought out the fact that there were just two means at hand, one being dynamite, the other the oxy-acetylene flame. Each was peculiarly adapted to certain conditions, so that each supplemented the other. Together they have performed feats not matched in the annals of engineering.

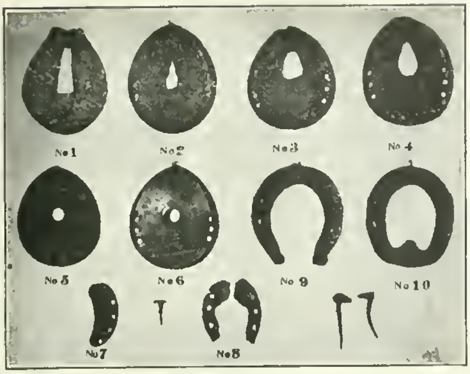
Dynamite worked particularly well under water. One stick of the explosive would break a plate half an inch thick, while to break a plate an inch thick two sticks were required. In order to cut one of the great girders, sticks of dynamite were placed end to end across it, usually tied to a stick of wood or placed in a piece of cheap rubber hose. If the cut was to be done on the water the explosive was placed in position at low tide. Then the workmen waited until the tide rose, thus affording a water tamping. Above high water the charge was covered with a few inches of earth. Extra precautions had to be taken in seeking shelter when a charge was to be fired, for pieces of steel were thrown great distances. One piece was thrown across the river. Twelve tons of dynamite were used in breaking up the south anchor arm.

Oxy-acetylene gave remarkable results. It was used to greatest advantage in cutting the heavy chords and posts into pieces. The flame cut very rapidly, leaving a narrow, sharply defined slot not wider than a saw would make. A square inch of steel could be cut through in 5⅝ seconds with 0.4 of a foot of gas costing 1.2 cents. An eyebar 2 inches thick and 10 inches wide was cut through in one minute and fifty seconds with the flame. This method proved very convenient, for as the torch weighs but a few pounds it could be carried around anywhere. When ten of the sixteen months had elapsed but half the wreckage had been removed. The contractor, who gets $45,000 and the scrap, doubtless feels that he is earning his money.

As the new bridge is to be wider, shorter and heavier than the old, the original piers could not be used, although the masonry was unharmed. The foundation of the old south main pier, however, was all right so far as it went. So the masonry was stripped off down to the caisson, a solid block of concrete 150 feet long, 49 feet wide and 25 feet deep. This is to be pieced out by an L-shaped extension to be formed of two caissons, one 25 by 31 feet, the other 31 by 85 feet, which are to be sunk to the same depth as the old one this spring. On top of the extended foundation a third caisson 180 by 79 feet and 27 feet high, to be of solid concrete strongly reinforced with steel, will be built, upon which the masonry will be erected.

As the river span is to be shortened forty-two feet, the north main pier will be nearer the river and entirely clear of the old. For the foundation of this pier a caisson of unusual size was built. Some idea of the magnitude of the undertaking may be gathered from the fact that two hundred thousand dollars were expended on a plant for building the great caisson and the smaller ones for the south pier. The north caisson, 180 by 55 feet, was built of timbers 12 inches square and solidly braced by dividing the interior into eighteen working chambers, each 20 by 25 feet, with heavy timber walls. By the time the outer walls had been built up to a height of 21 feet 9 inches and the total weight was 1,700 tons it was deemed ready for launching. The remainder of its 68 feet in height was to be built up as sinking proceeded. The launching took place July 7, 1910, and the big box was towed three miles up the river to the bridge site. Unfortunately it sprung a leak after the work of sinking had begun and the pumps breaking down, it filled and sank on the big boulders in the river bottom in such a position that it was strained. So it had to be laboriously floated and towed to a dry dock for repairs. To gain time a hole twenty feet deep was dredged on the pier site, leaving just that much less excavating to be done under compressed air in the caisson. A boiler plant of six hundred horse-power was required to furnish steam to run the compressors in sinking this caisson.

If everything goes as it has been planned the masonry work on the piers will be finished by November 1, so that the erection of the superstructure may begin as soon as the weather will permit in the spring of 1912. By 1915 trains will be crossing, it is hoped.



NATIVE AND EUROPEAN HORSE SHOES AND CATTLE SHOES USED IN PALESTINE.


PHOTO BY AM. COLONY, JERUSALEM

SHOEING AN OX FOR PLOWING.

HORSESHOEING IN PALESTINE

By H. J. SHEPSTONE

IN Palestine the native horseshoer, known as a "betar," not only shoes but also treats sick animals, corresponding in this latter respect to our veterinary surgeon. His shop is invariably a very small concern, unlike anything found in the Occident. In the first place, there is no blacksmith work done of any kind, hence, no fire or forge. Two methods of shoeing are followed, one known as the native and the other as the European. The native shoes are solid plates, covering the entire hoof, with a small air-hole in the middle, and curving outwards at the back. Those known as European are very similar to our American shoes.

The assistant holds the animal's leg up when the farrier, or shoer, in a half-kneeling position, removes the old shoes with a pair of large pincers, the jaws of which are very dull. The trimming or cutting of the hoof is done with a draw knife, the blade of which is six inches long and four inches wide, very sharp and thin.

The shoes are fitted cold, and as soon as they are placed upon the feet, a curious little wooden block is brought into play. Upon this the animal is made to place one foot at a time while the farrier drives home the nails. These latter protrude about half an inch or a little more. The inside ones are cut off, turned over and clinched into the hoof, while the outside ones are curled around and around by being lightly tapped with a hammer.

In a dry and stony country like Palestine native shoes have these advantages over European ones: stones cannot get into them, while the hoof being practically entirely covered keeps moist and much softer, making the liability of cracked hoofs quite remote.

The native shoes are made from thick sheet iron and also from wrought iron. They are finished very roughly and require a good deal of hammering before they are ready for use.

The European shoes are finished ready to be put on. In Jerusalem there are only two European blacksmith shops doing European shoeing. One is run by Germans and the other by an Armenian, who learned the trade from the Germans. They are mostly patronized by foreigners. The natives have a prejudice against burning the hoofs with the shoe. Less than half a century ago European-shaped shoes were entirely unknown in Palestine. The first horse shod in this manner was that belonging to the Russian consul some thirty-nine years ago.

Why He Stopped

They had been engaged only a week. He had kissed her fully forty times that evening. When he stopped the tears came into her eyes, and she said:

"Dearest, you have ceased to love me."

"No, I haven't," he replied, "but I must breathe."—*Ladies' Home Journal.*

Of Such Stuff Are Heroes

"Now then, men," cried the gallant captain, "fight like heroes till your powder is done, then run for your lives. I'm a little lame, so I'll start now."—*Wasp.*

Minute Specialization

A young medical student was being quizzed by one of his teachers: "In what will you specialize?" he was asked. "Diseases of the nostril," replied the student. "Good," said the professor, enthusiastically. "Which nostril?" —*Success.*

Up Against It

She—"Lizzie's bloke calls 'er 'is peach and the apple of 'is eye. Why can't you call me things like that?"

He—"Yus, that's all very well; but 'e's in the vegetable business. I'm in the fish trade, remember."—*Punch.*

Domestic Wrappers

"Your friend is rather indelicate," remarked Mrs. Wombat. "Says he gave her husband some panatellas for Christmas."

"What's wrong with that?"

"I wouldn't think of mentioning sleeping-garments in public."—*Louisville Courier-Journal.*

Not Boastful

"I was in a Missouri town two years ago," said a local dramatic producer, "trying to get up a show. The landlord of the chief and only hotel seemed half-way intelligent, and I interviewed him, as a preliminary. 'Your town boasts a band, does it not?' I asked. 'Well, no, stranger,' he responded. 'We've got a band, but we don't boast of it. We jest endure it.'"—*Boston Traveler.*

A Crusher

Gerald—"My dog knows as much as I do."

Geraldine—"Why don't you get an intelligent dog?"—*Chicago Record-Herald.*

Fruitless Struggle

"I understand that, after waiting twenty years, she married a struggling man."

"Yes, poor chap. He struggled the best he knew how, but she landed him."—*Brooklyn Life.*

Filling Her Program

"AH say, Miz Mandy, am yo' program full?"

"Lordee, no, Mr. Lumley. It takes mo' an a san'wich an' two olives to fill mah program."—*The Coyote.*

His Object

"I NOTICE," said the young man's employer, "that you are always about the first in the office in the mornings."

"Thank you, sir."

"Why do you thank me?"

"For noticing it."

Reassuring

NERVOUS PARTY—"The train seems to be traveling at a fearful pace, ma'am."

ELDERLY FEMALE—"Yus; ain't it? My Bill's a-drivin' of the ingin, an' 'e can make 'er go when 'e's got a drop o' drink in 'im."—*Tit-Bits.*

A Wise One

"Do you think I am really your affinity?" asked Solomon's 985th wife, coquettishly.

"My dear," said the Wisest Guy, "you are one in a thousand."

He got away with it, too.—*Toledo Blade.*

Why He Mourned

O'TOOLE—"An' why are yez wearin' mournin', Muldoon?"

MULDOON—"Shure an' Oi hov t'. Th' iditor ov a magazine Oi 've been takin' wrote me yisterd'y an' sed thot me subscripshun hod exphired."—*Judge.*

Desperate

"FATHER, do lawyers tell the truth?"

"Yes, my boy," the father answered. "Lawyers will do anything to win a case."—*Washington Star.*

Rear View Exhibit

DOCTOR—"You must put a porous plaster on the small of your back."

LADY—"That's impossible, doctor, I'm going to the opera tonight—how would I look?" —*Milwaukee News.*

A Literalist

SHE (as they encounter a vicious bulldog)—"Go on, Percy, you know you said you would face death for me."

HE—"But he isn't dead."—*Tatler.*

One as Good as Another

PROFESSOR (returning home from visit)—"Aha! Your absent-minded husband didn't forget to bring home his umbrella this time. See!"

HIS WIFE—"But, Henry, when you left home you didn't take an umbrella."—*Boston Transcript.*

Truth Will Out

THE CANDIDATE (having quoted the words of an eminent statesman in support of an argument)—"And, mind you, these are not my words. This is not merely my opinion. These are words of a man who knows what he's talking about."—*London Sketch.*

Hair-Raising Performance

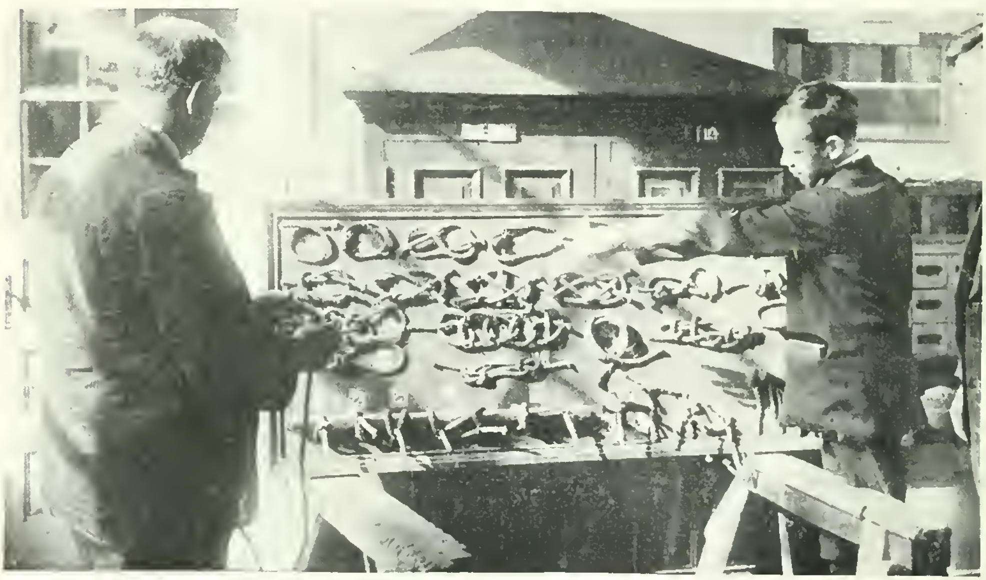
"THE baby likes to play with my hair."

"But aren't you afraid he'll muss it, dragging it all over the floor?"—*Washington Herald.*

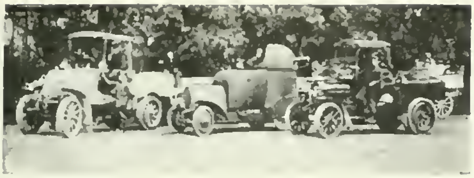
POPULAR · SCIENCE & MECHANICS SUPPLEMENT

TO TEACH BOYS KNOTS

A NEW educational idea—teaching boys to tie knots scientifically—has been adopted in a Philadelphia school. A case of specimen knots has been set up in the classroom and the boys are required to memorize the names of these and then learn how to tie them. It is not easy to learn how to tie a knot when it is tied in a way that differs from the twist we have been accustomed to give our knots, but once learned it is never forgotten. For that reason it will pay one to study the knots illustrated on this page and learn how they are manipulated, for in this art the landsman can learn much from the sailor.



THE KNOT CLASS IN SESSION.



. Armored Autos in the Austrian Army.
They are equipped with rapid fire guns.

UP IN A HOT-AIR BALLOON

Acrobat Thomik Dropping from a Hot-Air Balloon.

THE photograph at the left shows acrobat Thomik of Berlin, rising in the air in a hot-air balloon. He arose to a height of approximately two thousand feet and fortunately dropped safely to the ground in a parachute.

Almost every other day the newspapers call our attention to some remarkable feat of daring, performed by some person either for money, notoriety or the mere hazard of the thing.

Most of us are astounded at the risk these persons take and while, if we get the opportunity, there is a certain fascination in watching, we usually conclude that it is very foolish.

A LESSON IN TREE CLIMBING

For "Hanging" Nervous Patients.

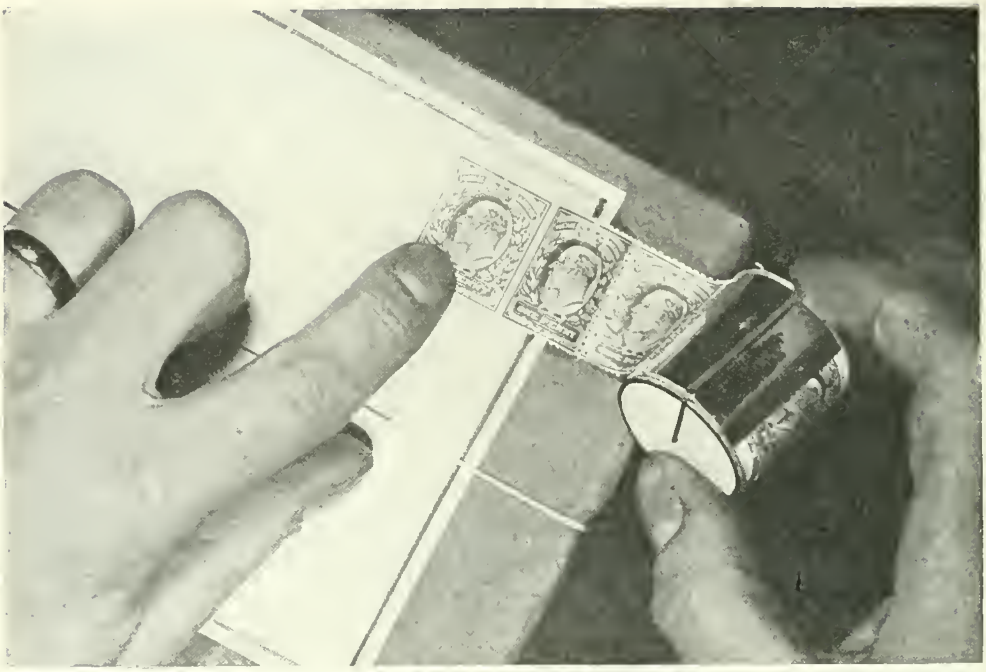
Apparatus in use at National Hospital, Bloomsbury, England. The patients are "hanged" for a few seconds each day.

WHENEVER it becomes necessary to trim the foliage from the "living flag pole" in Los Angeles, a linesman is sent up, scaling the slender sixty-foot trunk without any difficulty by means of his climbing spurs. The main difficulty would appear to be in keeping the swaying stem erect and steady enough to bear his weight, for anyone seeing the tree as it sways in the wind would as soon think of climbing a fish pole, as to tackle it.

As the picture shows, however, the feat can be accomplished and a secret is very simple when you know how. As the linesman ascends the smooth and pol-

"A Living Flag Pole."
The daring climber has a novel method of ascent.

FASTEST WAR VESSEL IN THE WORLD.
The destroyer *Paulding*, United States Navy; speed, 34.85 knots an hour.



STAMPS BY THE ROLL.
A clever device of the English postal authorities.

ished stem, he pushes ahead of him a small hoop or ring which encircles the trunk and to which are attached four long wires. These lengths of wire are paid out by four men, who steady the tree in four directions, so that the man with the pruning knife can go clear to the topmost tuft of foliage without danger.

The tree is a twelve-year-old specimen of *Eucalyptus Citriodora,* which is growing in the center of Los Angeles and is used as a flagpole on holidays and similar occasions.

JAWS OF SHARK THAT WAS ONE HUNDRED FEET LONG.
This model, in the Museum of Natural History, N. Y., is that of the great white shark, which lived ages ago.

STAMPS BY THE ROLL

IT is not often that the English postal authorities are guilty of innovations but recently the postmaster general has concerned himself in popularizing the postal service throughout the United Kingdom. The little novelty seen here is a case in point. Any one who desires to buy five shillings worth—$1.20—of penny—two-cent—stamps may now purchase them in the very neat contrivance shown in our picture which holds exactly sixty stamps, each one of which may be easily detached in the manner shown. Apart from the cost of the stamps there is of course no charge made for the roll carrier. The device really appears superior to the stamp books in use in the United States.

WORLD'S BIGGEST BALLOON SHELTER

AT Konigsberg, Germany, there has been erected a big building capable of accommodating two airships of such gigantic proportions as Count Zeppelin's. It is 540 feet long, 180 feet wide, and 120 feet high. The entire building is rendered fireproof by a covering of asbestos.

To admit light, there are windows in the side, front and roof, of twenty-five square yards each. The doors are almost incredibly heavy affairs, each weighing 50 tons, with dimensions of 90 by 120 feet. They open and shut by means of wheels which roll on iron rails.

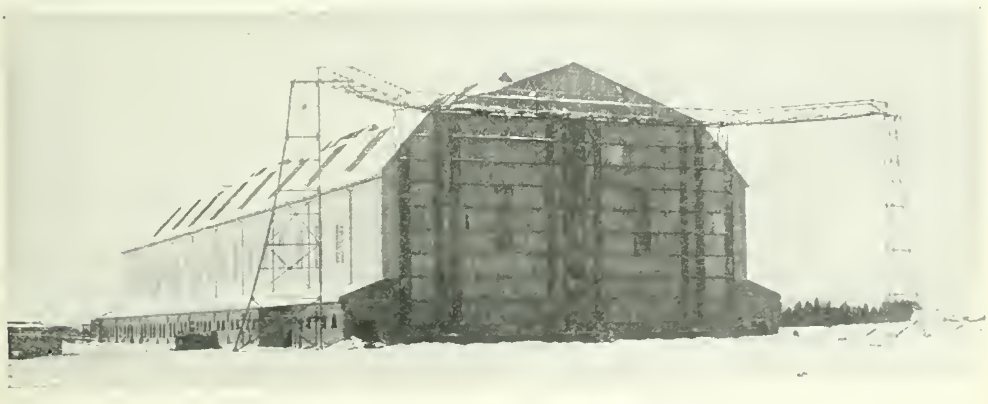
The structure is built on so substantial a basis to protect against three things: fire, wind and predatory persons. Where hundreds of thousands of dollars are invested in a single balloon, it is well worth while, the Germans think, to protect adequately so big an investment.

TRAINING A STIFF-NECKED HORSE

THE accompanying photograph shows a real "cow-puncher" subduing a real bronco according to a well known method on the range. The horse had just been broken to the saddle but he was self-willed and refused to answer to the bridle, or as the cowboys express it, "he was stiff-necked."

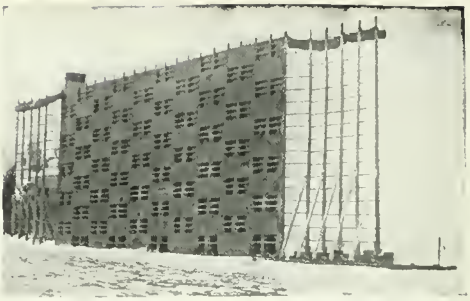
Breaking a Horse to Answer to the Bridle.

In order to correct that the rider first constructed a rope bridle known as a "hackamore," which exerts a painful pressure on the horse's nose and when even this failed to produce the desired effect he took a lariat and a short length of rope and effected a cure in this way: the short piece of rope was fastened in the hair of the horse's tail so as to form a loop and the end of the riata was attached to the bridle and the other end passed through the loop so that when the free end of the lariat was pulled the horse's head and tail would be drawn together. Naturally the bronco resented this, but as the cowboy was at the other end of the forty-foot rope his kicking



ARCHITECTURE KEEPS PACE WITH AERONAUTICS.
Huge building of special design to accommodate German dirigible balloons.

Aeroplane Propeller on a Sled.
An ice-vehicle driven by a motor.

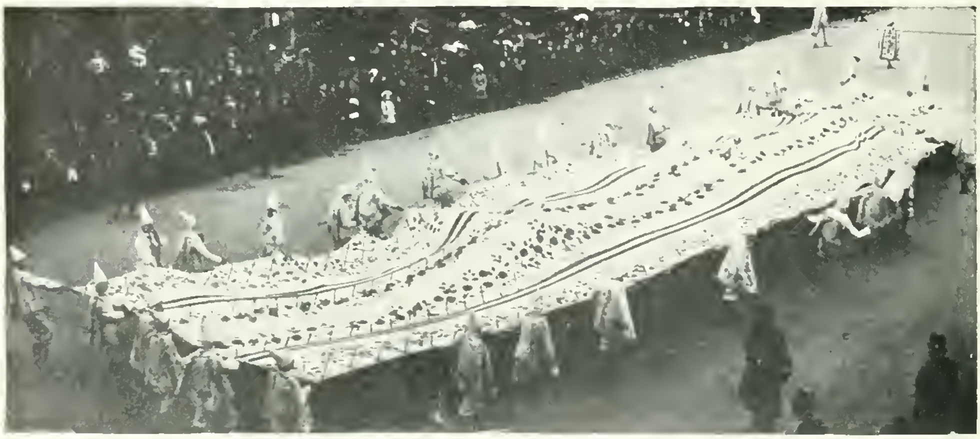


Practice Target in the British Navy.
The plates, of thin steel, easily replaced, may be penetrated without injuring the general structure.

The Most Northern Tramway in the World.
In the Spitzbergen Isles, off Norway, within the Arctic Circle.

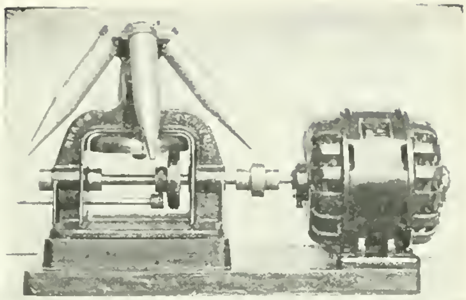
and pawing did little good. When the bronco began to quiet down he tried to ease the strain on the neck by turning round and round slowly, and the horse breaker allowed him to do this, merely flipping the rope over his back so that he would not get tangled in it.

This was exhausting work for the bronco, and sweat began pouring from him but his master was not satisfied until the operation had been repeated, turning his head the other way. After about an hour of this treatment the bronco was thoroughly tired out and the muscles of his neck were so painful that he was willing to obey the slightest pull of the bridle. It was a lesson that did not have to be repeated, and while it was unpleasant for the animal did not injure it in the least.



CARNIVAL PAGEANT AT PHILADELPHIA.
It took twelve months to make this highly embroidered robe to be worn by the chief mummer.

A "Jug" in Name and Fact.
This city jail—of concrete—at Mansfield, Mo., is, however seldom used.



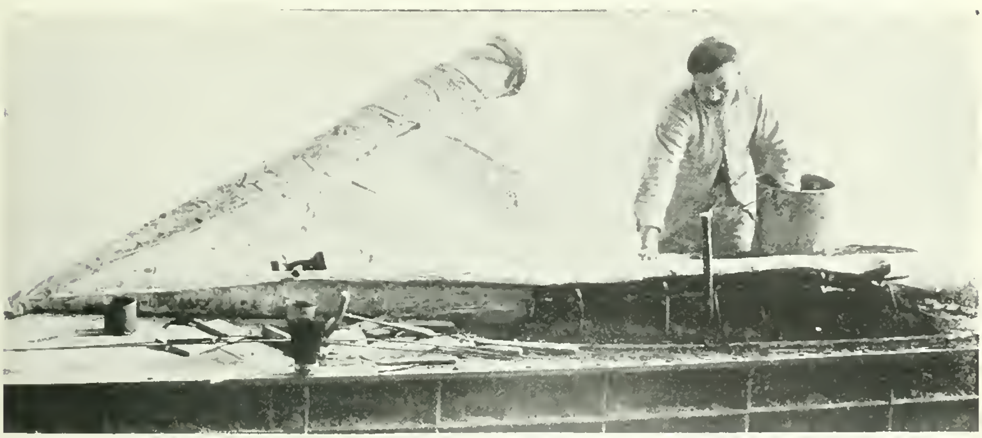
Analyzes Oil in Minutes, Not Hours.
Motor-driven device supersedes gravity test.

QUICK OIL TESTER

A WESTERN firm has recently perfected a centrifuge for testing oil, which will be of great value to producers as it will determine the proportion of sediment, water and oil within a few minutes instead of the forty-eight hours or so required by the gravity test. The new device may be briefly described as follows: four glass flasks are set in aluminum cases which are adjusted about a vertical shaft in such a manner that they revolve with it, the centrifugal force, causing the flasks to stand out in a horizontal position and rapidly precipitating those elements which are heavier than oil. The improved type is driven by a motor.

This centrifuge is now being modified for the use of mining men for the testing of slimes.

Life-Saving Helmet for Use of Crews in British Submarines.
Escape is made from the sunken vessel—as shown—by coming up through the conning tower.



CASTING A TATTERED BATTLE FLAG IN BRONZE.
One of the most difficult feats in the work of making statuary.

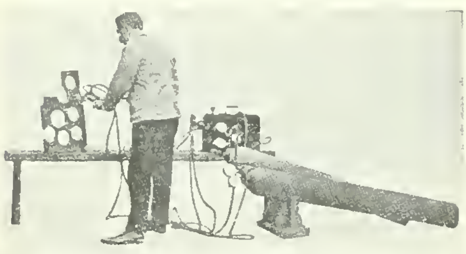
ROLLING DAM IN MEXICO, ONE STEEL CYLINDER LOWERED, THE OTHER RAISED.

DAMS OF STEEL

IN the irrigated Laguna district of the Nazas River valley of Mexico, steel cylinders are being used for dams where the construction of water storage reservoirs and the control of the flood of water in the large irrigation canals are necessary. This type of dam is said to be specially adapted for use in streams which are given to sudden rises, as the cylinders may be raised and lowered.

The first of these rolling dams, as they are called, to be erected in Mexico was located on the San Marcos plantation, near Torreon. The dam is composed of two cylinders, each sixty feet long and eight feet in diameter. The cylinders form a water-tight reservoir when in place.

A second dam of larger size, the cylinder being ninety feet long and twelve feet in diameter, has been constructed in the same district, at a cost of about \$250,000. The cylinders are easily operated by electric power. They are raised or lowered on heavy racks, set in masonry abutments. Each cylinder is operated as an independent dam. The power equipment is placed on a masonry pier in the center of river or canal.



FOR CUTTING METAL WITH GAS.
A fine spray of oxygen cuts like a knife through the heated substance—an English invention.

COACH—ITSELF INTACT—SPLITS ANOTHER IN TWAIN.
A most extraordinary railroad wreck that occurred at Clayton, Kansas.

A MODEL TOY MOTOR BOAT AS IT TOOK PART IN A "REGATTA" IN VICTORIA PARK, LONDON.

MOVING TRUNKS BY ELECTRICITY

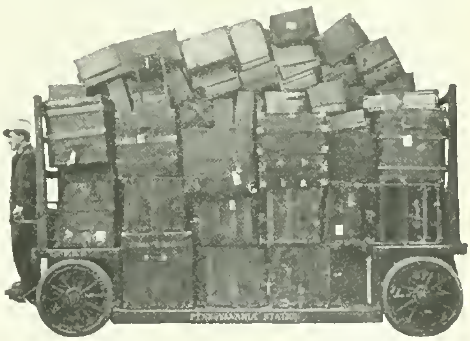
ANYONE who has watched the baggage men at our railway stations tugging the great truck load of trunks about can not help feeling that a partial relief at least from their strenuous labor is due them if some invention will make it possible.

That this feeling has been shared by railroad officials is demonstrated by the development of a motor driven baggage truck shown in the illustration.

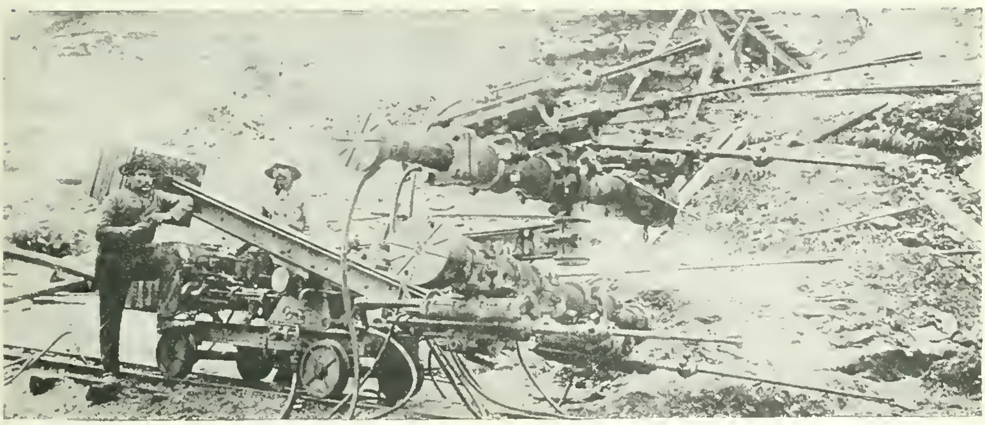
Two styles have been designed, one much resembling the flat truck we are accustomed to seeing on station platforms, the other having a drop frame as shown in the picture.

The latter style is for use at stations where the platforms are on a level with the steps of the coaches, the other where the platform is on a level with the track.

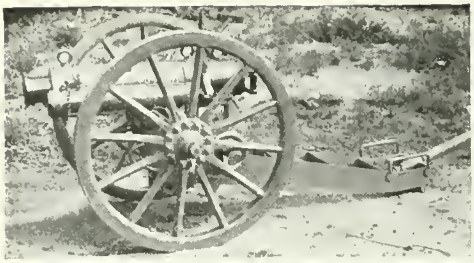
Both styles are arranged to be driven from either end, thus saving the necessity of turning. All the wheels are connected with the steering gear so that the truck



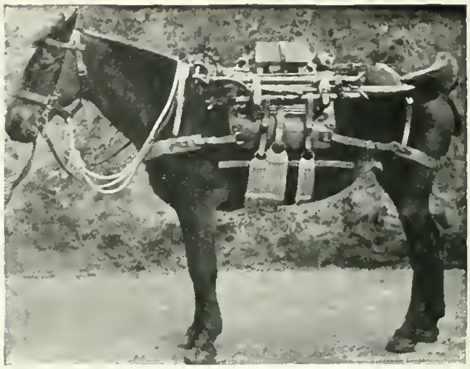
AN ELECTRIC BAGGAGE TRUCK.



UNUSUAL TYPE OF BORING MACHINE IN USE IN SOUTH AFRICA.
The machine is compact and comparatively small, and yet has tremendous power.



A New Mountain Gun in Our Army.
It is light and compact.



The Equipment for this Gun Can Be Carried on a Horse.

is extremely sensitive to every touch of the steering lever, making it possible to handle it well in congested surroundings.

The capacity of the drop frame truck is slightly more than that of the other, being from 20 to 28 trunks, the weight likewise also being somewhat greater.

All bearings run on balls or rollers and the wheels are equipped with solid rubber tires.

The battery equipment consists of 12 cells and is so attached to the truck that it can be instantly removed and a freshly charged set attached.

The truck can be run at a speed of six miles an hour and is also supplied with a pedal brake at each end capable of stopping it in one-half its length when running at full speed.

Siamese Actress of the Better Class.
Her costume is studded with precious stones.

Nelson's Flagship *Victory*, in Portsmouth Harbor, England, on a Gala Day.

Device for Testing the Heat of Flame.

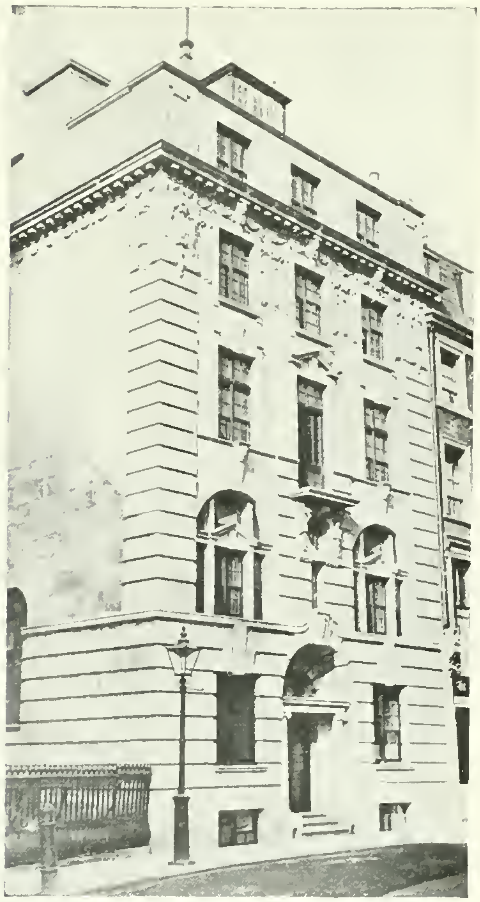
The New French Vedovelli Multiplane.
Its pilot is protected against wind and rain by a closed hood of mica.

HOW HOT IS FIRE?

HOW hot is fire may at first sound like one of the old catch questions such as, how cold is twice zero? and similar conundrums. As a matter of fact, however, this particular question is not asked merely to exercise the mental faculties, but because it is a serious scientific idea, the solution of which has been most practical in certain manufacturing industries.

In the manufacture of iron and steel as well as in the chemical processes requiring great heat, it is often necessary to ascertain the exact temperature of the product within the furnace. No ordinary instrument can be used for this purpose. Other devices have also been used but with only fairly accurate results, until the

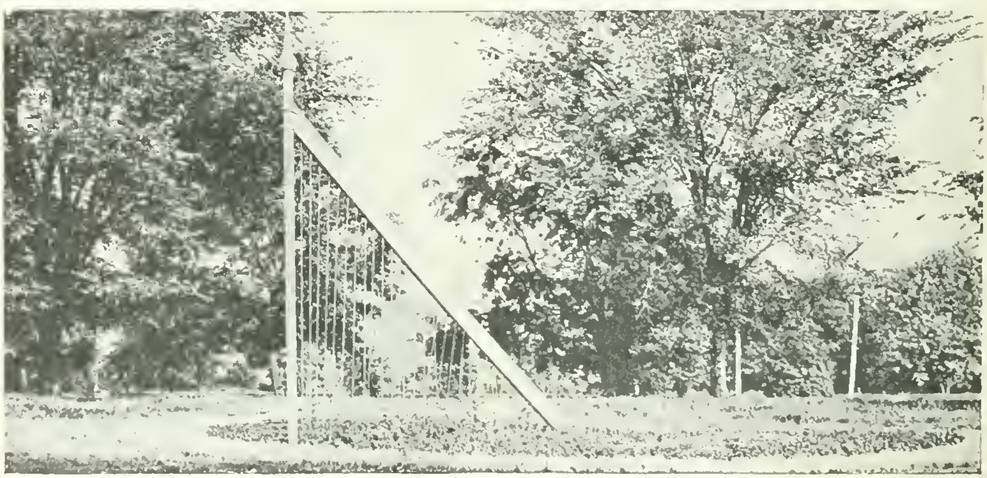
Monument to Bismarck in the Town of Bismarck
It is the custom in Germany to name small cities after famous Germans.



New Radium Institute of London.
This is the world's center of scientific research regarding the properties of this wonderful mineral.

ROLLER SKATE RACE FOR THE CHAMPIONSHIP OF BERLIN.
The winner—No. 1—"running the round of honor."

invention of what is called the radiation pyrometer, an instrument which measures, with the greatest accuracy possible, the temperature of the interior of a furnace, although located on the outside and at a distance of several feet from the source of the heat. If two different metals are joined together and their junction heated, there will be an electric current developed which will flow in a circuit, if one is provided. The more the point of junction is heated, the more current is produced. When we introduce into this circuit an instrument for measuring the amount of electricity generated, and instead of marking the scale to read in volts or amperes, we arrange it to indicate degrees of heat, then we have a heat measuring instrument which may be near or far from the heat source, and yet secure the same accurate result. With the instrument shown in the illustration, p. 249, the temperature of a stream of molten iron is being taken, although the instrument is some distance from the furnace. In like manner the temperature of a steel billet may be taken as it passes between the rolls which form it into a rail.



A FLORAL SUNDIAL, CHEAPLY AND EASILY MADE.

MULE THAT LOST HIS HEAD.

SUDDEN DEATH FOR THE MULE

NOT long ago there was a mule at the Arsenal Barracks in Washington which had survived the period of its usefulness. In its day it was a pretty good mule, but it had become superannuated. The question was, what to do with it. Something sudden and merciful seemed desirable.

A young lieutenant suggested dynamite, of which there was plenty on hand. It was quicker, he said, than gunpowder. The idea seemed a good one, and a stick of giant powder with a fuse was attached about the neck of the mule, who indifferently awaited his fate, with all the calmness of a veteran.

It certainly was very sudden. A snapshot photograph taken of the animal when the dynamite went off showed it still standing on its four legs, but lacking a head. What became of the head nobody ever found out; but this much was tolerably certain: the mule was no longer alive.

A TEST THAT TESTS

THE manufacturers of an improved steel window sash have devised a unique test to show the strength of the ventilator frame.

The combined weight of eight men was placed upon the frame, as shown in the illustration, in such a manner as to balance each other. In spite of this unusual strain the frame showed no tendency to break nor was it even sprung sufficiently to crack any of the panes of glass.

This unusual strength is due, it is claimed, to the method of construction, the frames being formed from heavy sheet steel by means of dies under tremendous pressure. The glass is held in place by small steel clips and a very small amount of putty. This method of glazing requires less time and trouble than the use of iron pins, ordinarily used in such frames, and fifty per cent. less putty.

It is also claimed that in case of breakage, glass can be replaced without the removal of putty from the surrounding lights as is required when iron pins are used to hold the glass in place.

The ventilator has a peculiarly designed outside frame at top and bottom, insuring an absolute weatherproof condition when closed.

A WINDOW FRAME THAT'S REALLY STRONG.

Novel Diversion for Athletic Club Members.

Mission Style Car on a California Tourist Railroad.

Boy Fills Sack as Easily as a Man.

SHOOT-THE-CHUTES IN A CLUB HOUSE

ATHLETIC clubs are up to the minute of progress in the installation of modern appliances and novelties for the physical well-being and entertainment of their members.

A famous athletic club of California recently installed in their tank in the gymnasium a shoot-the-chutes, which is a long track-like affair extending from the ceiling into the tank. It takes three seconds to make the trip down the slide, and a considerable bump has been erected in the center, which increases the pleasure and the speed during the second part of the slide.

SACK THAT'S PLAY TO FILL

"SO easy that a child can work it" is more often than not the misleading description applied to certain inventions which from time to time find their way on the market, but in the case of a new type of sack loader and lifter recently patented in England by a Salisbury agricultural engineer, the description would appear to be fully justified. Tests have shown that one man or a fairly strong boy can raise sacks of corn, grain, manure, coke, etc., into wagons with ease, thus doing the work of three men and often saving the necessity of having to stop the lifting machine usually employed and all hands each time the wagon is to be loaded. The Andrews' patent sack elevator, as it is called, has a unique method of gearing and this reduces the expenditure of energy required to a minimum. The sacks are lifted by means of endless chains, with the result that the carriers do not have to return for the next sack, either one of the steel carriers taking hold of the sacks as they come around. The sacks are securely gripped and cannot possibly slip off in transit; the apparatus is nevertheless free from danger by the use of hooks, etc. The accompanying illustration shows a lad of nine years loading a wagon by means of the Andrews elevator. In this instance he loaded five sacks in two minutes. The elevator is strongly made of pitch pine, steel, malleable iron and endless chain belting.

LAND AND SEA AUTO

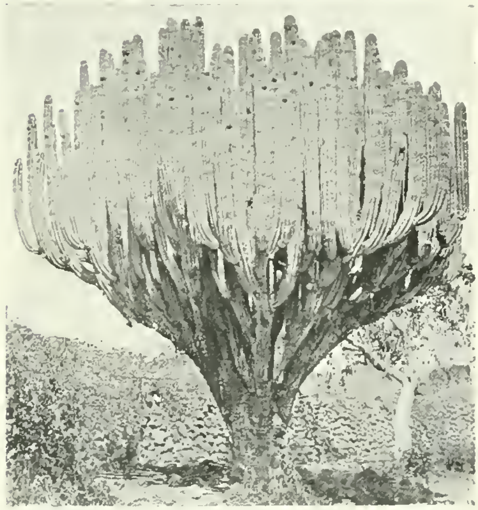
THE amphibious boat herewith shown is owned by Rear Admiral Howell and he has developed a second model which he has been testing with a twenty-horse power marine motor. This remarkable boat after finishing its cruise on the water propelled itself with neatness and despatch up on the beach at Atlantic City, N. J., as easily as an automobile would travel upon the sand.

Auto That Travels Over Both Land and Sea.

A GIANT CACTUS

THE cactus known as "*bisnaga*—the water barrel—of the desert," is believed by the Indians of the Mexican plains to be the gift of the rain gods. Within its huge hollow cylindrical fronds the rain water collects and remains there fresh for weeks. Another water-containing cactus has its giant fronds shaped like a huge candelabrum. This cactus also bears an edible fruit much the color of th pomegranate. The natives often make a preserve of it, which looks like raspberry jam. Other cactus fruits are eaten raw or boiled like vegetables.

The photograph is of a giant cactus growing near Lake Chapala—the highest navigable body of water on our continent—in the State of Jalisco, Mexico. This cactus growth is upwards of sixty-five feet in height and over one hundred in girth. It is of the variety known as the organ cactus because of the resemblance of its columnar-like fronds to the pipes of an organ.



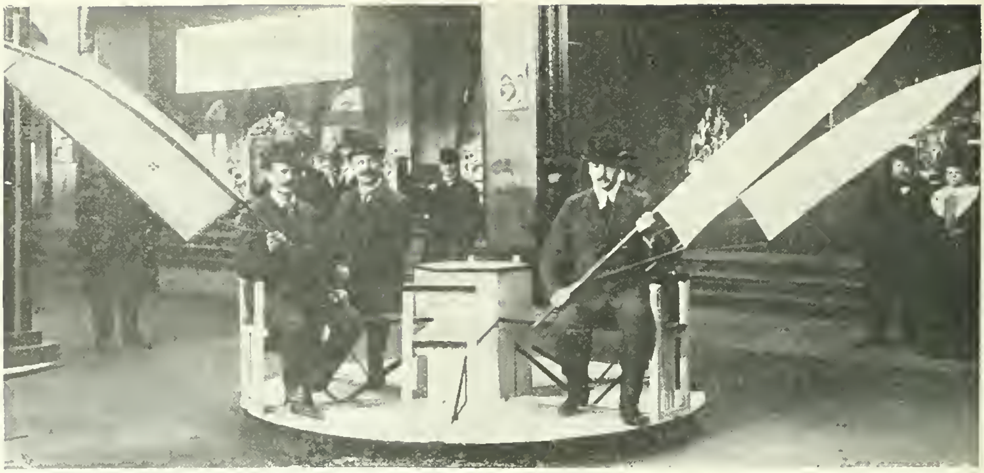
A Gift of the Gods.
So seems this water-bearing cactus to the thirsty Indian.

QUEER KOREAN GAME

THE Koreans prefer stone fighting or throwing to any other game. Travelers soon learn of the art acquired by stone fighters, though there is but one day in the year given over to it. If any one offend a Korean, he answers with a stone. During the war between China and Japan, the latter found their greatest difficulty in dodging missiles from roof tops and trees. All classes indulge in the habit. It is said of a Korean woman she never fails to throw a stone straight. Within bounds she is as expert as a man.

On stone-throwing day, however, mere woman is restricted to curfew time for

Koreans Preparing for Their National Stone Throwing Game.



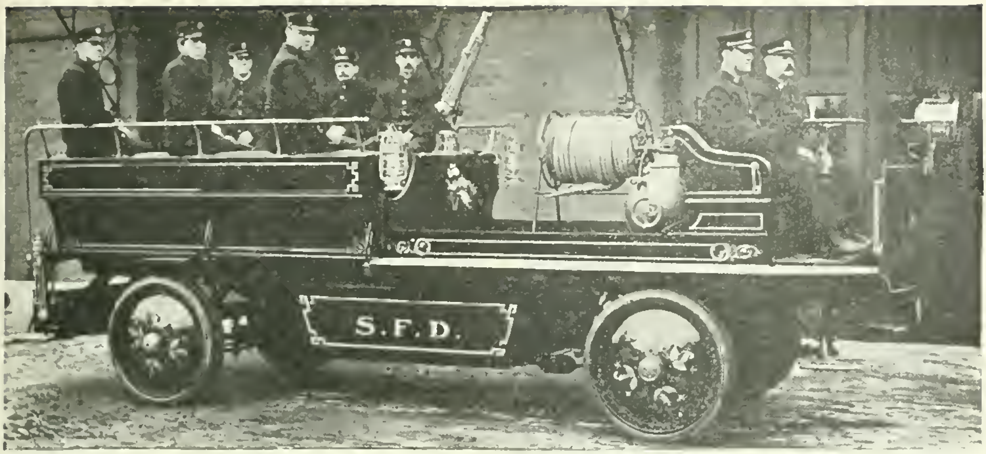
A NEW STYLE OF MERRY-GO-ROUND, AS SEEN IN BERLIN.
The people sitting on the turntable are furnished with aeroplane wings, which they wave in a uniform direction until the table begins to turn slowly. As soon as it has started, it is easy to make it revolve quickly by waving the wings rapidly.

her pleasure as upon other days. In the Land of the Morning Calm women are allowed on the streets only during curfew time, between twilight and early forenoon. During the day they are in seclusion.

In preparing for the fete, towns and villages put aside a goodly sum of money for the wounded, and to buy prizes for the champions. Queer bands, composed of strange instruments, mostly drums and moon fiddles, announce the opening of the festival. The participants are drawn up in two sides like an army in battle. At the signal, stone throwing begins, and soon the rules are laid aside, and the game becomes hot and furious. Game is called by some member of the squire-noble class, a village elder or a court official.

PLAYING DIABOLO WITH A HUMAN BEING.
Mme. Renie Furie, a young Parisian woman, nightly draws a large audience at the Nouveau Cirque. The spool in which she is carried, rolls along the wire cable, and finally lands in the net.

DOWNY NESTLINGS OF THE FISH HERON.
These little fellows might, at first glance, be taken for some weird little monsters. They certainly bear very slight resemblance to their long-limbed, long-billed, long-necked parents.



COMBINATION HOSE AND CHEMICAL AUTO USED BY THE SPRINGFIELD, MASS., FIRE DEPARTMENT.

AN ELECTRIC FIRE DEPARTMENT

SPRINGFIELD, Mass., has the first complete electric fire department in the United States. While gasoline electric fire fighting equipment is used in many places in the country the manufacture of efficient electric propelled vehicles for such work was not possible until recent improvements were made in the storage battery. Electricity is much more dependable than gasoline and as the storage batteries are constantly connected to the charging mains while the apparatus is in the engine house there is no danger of the cells being discharged, as they have a capacity of about forty miles, which could hardly be exceeded on any one trip, unless there was a call for assistance from afar.

Two pieces of the new electrical fire apparatus are in use at the present time, one a hook and ladder truck having a maximum speed of twenty miles an hour and eighty cells of battery, and the

A Common Spectacle in Lapland.
The deer is used as we employ the horse, in the snowy country of the far North.

Picking Up the Mail.
An apparatus for use on express trains that do not stop at small towns. It is the invention of a Swedish engineer.

A New Aeroplane Sleigh.
This is the invention of a German. The sleigh is driven over the snow, as an aeroplane is through the atmosphere, by means of the propeller.

other a combination hose wagon and chemical engine, having a maximum speed of thirty miles per hour and the same number of storage cells. In the accompanying photograph the wheels look peculiar to anyone accustomed to see the open spoked wheels usually employed on such fire apparatus. The wheels are simply electric motors with the tires placed on the rim over the field magnets and the armature serving as the axle. This does away with all gearing, differentials, etc., usually employed on automobiles, and applies the power directly, without any transmission loss, to the ground where it is wanted.

A Rattlesnake's Business Tools.
These fangs show, by front and side view, the form of these poison injecting weapons. The poison is squeezed through the slit in the fangs.

ENORMOUS YIELD OF GRAIN

REMARKABLE results in the way of enormous yields of Egyptian wheat have been obtained in the lower Rio Grande Valley, on the American side, according to authorized statements made by the Texas state department of agriculture. This grain belongs to the same family as kaffir corn and milo maize. Upon the rich lands of the valley of the Rio Grande it is grown by means of irrigation, and produces two to three crops per year upon the same land from one planting of the seed. The second and third crops spring up from the stubble and give yields equally as abundant as the first crop. In several instances these yields amounted to 100 bushels of grain for each crop, or a total of 300 bushels per acre for the three crops, all harvested within a period of nine months. The grain is used chiefly for feed for live stock, although a wholesome flour may be made from it and used for bread. The stalks and foliage of this Egyptian wheat are more delicate than that of either kaffir corn or milo maize and the yield per acre of this forage is very large.

Such a heavy yield of grain is, of course, one of the most remarkable ever recorded.

Third Crop of Egyptian Wheat from One Planting.
The total yield on this Texan land was 300 bushels to the acre.

CRANE LAYS RAILROAD TRACK

THIS picture shows a novel method of taking up or relaying railroad track with a regular wrecking crane.

This was done in connection with the building of the second main track and grade revision of the present main line on the Northern Pacific Railway between Staples and Philbrook, Minnesota, in 1910. The track on the left is the second main and on the right the present main line, the grade of which is to be raised. The track in the center is the contractor's narrow gauge road used for hauling material into the fill.

The sections of track were laid temporarily on the left shoulder of the fill and later were relaid to proper alignment when the right side was built up to grade. About one mile of track was raised in this manner in six working hours.

TAKING UP A SECTION OF RAILROAD TRACK WITH A WRECKING CRANE.

Ingenious civil engineers often create unusual and unexpected short-cuts.

SETTING NATURE RIGHT

IN an attempt to rectify a mistake of Nature a unique experiment is being tried at the Cincinnati Zoological Garden upon a two months old baby llama. The little fellow was born knock-kneed and to save the career of the valuable animal a set of unusual braces were made to straighten the crooked forelimbs. Various experiments were tried to rectify the mistake but not until the braces were secured was success apparently assured.

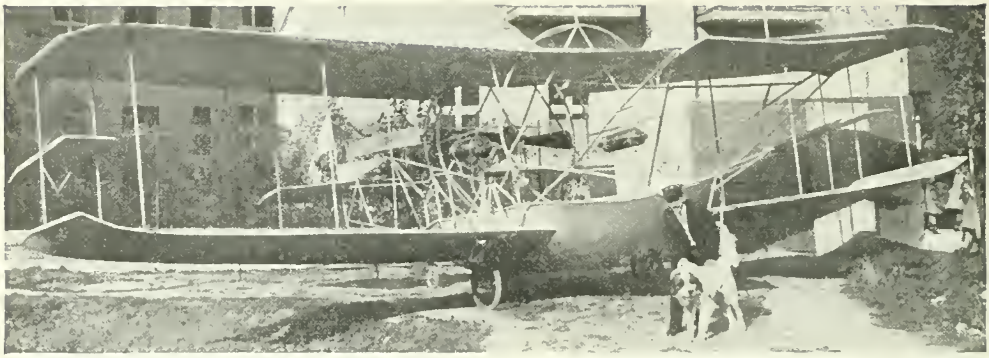
TRYING TO STRAIGHTEN THE LEGS OF A LITTLE KNOCK-KNEED LLAMA.

The little fellow was born at the Cincinnati Zoological Gardens.

Wearing his steel supports, the little valuable animal is able to walk around without his weak knees bothering him. This is the first time such an experiment was ever attempted upon a wild animal, and it is to be hoped it will prove a success, to offset the shabby trick that Nature has so unkindly played him.

NOT THE MODEL OF A GIGANTIC FOOT, BUT A NET FOR WARRING ON MOSQUITOES.

They are fighting the dreaded malaria in the Island of Mauritius, by thus trapping the winged pests.

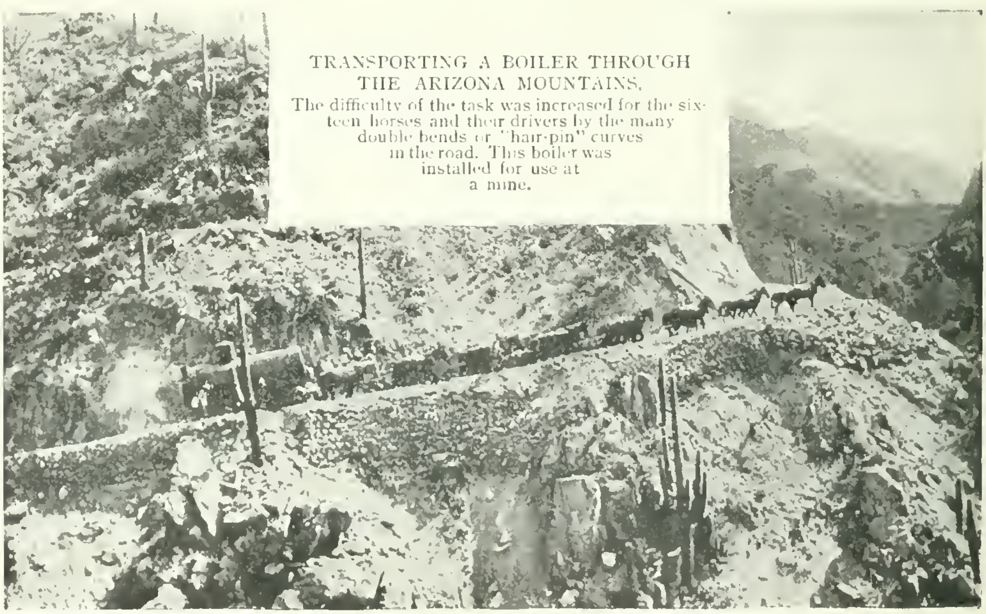


A FRENCH AEROPLANE THAT CAN FLY IN THE AIR AND RUN OVER LAND OR WATER.
When traveling along the ground or through the water, the planes are detached.

"TEAMING" A BOILER

THE difficulties of heavy freighting in the Southwest are indicated in this photograph which was taken in the mountains of southern Arizona near the Mexican boundary. Sixteen draft horses are required to haul the boiler over the steep grades to a mine. One of the great difficulties lay in the fact that there were a number of "hairpin" and "horseshoe" bends in the road. Along a good part of the way the cliffs dropped straight down for two hundred feet or so below the road, so that any fright on the part of the horses or lack of control by the teamsters would have caused very serious results.

Even these hardships are slight compared with the conditions of two years ago when pack burrows were used, as there were no roads at that time. It was then necessary to take all machinery apart so that each piece could be hauled by one or two burros. A bed plate which was too heavy to transport otherwise was sawed in two, hung on an axle between two wheels and worked after prolonged exertion by a gang of Mexicans over the mountains.



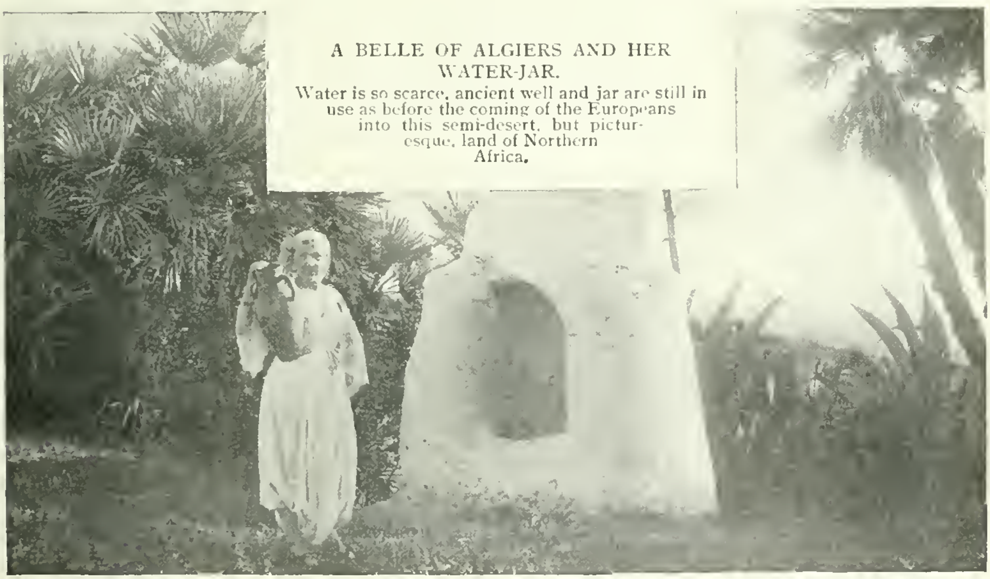
TRANSPORTING A BOILER THROUGH THE ARIZONA MOUNTAINS.
The difficulty of the task was increased for the sixteen horses and their drivers by the many double bends or "hair-pin" curves in the road. This boiler was installed for use at a mine.

GAS WELL ON FIRE NEAR HAMBURG, GERMANY.
The outburst could not be checked, and had to be fired to purify the atmosphere.

REMARKABLE OUTBURST OF UNDERGROUND GAS

WHILE workmen were boring for water during the beginning of last November near Hamburg, gas suddenly came out of the boring pipes, expending itself as three gigantic flames. The bore hole was 600 feet deep. There was an enormous heat, the engine in front of the fire getting red hot. Owing to the gas coming out of the narrow pipes with such pressure, however, so much heat was absorbed that the top hole was temporarily covered and finally entirely shut up by ice.

No use has yet been made of the gas, but in the beginning of December it was extinguished and covered with a huge iron bell. The gas escaping, however, poisoned the air, so that it had to be lighted again and was burning with a bigger blaze than ever at the end of December. This phenomenon attracted huge crowds of people from all directions. On a bank holiday about 120,000 people went to the place, sixty special trains running from Hamburg and five special trains from Berlin, which is about 200 miles away. Along the road from the railway station to the blaze there were hundreds of tents for beer and sausages, and roundabouts. Good business was done by men selling balls of cotton wool



A BELLE OF ALGIERS AND HER WATER-JAR.
Water is so scarce, ancient well and jar are still in use as before the coming of the Europeans into this semi-desert, but picturesque, land of Northern Africa.

A Bold Woman Mountain Climber.
On the Scheaporn peak, in the Swiss Alps.

A Sled Similar to a Bicycle.
It is propelled by a rod near the center.

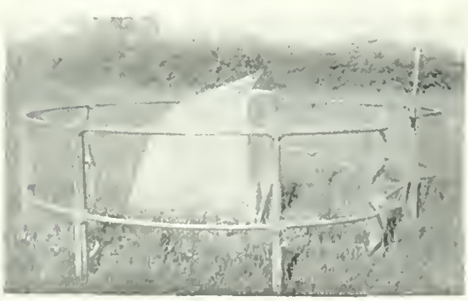
A Clever Invention of a Clever American.
A. L. Wilaman and his auto-sled.

to be put into the ears as the noise caused by the exploding gas was tremendous.

COMMEMORATES BALLOON FALL

ABOUT four miles from Ware, in Herefordshire, England, may be seen a stone, depicted here, marking the spot where the first English balloon fell or landed.

It bears the following odd inscription: "Let Posterity Know And Knowing be Astonished That On the 15th Day of September 1784 Vincent Lunardi of Lucca in Tuscanny The 1st Aerial Traveller in Britain Mounting From the Artillery Ground in London and Traversing the Regions of the Air For Two Hours And Fifteen Minutes In this spot Revisited the Earth On this Rude Monument For Ages be Recorded That Wonderous Enterprise Successfully Achieved By power of Chemistry And the Fortitude of Man That Improvement in Science Whith The Great Author of all Knowledge Patronizing by His Providence The Invention of Mankind Hath Graciously Permitted To Their Benedit And To His Own Eternal Glory."



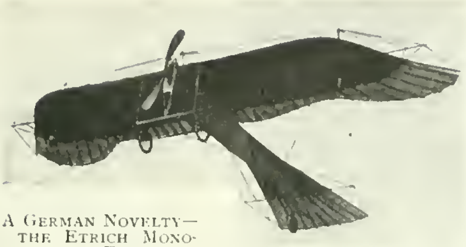
Where the First English Balloon Fell.

A Believer in Feminine Dress Reform.
A familiar figure on the Paris boulevards.

The Strange Way in Which Cocoa Pods Grow on the Tree.
They project from the trunk in odd protuberances.

An Oil Derrick of New Design in Use in Pennsylvania.

A Ram with Four Horns from the Cedar Mountains in South Africa.
A curiosity that aroused interest in Capetown.



A German Novelty—the Etrich Monoplane in Flight.

NEW TYPE OIL DERRICK

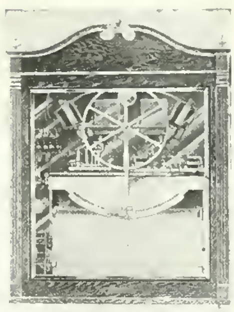
ON this page is shown a photograph of a new type of oil derrick recently put into use in some of the oil fields of the eastern states. This rig is found to be fully as serviceable as the old standard plank rig and can be built at a fraction of the cost of the old style derrick. In fact to the scarcity and high price of lumber is due the introduction of this modern type of rig. The derrick shown in the picture is in operation in the Pennsylvania oil fields and is 61 feet high. The legs, spliced near the center, are held together by clamps, having been put together on the ground and raised with the drilling machine.

ELECTRIC RECORDING COMPASS

THROUGH the agency of delicate contacts on a compass, and the communication of the corresponding electric currents to a recording stylus controlled by two magnets, an electric recording compass has been perfected by a Western inventor which promises to become indispensable to the mariner. The compass proper makes the observations automatically and communicates them through two conductors to the recording mechanism enclosed in a cabinet in the pilot house or elsewhere. The device is

The Etrich Monoplane on the Earth.
It seems to rest like a huge bird.

Church Bells on a Tree.
This was a scene in Santiago after the American bombardment. The church being destroyed, the undaunted priest found a place for his bells.



Electric Compass with Recorder, Connected for Use.

THE NEGRO AS HE IS TODAY.

as Nature only can. An ingenious feature of the instrument is the circuit changer, which automatically throws the instrument on a set of batteries if the dynamo current for any reason should give out, and again switches the dynamo current in when it is again in operation. Each chart lasts 31 days and the time and date is printed thereon, the time being graduated to five minute spaces, so that it is the easiest thing in the world for any one acquainted with the work to ascertain whenever it may be so desired, the time down to the fraction of a minute.

so designed as to produce a continuous record of the direction of the ship with relation to time; so that the direction in which a ship was moving at any hour and minute can be determined at a glance by the officers in charge at any time thereafter from an inspection of the records produced.

The clock movement which controls the chart in the recording mechanism allows it to pass by the recording point 2½ inches every hour. The clock is wound by electricity automatically and requires no attention whatever on the part of any human being, the mechanical laws of Nature carrying out the essential work

THE SOUTHERN NEGRO IN ANTE-BELLUM DAYS.

THE MATERIAL EVOLUTION OF THE NEGRO RACE.
Models made by a well-known sculptor who keeps his identity secret. This photo shows the landing in America of the first negro slaves.

J U N E

"NO WONDER THE WEALTH OF THE NATION CENTERED IN THE CITIES!"

—"*From Farm to Table*—"

THE TECHNICAL WORLD MAGAZINE

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FROM FARM TO TABLE—THE ROAD OF A HUNDRED PROFITS

By

AGNES C. LAUT

There is a national pickpocket who snatches 75 per cent. of the farmer's profit and 80 per cent of the city man's income. He exacts a toll both going and coming, and his operations furnish one cogent reason why men are driven from farm to factory and country to counting house, and why the country man cannot make and the town man cannot save. This article suggests a remedy for the national pest.

A MAN and his wife had given up farming in one of the best fruit regions of New York State for what they thought a more lucrative position in town. As they were taking the train away, children came selling grapes around the station at 2 cents a box.

"Don't let us open the suit case! We can buy these grapes just as well in New York," demurred the man.

"But the express charges," suggested his wife.

"Won't be more than a cent a box for those! I should know! I've shipped enough of them."

But on arrival in the city, what was the man's amazement to find he could not buy that 2-cent box of grapes under 40 cents.

Forty cents! The ex-fruit farmer rubbed his eyes. That was an advance of 2,000 per cent. on the price the buyers used to pay him. How in the world was the price made up? Express was only 1 cent. That brought the cost to 3 cents as the box reached New York. Allow 1 cent more for risk and handling: 4 cents. Now 20 to 40 per cent. advance is a high profit for a wholesaler; at most, so far only 6 cents. Add the retailer's profit of another 20 to 40 per cent. At most, the grapes should not be marked to exceed 10 cents. What unseen hand had juggled prices up to 40 cents—75 per cent. too high for the man who eats; 2,000 per cent. too low for the man who grows?

The city man had not added 1 cent to the value of the grapes. He had not paid for the labor and the forethought and the care and the first outlay of growing them. All that had to come out of the 2 cents paid the grower. Give the wholesaler and retailer each a profit of 100 per cent. That would bring the grapes to only 16 cents, not 40. Was it a skin game both going and coming? Did it skin the man who produced the food; and then skin the man who consumed the food?

And who got the big increment? That was the question. If the grapes had paid the grower a flat 10 cents, he could have made his fortune on the farm and put away 80 per cent. profit on investment. All these farm-improvement evangelists —railroad men, chambers of commerce, pink-gloved professors — could stop shouting themselves black in the face preaching "back-to-the-land." If farmers could put away 80 per cent. profit a year,

IN THE COMMISSION MARKETS, WHERE THE PRICES OF FARM COMMODITIES BEGIN TO SHOOT SKYWARD.

chains and wild horses and regiments of rifles could not keep them off the land. If the farmers were putting away 80 per cent. of the first cost of their land a year, there would be such a rush from factory back to farm as would outsprint speed laws. If farmers could earn even 50 per cent. on capital invested, there would not be a banker in the United States, from Hetty Greene to Pierpont Morgan, who would not turn farmer quicker than a motor car turns turtle. And after all, aren't the farmers the bank of the nation? And what per cent. do they make on their investment? This man knew when he had to let grapes rot, or sell for 2 cents, he was not making 1 per cent. on his investment. He was not breaking even. He had to quit.

Why, he could have afforded to pay the freight, to pay the New York end of the handling, to pay a man to look after the sales, and still have put away 50 per cent. profit on his grapes. Then, he wanted to knock his head against something; for wasn't that exactly what he had been doing, though he did not know it? Paying for the freight—that is, his price had been knocked down so buyers could pay for the freight out of what should have been his profits, leaving their own profits intact. Paying for the New York end of the handling—that is, knocking his prices so low it left them margin to pay that handling. Paying the risk whether there was loss or not. Paying the wages of the salesman out of what should have been the farmer's margin. Paying the New York extortionate ground-floor rents—the big grocery, where the ex-farmer made his first inquiry, was on Broadway and paid a rental of $12,000 a year. And then over and beyond these preliminary charges against the grapes, paying a clear dividend of about 500 per cent. each to commission man, wholesaler, retailer.

No wonder the wealth of the nation centered in the cities! No wonder the boys and girls broke away from the farm to pursue that wealth! This sort of game made the farmer's nine-billion-a-year crop a sort of sluice box for depositing gold in city vaults. When the farmer, however, wanted a loan, he had to come on his knees to those bank vaults for it.

They might yell "stop—stop" till they were hoarse, that farm-improvement crowd, at the exodus from country to city. If they really wanted to turn back the human flood, they would have to turn back some portion of the big money sluicing into those city vaults. Long as the gold flowed to town, so would the boys and girls; though you might preach your head off at the folly.

But, perhaps the grapes were an exception owing to their perishable nature. Your ex-farmer continued his first-hand investigations of the things he used to grow for the city man to eat. The more he investigated the hotter he grew. This is the record his accounts showed at the end of a month:

Potatoes, price paid the farmer 35c; cost to the city man $1.50; advance 300 per cent., of which only 30 per cent. went for freight and handling in the case he investigated.

Asparagus, price paid the farmer 8c; cost to the city man

IF THE FARMER THINKS HE GETS A GOOD PRICE FOR EGGS, HE SHOULD SEE THE HOUSEWIFE'S BILL.

On the Tables of Hotels, Strawberries Retailed at Twenty-five Cents a Dish, or One Dollar a Quart—

Eggs, country price 20c to 48c a dozen, or 2c to 4c an egg; cost in hotels 30c for two or 15c an egg; advance 400 to 800 per cent.

Apples, price paid grower $2 for a 10-dozen box, best grade, or 20c a dozen; cost to city man $1 to $1.50 a dozen; advance 500 to 700 per cent.

Oats, price paid farmer 1c a pound; cost of oatmeal 7c to 10c; advance 700 to 1,000 per cent.

30c to 40c; a neat little advance of 400 per cent.

Milk, price paid the farmer 4c; cost to the city man 8c; advance 100 per cent.

Pork, price paid the farmer 4c to 6c; cost to the city man 20c to 30c; advance 500 per cent.

Wood, $3 a cord; city price $8; cost of cutting $2; advance 100 per cent.

Strawberries, 10c a quart or 2c for a quarter dish; cost in city hotels 25c a dish or $1 a quart—an advance of 1,000 per cent. No wonder there were million-dollar eating-places and twelve-million-dollar hotels.

Cabbage, price paid farmer $1 per 50 cabbages, or 2c each; cost to city man 10c each; advance 500 per cent.

Tomatoes, $2 for 24-pound crate, or 8c per pound; cost in town 25c per pound; advance 300 per cent.

Beef, per steer $50 to $60 to the farmer; cost to city man figured out on the basis of prices paid in the Senate Restaurant $2,000; advance 3,000 per cent.

Wheat, $1 per 60 pounds; breakfast cereal 15c a pound, or $9 per 60 pounds.

Bread, 8c to 10c per pound; advance 800 to 2,000 per cent.

WHILE THE FARMER WAS PAID BUT TEN CENTS A QUART.

WHAT'S THE REASON FOR THIS? THE FARMER GOT THIRTY-FIVE CENTS A BUSHEL FOR POTATOES—

Now our farmer-man had not gone far in his investigations before he became convinced of several things. Railway charges did not account for the difference between the price on the field and the price on the city market. The farmer alone created the wealth; but he didn't create it for himself; and he didn't create it for the consumer. He created it for the man who came between the producer and the consumer; in a word, the middleman. A sort of colossus, or giant, that middleman appeared, as you thought about him, with one hand picking the farmer's pocket and the other hand digging into the city man's coat tails; with one foot out on the farmer's back and the other foot solidly planted on the consumer's stomach. But as our farmer-man was not a Sir Galahad to knock his head against stone walls or a Don Quixote to tilt wind-mill theories, he accepted the gospel of things-as-they-are, and came to a still more pertinent and personal conclusion. The town was the place to make big money. The town was the place to come to; and so the farmer comes and comes and comes in spite of the cry "back-to-the-land"; comes with Dick Whittington's hopes in his heart to make good, and save money, and get in on this game that skins both going and coming; or know the reason why.

Before many weeks passed, he knows the reason why making good as a city man is still harder than making good as a country man. It is that matter of *saving* before you can get in on the game. Your farmer-man does not begrudge the railway its freight—even for dividends on watered stock. He does not begrudge the wholesaler and retailer their 20 or 40 per cent.; or the milk people their $8,000,000 surplus; or the pork packers their 500 per cent.; or the mill men their 1,000 per cent. He would make all that for himself, if he could. It is, that having been skinned off the land and forced to come to town, the high cost of living now skins him out of that margin he was going to save. The town salary that looked so big when he was out on the

But the City Consumer Paid One Dollar Fifty a Bushel.

town to find the same insidious and unseen hand picking the same old stupid pocket.

If you want to know whether his figures are based on fact or fiction, just consider a few well-known cases that are on record.

A farmer in New Jersey sold two hogs on the local meat market at the current prices for live squealers. Before going home, he asked the butcher to keep a couple of hams for him. A week later, he came around for the hams and asked for the balance of the money coming to him. The meat man presented him with a bill for $2.85 over and above the credit due for the live hogs. A like case is on record of a similar dicker in lamb. Why did the farmer sell at the low price of 4 to 6 cents, and buy at the high price of 25 cents? Because your middlemen are so leagued together, the prices are—one cannot say "fixed"—but *uniform;* and the dealer breaking those uniform prices will have to look out for independent means to supply himself with meat.

There was a great scarcity of turkeys one Thanksgiving. Vermont farmers supplying the Boston market could not understand why in a scarce year prices ruled uniformly 12 cents a pound lower than beef or bacon. A written agreement in restraint of prices would, of course, have been unlawful; but the fact remained, not a commission agent offered prices above 12 cents. The Vermont farmers picked and dressed their turkeys.

For Wheat, the Farmer Got One Dollar for Sixty Pounds—

farm has a surprising way of melting to nothing at the end of the week when bills are paid. He is no longer a producer. He is a consumer. He is the man who is paying 75 per cent. too much for those grapes that ought not to have cost more than 10 cents.

If those potatoes could have been sold direct from the farmer to the city man for 75 cents, it would have netted the farmer 100 per cent. profit and saved the city man 100 per cent. cost.

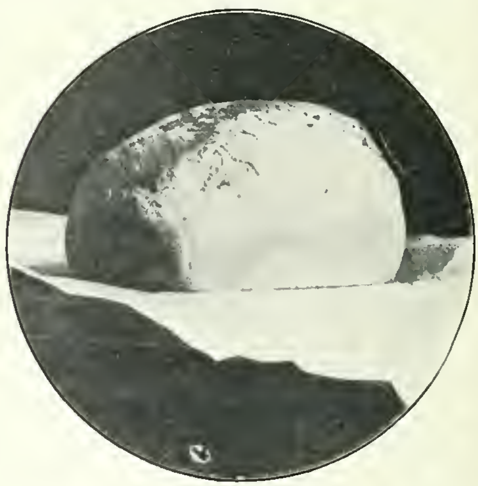
If that asparagus could have gone straight from the producer to the consumer at 15 cents, it would have netted the farmer 100 per cent. profit and saved the city man 100 per cent. cost.

If that milk could go direct from farm to table, at the present cost of producing milk, the farmer could make 66 per cent. profit and the city man save 33 per cent.

Pork at 12 cents to the farmer would give him 200 per cent. profit and save the city man 100 per cent. cost.

And so on down the list as supply and demand determined *natural* values, with the undue depression of the middleman's foot removed from the farmer's back and from the consumer's stomach.

If this farmer-man were a story-book hero, he would rise from his figures fired with a great purpose to bring producer and consumer together; but he isn't a story-book hero. He is just a plain ordinary person, one of the million and million who have gone from country to



And Bread Sold at Eight to Ten Cents a Pound.

Then they pushed a tiny letter inside those turkeys, amidships, telling the unknown city buyer what price was paid in Vermont and asking him to write back from Boston and report what price was charged there. The letters came back. Boston had paid 36 cents a pound for its turkey—an advance of 300 per cent.

BETWEEN THE FIELD AND THE TABLE, TOMATOES MANAGED TO ADVANCE THREE HUNDRED PER CENT.

Or go West! A rancher in Washington found it hard to make ends meet. He could not sell wood at any price. His beef brought only 4 cents, his pork 8 cents. He went in one winter to Spokane. Wood was selling at $8 a cord, beef at 30 cents, ham at 35 cents.

A Michigan fruit man sent a specially fine lot of grapes by water-freight to Detroit. He realized only 10 cents a basket. He traced up that fruit. It had sold for 20 cents to the city people. One of the big potato growers of Maine sent a car load to a Massachusetts city. The commission agent credited him at 35 cents a bushel. Deductions of freight and commission left only 19 cents a bushel. Those potatoes sold in Springfield at $1. Another Maine man sold his at 36 cents. They sold in Boston at $1.15. A North Carolina trucker sent a half barrel of beans to New York. Deducting express and commission, they netted him only 78 cents. They sold in New York at $4.

Secretary Wilson says the farmer gets but 55 per cent. of the consumer's price. Mr. Yoakum says the middleman gets 60 per cent. of the city man's price; and whichever is right, the fact remains that the farmer is not getting market value for what he sells, and the city man is not getting farm value for what he buys. The same unseen hand is guilty of the underpay on one side and the overcharge on the other. And the hand that picks the pockets is not the hand that toils. The middleman has not added one cent's value to the farm produce. He has been the drone of the commercial beehive.

We scorn mediaeval legends of vampire monsters devastating whole country sides. No such old wives' tales for us, thank you! Yet the high cost of living had reached such a point that in one city alone last winter—Brooklyn—more than three thousand children had to be taken out of school because parents could not afford to supply them with breakfast; and these youngsters were put to work on the industrial tread mills; whether the mills of the gods, that grind so slow and so exceedingly sure, I don't know. They may have been.

We have nothing but the most scornful pity for the people of middle-age Europe, who permitted monopolists to grind them down to destitution. Italy, France, Spain—all passed through that era when country districts were literally depopulated by the advent of the tax collector. So extortionate were the demands on the tiller of the land, that the tiller literally deserted his land; and vast tracts of it fell into the hands of the very monopolists who had fattened on the farmer's poverty. Why did the people supinely permit their own ruin? They were in the majority against their oppressors a thousand to one; but the monopolists were organized, a unit, in a word, an army. In Rome, free citizens actually sold themselves into slavery to pay their debts. Does history repeat itself under protean form? Herbert Spencer declares industrial pressure may develop greater hardship and destitution than the slavery of feudalism. Calamity howlers are at a discount in optimistic America; but isn't it worth while looking at a few facts, showing a little nerve in the matter, without blinking or side-stepping?

In one state alone, New York, 400,000 people have deserted the farm for the city. Why? In another state—Vermont—rural population has gone back in many places 10 per cent. in ten years. Last year, the Russell Sage Foundation experts investigated what it cost in New York and Pittsburg at the lowest possible figure to sustain a family of five. Twist figures which way they might, those experts could not force the total lower than $600 for a year. Now the average wages of the average unskilled worker in the United States are not $600 a year. They are under $500. What is the result? Did men sell themselves to pay their debts? Not at all! The experts found whenever the price of meat went up, these people did without it. As the prices of food mounted the ascending scale of the last five years, the number of people renting dark inside windowless tenements increased. That is the way the game that skins at both ends works when you follow it off the market into the homes of the poor.

There is no use shouting vaguely in the air against "trust-trusts." If you bring a bill of indictment against the trusts, they are going to say "prove it."

And there's less use telling men living is high because lots of gold is coming down from Alaska. More gold has gone to England from South Africa than has come to the United States from Alaska; and prices have not gone up correspondingly in England. American meat sells cheaper in England than in the United States; and last year eggs were being imported to the United States from England because the price was cheaper. It is not convincing to tell a man hard up from high prices that his pocket book is empty because there is a lot of gold. He wants to know where that lot of gold goes.

And there is no use lecturing the farmer about his duties to stay on the land and feed the city. He is going to answer "show me"; and if you can show him more profit on the farm than in the factory, chains won't keep him in town.

Nor is it logical to scold at the middleman! He sees his chance for 500 per cent. profit, and he takes it, just as you or I would take it in similar circumstances. If you accuse him of high prices, he goes into elaborate explanations of risk and loss on perishable products and the expense of big storage plants in congested centers, though that hardly explains why it paid the cold-storage men this last year to dump millions of dozens of eggs in the sea rather than break 50 cent prices. While eggs were costing 4 and 5 cents each in New York and Chicago last winter, and were being imported in shiploads from Europe and Asia, cold-storage men were talking scarcity; but no sooner did half a dozen states prepare to pass laws forbidding the storage of food products for longer than a year, than those same cold-storage men who had talked scarcity began dumping old eggs by millions of dozens into the sea. Prices dropped from 50 and 60 cents a dozen to 8 cents; and the stored eggs could not find purchasers. The storage men explained the eggs had been dumped into the sea because they had spoiled. The public that had been paying 60 cents a dozen wanted to know why those eggs had been held so long they had spoiled. Butter tumbled from 40 cents to 30, the lowest in ten years, though the number of cows had not increased; neither had the butter eaters decreased. And the drop in perishable foods within a week reacted on canned goods because people stopped buying canned vegetables when they could buy the fresh cheaper. In fact, for a family of three, the differences in prices from the time cold-storage laws forbade long-time keeping of food would run from 25 cents to $1 a day in food purchases.

But this sudden glut of the market from sudden release of stored foods can hardly prove other than temporary, like the drop in Wall Street values when certain court decisions have compelled speculators to sell. Long as the middleman plies his shuttle-like trade between producer and consumer, he will regulate prices. And can government regulations put him out of business? Would Supreme Court decisions sustain such regulations? It is so easy to hoist on the shoulders of government the duty that each man can and ought to do at first hand. The first people in the United States to wipe out the middleman have been the irrigation farmers of the West.

How? By getting together.

Why? Because the excessive cost of irrigation *compelled* the farmers to work together and pull in the same direction. When a valley of, say 20,000 people, all dip into the same well for water, all draw prosperity or failure from the same ditch—there has to be harmony. In the East, each man is still dipping in his own little individual mud puddle. While Abram's herders quarreled with Lot's, the bandits stampeded the profits—same old problem as in scriptural days, isn't it? If irrigation never accomplished anything more than compelling co-operation, than pointing the way to elimination of the middleman, it would mark a new era in national life. In teaching communities how to use the same water; how to fight frosts and insects together; how to incorporate so they can borrow at lowest rates—2 per cent. instead of 6 per cent.; how to buy all supplies wholesale; how to keep their own agents on the big world's markets; how to provide cold-storage warehouses and cars for their own perishable produce — irrigation has pointed to the one and only effective way to eliminate the middleman, a way that avoids costly long-drawn-out appeals to the Supreme Court.

You may think the remedy sounds too easy to be true. Don't flatter yourself! Try it, if you think it easy! Last year, when city people on salaries were feeling the increased cost of living almost unendurable, a group of railroad men in a Pennsylvania city arranged to send one of their number to the country to buy direct from the farmer and save the swindle that cut the farmer 50 per cent. and jacked the buyer's price up 50 per cent. The office man hired a rig and drove out. At the first farm where he stopped he found the farmer busy in the barn.

The Farmer Sells His Pork at from Four to Six Cents a Pound—

"Good day," saluted Mr. Office Man.

Mr. Farmer returned a gruff grunt with the cordiality ordinarily accorded a burglar. Undaunted, the city man launched his evangel. The farmer straightened up and listened. Wheat was selling at 60 cents in the country, butter at 22 cents, apples at $1 a barrel, etc. The city people purposed paying an advance of 20 to 40 per cent. on these prices if they could induce the farmers to guarantee definite supplies for the year.

"But the prices might go higher."

"But we are guaranteeing you 20 per cent. higher than you have ever got."

The farmer hummed and hawed and rolled the suggestion backward and forward for an hour looking suspiciously for some graft. Then he found a loop-hole of escape from the convictions that had been forced on him. "It was like this, you see. His three boys were not home—couldn't induce them to stay on the farm. Queer—wasn't it? One was getting $40 a month as a street car conductor, another $30 in a fac-

When Laid on the Consumer's Table in the Form of Chops, It Has Gone Up Five Hundred Per Cent.

Two Cents a Head on the Farm—

tory; and so on. Who was going to do the extra hauling? *He* hadn't time."

In vain, the city man pointed out that when city people sold goods, they also delivered them. Well, Mr. Farmer was not going to, so there—He didn't think much of the idea anyway. That office man went back without any supplies. If Mr. Farmer had had an annual water tax of from $1 to $6 an acre, and would have had his water shut off if he didn't pay, it is a safe wager he would have given different consideration to that plan of co-operation.

But all efforts to wipe out the middleman have not failed in the East. Wherever the compulsion has been acute enough to compel union, the middleman has had to go.

In Erie, Pennsylvania, in December, 1899, sixty dairy men decided that milk rates did not yield a living wage. For each dairy man to become an independent peddler would send prices still lower by competition. The sixty men signed a five years' contract to do no individual peddling but to act only as members of the Erie County Association. Ten wagons were cut down to two. A three-story cold-storage milk plant was put up at a cost of $26,000, with $13,000 equipment, the expense being met by the members buying shares, though they paid only a percentage down for the shares, paying the balance in their milk deliveries. All milk was certified sanitary. All unsold product was utilized in ice cream, etc. Today, that dairy association has fifty-five employees, twenty-three drivers, twenty-two office men. The first year, returns amounted to $100,000. In 1909, sales totaled $225,000. Deducting wages, the net returns can be estimated. Of course, it was not all easy. Independents, big and little, fought them bitterly for two years, and caused diminished returns. The milk was delivered to the factory on a contract of under 4 cents a quart, or about the same price paid by the big companies; but in this case, the profits went to the farmer, not to city shareholders. It is impossible to put the returns in terms of net profits to the farmer; for in each case, the profit would depend on the quality and cost of the cow.

The point is—by co-operation, the farmers got all the returns the big buyers would have paid them, plus their share of profits, which would otherwise have gone to the middleman. This scheme is practicable only in proximity to a city;

Ten Cents a Head in the City.
And the farmer doesn't get the profit.

Bossy Doesn't Know How Highly Her Product Is Valued—

but it is worth noting that seventeen counties in the Eastern States have dairymen's leagues aiming at such elimination of the middleman.

Over in Long Island, farming has become trucking for city supplies; and the Farmers' Exchange of Riverhead with a capital of $12,460 has done in 1910 a business of almost half a million. Each member's fee amounts to about $20 a year. The shares to make up the original capital were valued at $5. If you divide the gross returns by the number of shareholders—600—you can figure out that the members of the Farmers' Exchange reaped ample return for the annual fee of $20. Produce is shipped by boat. The salaried manager resides in New York and handles the stuff exactly as a commission agent, only the commission goes back to the farmer; and the full city price goes to the farmer instead of a dozen city middlemen.

In Eastern Long Island, a Potato Exchange was organized by the growers. This exchange performs the same functions as the fruit associations of the West. Only the best seed is bought, never culls, and it is planted by machines. By wholesale purchase, the Exchange saves its members 8 cents a pound on insecticides and $2 a ton on fertilizer. The saving on fertilizer was $20,000 in a single year. In prices, the Exchange has realized 10 cents higher a bushel than by the former haphazard sales. Profits for two seasons amounted to $200,000—profits not for the middleman but back to the farmer.

In Monmouth, New Jersey, the farmers of a co-operative association made 29 per cent profit in one year on a million-dollar business. Truck and fruit were shipped to one-hundred-and-thirty-six cities and twenty-three states. Fertilizer and seed were sold at wholesale to 800 members.

In Norfolk, Virginia, is a union of 400 truckers who have made 100 per cent on their capital stock, and saved ten times over the face value of their stock in wholesale purchase of seed and fertilizer.

In Mercer County, New Jersey, owing to a slack market, farmers found they were losing on small vegetables. Tomatoes rotted before they could be sold. In 1892, a canning factory was organized in a town of a thousand. Stock was sold at $50 a share. The plant put up cost almost $6,000. Land here yields 6 tons of tomatoes an acre, for which the fac-

The Dairyman Delivers His Milk at Four, the Middleman at Eight Cents.

The Farmer Sells Wood at Five Dollars a Cord—
It costs two dollars to cut it.

The Consumer Must Pay Eight Dollars a Cord.

tory pays its shareholders $9 a ton. In addition, all profits from factory go to the farmers who are shareholders. Up in Livingstone County—the most prosperous county in New York—the farmers have organized weekly exchanges where produce can be sold as on a city grain exchange.

Down in Berkeley County, West Virginia, the fruit growers not only have an association similar to those in the West, but they are holding apple shows, apple carnivals, and festivals to promote the spirit of union and progress. "Pshaw," says your practical man, "I'll take all this sentiment in cash." All right, here is the way their sentiment cashed down. When the middlemen came buying apples in Berkeley County, they couldn't possibly offer higher than $2.50 a barrel. The growers had had "a gentlemanly understanding." They got $3 for 100,000 barrels inside of forty-eight hours: $50,000 extra cash for their spirit of union.

But how is your isolated up-state farmer, living amid such non-progressives as sent the office man home unsupplied—how is he to wipe out the middleman and remedy conditions? For him, there is only one way, by hook or crook, by some such ingenuity as the Vermont turkey raisers tried, to get in direct touch with the city buyer. Up in Maine, a farmer and his wife excelled in fancy cheese; but how to get a price for it? They began exhibiting at county and town fairs with name, address and price displayed. It took just five years to work up more orders than they could fill.

In Denmark, 162,000 co-operative farmers sell $78,000,000 of dairy produce a year, an average of more than $1,000 a member. In Russia are 800 co-operative milk factories using the product of 700,000 cows. In Germany, there are 19,000 similar societies. Why does America lag at the foot of the list in her farmers'co-operative societies?

But all this, you say, remedies matters only for the country man. How about the town buyer? Wouldn't the truly co-operative association embrace consumer as well as producer? I am not advocating socialism. I never read a book on socialism or attended a meeting on it in my life. The point is to get that middleman's heavy foot off the city man's stomach; to keep that unseen hand of higher cost of living from picking your pockets and mine.

As long as the consumer does nothing but grumble, he will continue to have his pockets picked; and the middleman may sleep easy. For the consumer, there is only one way out, and it is the way that irrigation has taught—buyers must get together. That is what the consumers' co-operative leagues of England have done. They buy direct from the producer. Only 2 per cent. covers the expense of distribution. Compare that with the 2,000 per cent extortion on the basket of grapes. And the co-operative leagues of England yearly feed 8,000,000 people. That is a cutting out of middlemen, isn't it? Feeding twice as many people as live in New York! England's co-operative leagues began sixty-five years ago among some twenty-eight poor weavers who succeeded in saving $5 each in one year, pooled their capital and did a total business of $3,550 the first year. The second year they made profits equal to their original capital. Today, those leagues employ 18,000 people, have 150 telegraphic addresses on their books, sell to members close on to six-hundred-million dollars' worth of produce, and pay back to their shareholders not the extortionate 2,000 per cent. but something over three million dollars, less than half of one per cent. on business done. This, of course, does not show the saving in price to the purchaser.

Mr. Wilson says there will be no bridging of the chasm between grower and eater, producer and consumer, till starvation drives men back to the land. Mr. Hill's prophetic vision foresees only one door of hope—also starvation, compelling higher yields on the land. Many thinkers agree with both big men. Are they right? Will America wait for starvation? She never has yet. She has taken time by the forelock always, and averted the evil. Will she do it in this case? Will some great co-operative organization bridge the chasm between producer and consumer? Reciprocity may bring an era of lower prices; but so long as farmers are flocking from the farm, the relief can be only temporary. Seven million people—Canada's population—cannot make material difference in the cost of feeding 100,000,000 people. Is the giant to be left standing with one foot on the city man's stomach and one foot on the farmer's back, filching from both sides; his warehouses literally bursting with food stored and held back to force prices yet higher; stored and held back till it rots and has to be dumped into the sea? It is for the people to give the answer.

CHAMPION MARBLE PLAYERS

BLUE SPRINGS, Mo., boasts of possessing the world's champion marble players. For nearly three years it has been the fad there for the men to play marbles in spare time instead of croquet or horseshoe quoits. The result is an accuracy in shooting that is as marvelous as the shots of an expert billiard player. Withal, Blue Springs doesn't take the game too seriously. The joke is told that the town has men so good that they can't defeat one another; and a favorite story relates that Uncle Dan Stanley, who is seventy-four years old, and Uncle Tom Halloway, who is seventy-five, "lagged from taw for two days" without either contestant winning the advantage of a sixteenth of an inch in the struggle to gain the privilege of claiming the first shot, so the contest had to be declared a draw even before it began.

In this photograph four champions appear: Uncle Dan Stanley, with the gray beard; at his left, with the derby, Captain George Webb, the undertaker; George Binger, farmer-champion, is shooting; next on the right is Lynn Pryor, the blacksmith, whose shop is headquarters and clubrooms for the world's champions.

The Champions in a Competition.

Trapping a Forest Fire Bug

Charlton · Lawrence · Edholm

ACCORDING to the California state board of forestry there were seven hundred and twenty fires in that state last season and they burned over one-half million acres of land—nearly half of which was timber land—and destroyed two hundred and forty million feet of timber.

This represents a loss to the owners of the timber, assuming an average stumpage value of two and one-half dollars per thousand, of about six hundred thousand dollars. The loss to the public, however, is much greater for the reason that if this timber, instead of being destroyed, had been manufactured it would put nearly two and one-half million dollars into circulation.

The direct loss, therefore, to the citizens of California was something over three million dollars, to say nothing of the loss due to destruction to watershed cover. The average fire covered 703 acres and took sixty men ten hours to extinguish it.

ABOUT TO DYNAMITE A BURNING "SNAG."
United States regulars fighting a forest fire.

As a rule, forest fires are caused by gross carelessness; a Mexican will throw away his half-burned cigarette into the tinder-like grass; a camper will neglect to extinguish the fire over which he broils his bacon, or will foolishly build it against a fallen trunk, rotten to the core, which may smoulder for weeks, like punk, and then start a blaze. Sometimes the fires are caused by sparks from engines used in logging camps or from a passing locomotive, and cases have been recorded where a fragment of a whiskey flask thrown along the trail has acted as a burning lens, starting destructive grass fires.

The Beginnings of a Conflagration in the Brush.

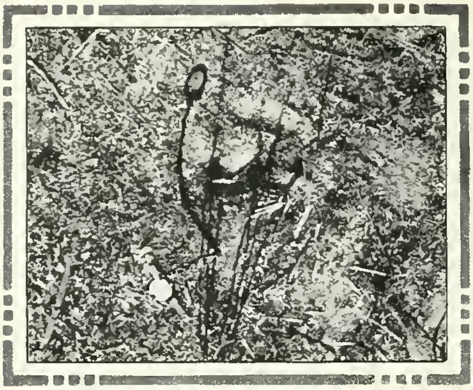
It is comparatively seldom that these forest and brush fires are wilfully ignited, yet there are people who are so shortsighted and selfish or so criminally inclined that they will turn a fire demon loose upon the country, which may destroy much property and many human lives before it can be checked.

This is a true story of one such "fire bug," a man who displayed remarkable cleverness in violating the law, but was finally met by the superior cleverness of the men who protect society from his sort.

The forest rangers in San Diego County, California, had long been perplexed by a series of fires of mysterious origin. The country thereabouts is well settled and the Forest Reserves consist mainly of hills covered with brush, of no value for timber but very valuable for conserving the rainfall.

Now some of the ranchers in that vicinity did not understand how the brushy growth could be of any use to anyone at all; it sheltered the rabbits and quail that preyed upon their crops, a nuisance and source of loss, and inasmuch as fresh feed would spring up on the burned-over fields to the advantage of their flocks and herds, they showed no great enthusiasm in co-operating with the fire wardens. Of course, when summoned to help fight a fire they would pitch in and work hard with shovels and axes—at the rate of twenty-five cents an hour—but when it came to helping the forest rangers by taking out the necessary permits whenever they burned off their own land, or being willing to testify against those who were careless with fire, they showed themselves indifferent if not hostile to the Forest Service.

Among the most persistent of these offenders was a young rancher who appears to have been the victim of what Kipling calls "an exaggerated ego," or as they express it in the Southwest, he was one of those fellows that you can't *tell* anything. The fact that a regulation existed irritated him so that he would go out of his way to defy it. Several times he had been reprimanded for failure to observe the simple precautions



Lens, or "Burning Glass," Focused Over Matches.

required by law when burning the brush on his place, and his answers had always been defiant.

Webster—his name was not Daniel Webster, but it will serve excellently to identify him—was finally threatened with prosecution by the forest supervisor, but he did not cease violating the regulations. These were so simple and easily followed that there seemed no excuse for his ignoring them. He was required to get a permit from the fire warden to burn off his land at a certain time and a few men must be on hand to see that the fire was kept under control. Instead of having four men to look after one fire, it was reported that Webster had sometimes had as many as four fires burning on his place with only one man, himself, to keep them from spreading. He was cornered once and asked why he ran the risk of getting into trouble with the authorities in such a foolish manner.

"Oh, I'll take the chances," he said, "they won't fine me more than $50 if they do catch me, and the feed is worth more than that. Besides I am not going to pay a lot of men to stand around like fence posts and watch a fire!" Which trend of thought showed that Webster considered this Western country the land of the free in its broadest and most unrestricted sense.

However, when the threats of prosecution reached him from headquarters, he apparently ceased his depredations. True, the fires continued in the neighborhood of Jamul Post Office and the fire wardens were kept busy. One conflagration injured a neighbor's olive orchard and another got loose on the forest reserve and burned over one thousand acres of land before checked by the rangers. But by the time the authorities began to watch him, Daniel Webster was invariably ready to prove an alibi that covered each fire. He would be seen riding across the country on his grey stallion or at work some miles from the origin of the blaze at the time it started, and could bring witnesses to prove it. Sometimes he would be among his friends at the store when attention would be called to a little puff of smoke that meant the beginning of more trouble for the rangers. His alibi was perfect, yet from his previous reputation the fire wardens believed that Webster had something to do with these conflagrations.

One trifling misdemeanor he did admit, not to the authorities but to his neighbor, an old man by the name of Dale, who woke up one morning to find his fence posts blazing from a grass fire. Webster was trying to beat the flames out and when the two of them finally succeeded, the young man said he was sorry the fire had got out of his control and offered to replace the burnt posts.

A few days after that, Forest Ranger John B. Simmons was riding in the neighborhood of Jamul Post Office, and

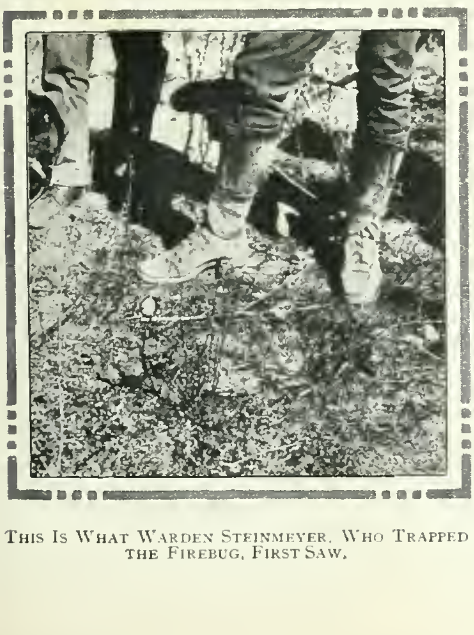
This Is One of the Photos That Convicted the Firebug.
Note the twisted wires, lens, and burnt matches.

Campers Are Not Always Careful About Putting Out Their Fires.

looking across the country a mile or so saw a small fire on the Curtiss ranch leased by Webster, and rode over to investigate and help put it out. Nobody seemed to know how it had started and after the ranchers had gone Ranger Simmons carefully went over the burned area but found nothing more suspicious than the prints of a horse's hoofs in an out-of-the-way place. These were not old prints but had evidently been made before the fire, as burned grass filled the depressions. The keen eye of the ranger noted a slight malformation, a nick, in one of the hoof prints, and he made a mental note of it.

The next day, the nineteenth of October, 1909, Ranger Simmons once more saw smoke in the same neighborhood just about noon and again rode over in that direction, but was met by Fire Warden Steinmeyer who said there was no hurry as the fire was already under control, being handled by Daniel Webster, Ranger Sears and a couple of ranchers.

It seems that Ranger Sears had seen the fire first and immediately rode out with Fire Warden Steinmeyer to get a force of men to fight it. They went first to Webster's ranch house and found him busily digging and apparently unaware of the cloud of smoke just over the ridge behind him. He expressed great surprise but said he was ready to help and mounted his grey stallion to ride over, first taking a pair of pliers out of his hip pocket and throwing them on the ground. Steinmeyer and Webster then hurried toward the fire while Sears rode over to get help from the Strong brothers who lived near by. After summoning them he took a short cut across the ridge and presently saw Steinmeyer and Webster ahead of him, the latter lagging behind and afoot, as he had tied the stallion in a safe place. Evidently Webster was not expecting any observation from the rear, for while he kept his eye on Warden Steinmeyer he would occasionally stop, strike a match and start a small blaze in the dry grass as he walked along.

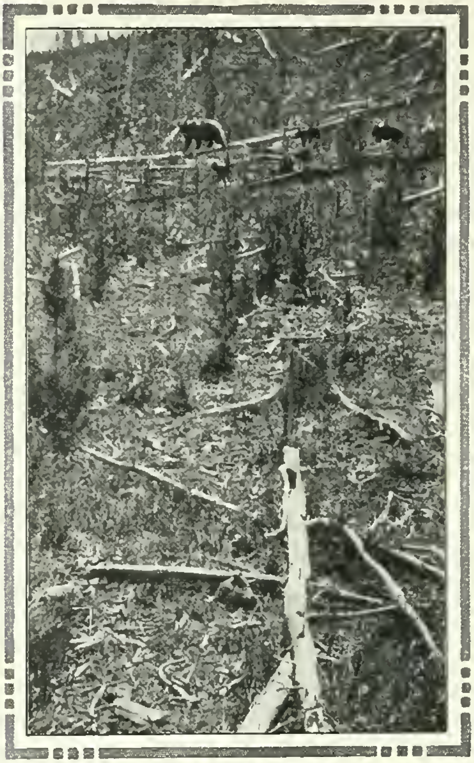


This Is What Warden Steinmeyer, Who Trapped the Firebug, First Saw.

Sears put his horse to the gallop and took the "fire bug" by surprise, but the young man had a ready excuse; he said he was starting back fires. As the fire had passed on a full half mile to the east, however, and there was a westerly wind blowing, this seemed a rather flimsy pretext to the ranger and he decided to keep a strict watch on the incendiary.

Presently the fire was under control and Steinmeyer rode back and met Ranger Simmons near the point where

Webster had tied his mount. The two men discussed the problem of how the blaze had started and the mystery surrounding the recent outbreaks and the too perfect alibi brought up by Webster in each instance. As this was near the point where the fire on the previous day had originated, Ranger Simmons, thought it would be a good idea to make a thorough examination. He spoke of having gone over the ground and finding the hoof prints, those of an unshod horse with a peculiar nick in its right fore foot. Then he noticed the stallion near by, which he knew to be Webster's, and the two men went over, raised the stallion's hoofs and found that they corresponded with the prints, being unshod and having the peculiar nick in one hoof. This looked suspicious but it was not evidence. The men went over the ground on their hands and knees and presently Steinmeyer sang out excitedly, "Look here what I've found!"



Hunters Sometimes Start Fires to Drive Out the Game.
Note the bear on the hillside.

It was a find indeed. It consisted of a piece of ordinary double strand fence wire, about a foot long, twisted together. One end was spread, forming a two-tined fork which held the lens of a pair of spectacles. The lower end was stuck firmly into the ground and just where the lens would focus the sun's rays upon them, were the half-charred stumps of several parlor matches. The device was a striking example of perverted ingenuity, and the two men could see at a glance how easy it would be to set this inconspicuous object in an obscure place among the grass and weeds, along a trail, first experimenting and adjusting the lens so that at high noon precisely, the plane of the lens being at right angles to the south, the focus would be upon the matches. Then the addition of a little dry grass and leaves would be sufficient to start a destructive blaze. At the hour set for the infernal machine to ignite, the man who made it could be miles and miles away. In fact by setting the device on a certain day after the sun had passed the meridian, by even a few minutes, it would be ignited on the following day almost a full twenty-four hours later.

Simmons and Steinmeyer decided to leave the little device where they had found it and try to entrap the guilty man.

As they were about to leave, they found a couple of short lengths of twisted wire which had been cut with a pair of pliers, and the noticeable point was that the cut had not been made at one stroke, but each wire had been cut separately. Now, there are various kinds of pliers, some of which would sever the two strands at one stroke and others which are so small that they would require two cuts, as in this case, and the men stored up the facts in their minds for future reference.

They rode back to the fire fighters, found that the blaze was completely extinguished, and the whole party returned along the trail by which they had come. Simmons made a sign to the other two forest officers to let Webster take the lead, and the rest followed in Indian file at his heels. Presently Webster started off the trail to make a detour through the burned brush, but the others did not follow as he had hoped. Instead of that, Simmons called him back. "Why are you going that roundabout way?" he asked. Webster made some non-committal reply, and Simmons pointed to the bit of wire and lens on the other side of the trail.

"Dan," he said, "what do you suppose that thing is?"

The young man immediately stooped and brushed aside the stump of matches and uprooted the twisted wire. "The fellow that put that there was on to his job all right," he chuckled. "He was as clever as the chap that put candle and matches in the rat's nest."

No one had suggested to him that this inconspicuous bit of baling wire and its fragment of glass was a firebug's device, and the fact that he grasped the significance of it at once had its weight with the jury later on at the trial.

Webster saw his mistake and tried to divert suspicion by calling attention to a speck on the lens. "This has been here so long that it is fly-specked," he remarked, casually. Then he added, "I guess I'll just keep this as a souvenir," and tried to slip the glass into his pocket; but Ranger Simmons was collecting souvenirs himself at that time, and the bits of wire, burnt matches and lens were turned over to Forest Supervisor Marshall, who had seen the fire from his office in San Diego, nineteen miles away, and hastened out, arriving that evening.

Now, the Forest Supervisor at San Diego is a man who has a genius for details, and his preparation of the case, built up on circumstantial evidence, was a matter of trifling details skilfully pieced together.

He adroitly questioned Webster before witnesses, and one of the first things he did was to destroy that gentleman's reputation for veracity in an apparently offhand manner.

"How about that grass fire the other day," he asked, "the one that burned Mr. Dale's fence posts? Have you any idea who started that little blaze?"

"No, indeed," answered Webster, "I couldn't say who started it, but I was one of the men who helped put it out,

SAPLINGS GROWING ON A FIRE-DEVASTATED AREA.

and if it hadn't been for me, Mr. Dale would have lost all his fence."

Then Rancher Dale was called in and questioned. "Have you any idea, Mr. Dale, who started that fire which burned your fence posts?"

"I certainly have," replied Dale. "Daniel Webster started it; he told me so himself and offered to pay for the burned posts."

Then Webster was suddenly asked what he had been doing in that distant part of the ranch the day before the fire broke out. He denied having been in that vicinity for weeks, and when confronted with the evidence of the nick in the fresh hoof prints that corresponded with that of his grey stallion, he relapsed into mere defiance and suggested that the forest supervisor might ask the horse if he wanted to know anything further.

Finally, the slight incident of the rancher throwing away a pair of pliers before starting to the fire was brought up and the tool was produced. It was found that these pliers were of the type that would require two strokes to sever the twisted strands of wire, just as the pieces of the "infernal machine" had been severed.

Such was the evidence that went before the jury in the Federal court when the case came to trial. On careful search of the ground where the fire had originated, a second igniting device was found about four hundred feet from the first, and this exactly corresponded with it. This was photographed just as it stood and enlargements to natural size were made and placed before the jury, with a speedy conviction as a result.

The sentence was comparatively light, only four months in jail, but the legal expenses practically stripped the ingenious Mr. Webster so that in the long run he would probably have found it more economical to have secured a burning permit and hired three or four men to watch the fire.

Much credit is due the forest officials who prosecuted this case in the face of adverse criticism by the very persons

STOCK MEN BURN THE BRUSH TO "IMPROVE THE RANGE."

READY FOR A FOREST FIRE—ONE OF INNUMERABLE INSTANCES OF CRIMINAL CARELESSNESS.
Logged district on private land where the brush is not piled, but is left recklessly scattered.

who had the best reason for co-operating to punish the incendiary, the ranchers in that vicinity. In forest fire cases it is exceedingly difficult to secure convictions, as the trouble usually starts in thinly-settled parts of the country, and moreover, the rangers and fire wardens who see a blaze cannot stop to gather evidence; their main business is to put out the fire. Hence, out of 307 fires suspected of being set in violation of the laws in California during the year 1909 only eighteen convictions resulted, and fines amounting to $385.00 were distributed among seventeen offenders, while one of these enemies of society got a ninety-day sentence.

Such leniency causes trouble for the fire fighters, as even a careless or malicious man would hesitate to violate the law if he were sure of speedy punishment.

Campers seem to be the worst offenders, and this includes sportsmen, prospectors and travelers. In the California Forest Fire report of 1909 they are blamed for one hundred and fourteen fires. Hunters, who intentionally set fires to drive out game, are made responsible for twenty-one such conflagrations. The report sums up the attitude of most of these people with the following pat remark: "Most of them would call themselves nature lovers, but their love of nature is not strong enough to prompt them to be sure that their camp-fires are out, or to be careful of their matches and tobacco."

The WORKERS

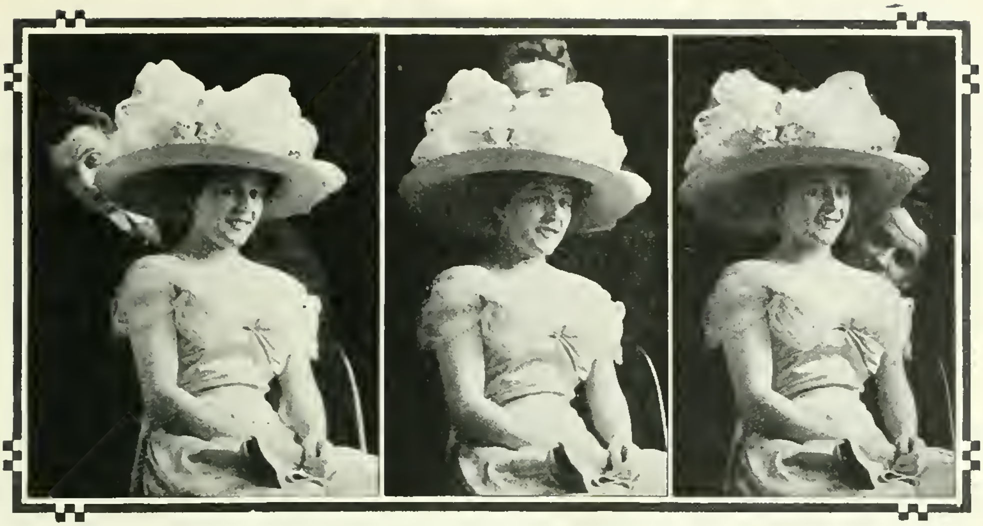
By Margaret Ashmun

Some speak today of labor as it were
A grievous wrong, mysteriously sent,
Whereby mankind must suffer; they would stir
In honest hearts, dissensions, discontent,
Wrath, quick and fierce, destroying where it may,
And rash rebellion, envious to slay.

O brothers! toilers with the hand and brain,
To scorn your task will make you men distraught!
Wherefore your strength, if not for greater gain
Of all your race, through what your strength has wrought?
Though mean your might or pitiful your wage,
You are the chosen servants of the age.

So much the world has need of, it were meet
That every man should count himself a part
Of all that lifts and labors, deeming sweet
His right to yield of muscle, mind, and heart
His manly share, nor let his gift be small—
For life is stern and all are kin to all.

Then curse not work. It is and still must be
The gracious way that each free soul must find
Who lives not to himself; and bless'd is he
Whose days are spent for profit of his kind.
O brothers! toilers! spare not of your worth,
But serve the world in gladness and in mirth.



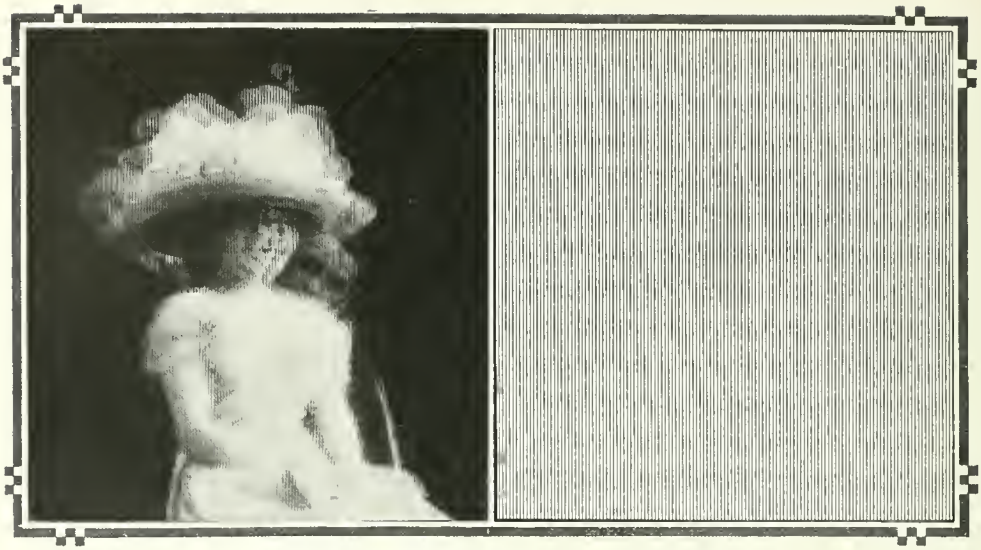
THE SIMPLEST MOTION PICTURE SYSTEM.
But three photos produce the desired effect.

Motion Pictures for Stereopticons

by Robert H. Moulton

TEN years ago the highest development of the "magic lantern," or stereopticon slide was the photographic transparency—usually plain black and white, but sometimes tinted to show the natural colors of the object represented. When a lecturer could show a series of such colored views of unusual subjects, he had reached the then existing limit in the field of projected pictures. Then came the moving picture machine, with its long roll of revolving film impressions, by means of which people, animals and other objects in motion could be reproduced with wonderful fidelity to nature. Since that time numerous inventors have exercised their ingenuity to perfect a device that would enable one to reproduce the same effect of motion with a single stationary slide. A recent invention called the genre motion slide seems destined to fulfill the demand for such an article. In particular it will be welcomed by the many amateur owners of stereopticons who find the expensive moving picture films beyond their reach, while as a means for advertising it will no doubt prove as valuable as the moving electric sign. Not only is this slide cheaper for the average user than the film rolls, but it also costs the maker considerably less, inasmuch as it does away with the necessity of employing a large company of people to act out before the camera scenes and plays such as are commonly shown at the moving picture theaters.

The public has become so educated to the moving picture idea that the motionless views of a few years ago now create but little interest. Since it has been shown that people can be made to pass in review before us on a screen and do



HOW THE NEW CINEMATOGRAPH IS OPERATED.

The composite picture is made from the three photographs shown on the preceding page. A vertically ruled glass, placed over the plate containing the composite photograph, and manipulated from side to side, produces the "motion picture" effect.

almost everything that they do in real life except talk aloud, no one cares any longer to see mere representations of "still life." Action and speed are as much expected and demanded today in the amusement line as in any other. Just as the bicycle has been superseded within the last few years by the swifter motor car, so has the old fashioned lantern slide given way to the quickly moving rolls of film with their constantly changing and lifelike action.

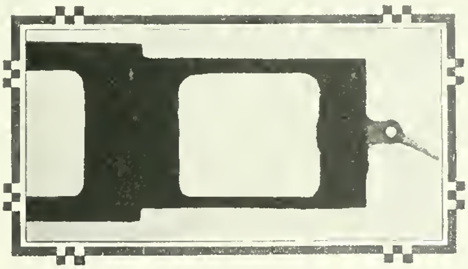
The moving electric light signs such as are commonly used in front of theaters, restaurants and stores furnish another illustration of the fact that any object which is shown in motion will catch the eye quicker and hold the attention closer than the same thing when shown in repose. The first electric advertising signs attracted so much attention and were such a great improvement over the ordinary painted sign that they soon came into general use. But their value as an advertising medium was increased many times over when a way was discovered to give the lights an appearance of motion. This is done, not by making the lights actually move, but by switching the current from one set of globes to another in such a way that they seem to do so. Some of these signs are really quite wonderful examples of realism.

The cost of a moving picture machine is very little more than that of a first class stereopticon for motionless views, and they are quite as easily handled; but the price of the film rolls, due to the elaborate processes employed in their manufacture, confines their use principally to theaters and professional lecturers. In the case of the theaters a single roll of film may serve to entertain hundreds of audiences in as many different houses. Coming from a central depot or manufacturing establishment they travel from one theater to another, from city to city and from state to state until they are literally worn out, or become too antiquated in subject to appeal to even a provincial audience. Thus the original cost of the film is divided up among many users.

The genre motion slide is a medium between the ordinary lantern slide and the moving picture film. That is, it is a single stationary slide which not only shows a picture of an object, but by means of a very simple contrivance, enables the operator to give the picture perfect motions. That such an effect could be produced with a single slide seems incredible. But it has been done;

and while the new slide offers opportunity for further improvement, it is already sufficiently developed to meet all ordinary requirements.

The common form of lantern slide, which shows a single picture of an object, consists of a glass plate on which is printed a photographic positive. In the case of a building or landscape only one view, of course, is necessary. But to show the successive attitudes accompanying the movements of a man or an animal it is necessary that a series of pictures be taken, the different exposures on the revolving film occupying less than a thousandth part of a second each. It is manifestly impossible that the impressions of all these negatives could be printed in the ordinary way on a single plate and show anything else than a dreadful tangle of lines and curves. The result of doing so would be like a photographer's "double exposure," only very much worse. The only way to show separately each of the individual pictures printed on such a plate would be to blot out all save one at a time. And this is exactly what the new motion slide does. The secret, of course, lies in the manner of printing.



The Carrier is Fitted with an Eccentric.
By means of this, the ruled plate is moved to right and left.

Three negatives are first made, but instead of printing from them in the ordinary way, each one is first ruled with a series of very fine vertical lines. A composite plate is then made from the ruled negatives. This plate somewhat resembles a mosaic in appearance, only instead of being broken up into small irregular particles it is composed of even and parallel sections. A second perfectly plain plate is then ruled like the composite plate, the lines being placed at such a distance apart that they will cover at one time *two* of the sections of the latter, leaving the third section visible. By moving the second plate from one side to the other, first one then another of the pictures on the composite plate is revealed, and if this is done quickly the subject is given a perfectly lifelike appearance of motion. Of course, the number of postures of a subject that may be shown on one of these slides is limited. No effort has yet been made to combine more than three, but it is not too much to expect that a way will yet be found to do so. Three positions, however, if judiciously selected will impart to the picture the same natural movements that occur in the long rolls of revolving film. The only difference is that the motions are repeated in the case of the slide. For instance, the picture of a baby can be made to smile, laugh and cry by turns, one expression changing to another with perfect naturalness; a small boy is shown going through a series of gymnastics, playing at marbles, or representing George Washington in his immortal act of cutting down the cherry tree; and the antics of a clown at the circus are reproduced accurately. In fact, any subject that lends itself to the moving picture films may be shown on the motion slides.

Another feature of these slides that will commend itself is the fact that the pictures used on them do not necessarily call for the services of living models, but may be made from a series of drawings in which the subject is represented in various attitudes. The effect is just as natural, and may be made even more amusing than where living subjects are employed. To see a Teddy bear turning cart wheels, or a monkey engaged in the act of pulling a suffering lion's tooth is something that no moving picture machine could ever reproduce. But on the motion slide such scenes are limited only by the artist's imagination.

The only thing necessary to show the motion slides in an ordinary lantern is a special carrier. This is fitted with an attachment in the shape of a small eccentric which is used to move the plainly ruled plate evenly and with the required degree of speed.

KNOWLEDGE IS "RUN" HERE ON BUSINESS PRINCIPLES.
Administration Building, Carnegie Institution, City of Washington.

$25,000,000 BRIBE FOR NATURE'S SECRETS

By

CHARLES FREDERICK CARTER

HOW does a young loggerhead turtle, thrown upon its own resources in a selfish world from the moment it leaves the egg-shell, know where to go to take up the struggle for existence with any prospect of success?

Davenport Hooker has found out the answer to this conundrum. Equipped with a quantity of glass of different colors he went to the Dry Tortugas where he put in a lot of time placing the glass in front of young turtles. When they saw the ocean through red, yellow or green glass they would not move toward the water; but when they saw it through blue glass, or when they saw the blue glass or even blue paper, they crawled toward it with evident excitement. Hence, Mr. Hooker concludes, the turtle's sense of color guides it to its natural element. Imagine the predicament of a color-blind turtle!

On these islets in the Gulf of Mexico, about seventy miles from Key West, where the United States Government entertained a large party of Southern gentlemen nearly fifty years ago, the Carnegie Institution of Washington now keeps open house for scientific gentlemen from various parts of the world. Here the scientists eat canned goods while they study original problems in marine biology, or else they study marine biology while they eat canned goods, I have forgotten which. Anyhow, it is one way or the other.

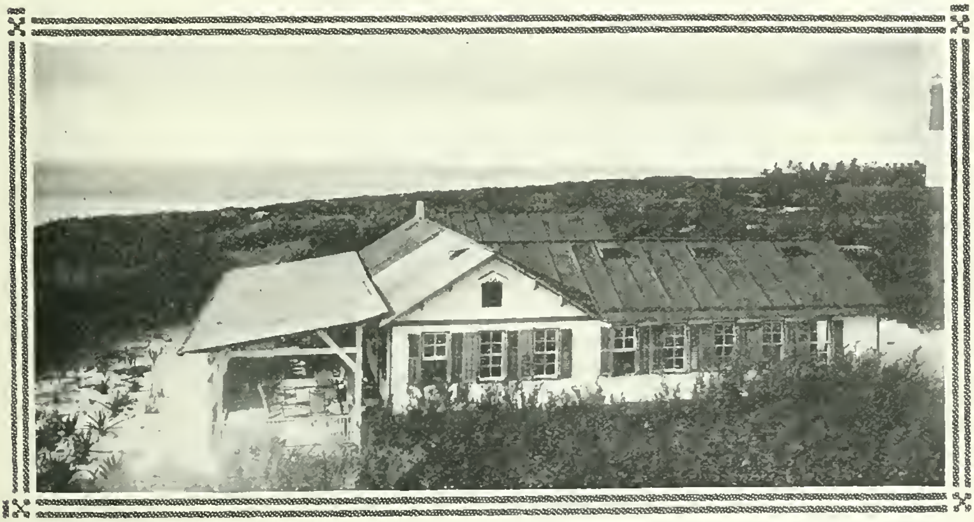
Many sensational disclosures have emanated from those glistening white sands since the biological station was established. It is now known that not only are loggerhead turtles possessed of a sense of color but that the gray snapper is similarly equipped. The scientific squad played a mean trick on the gray snappers which the Society for the Prevention of Cruelty to Animals would do well to look into. The snappers were tempted into developing a taste for sardines dyed red. When this had been accomplished some sardines were loaded by placing tentacles of the medusa in their mouths.

"Stung again," exclaimed the snappers as they dropped the loaded sardines. Thereafter the snappers would not touch a red sardine, no matter how hungry they were, thus showing that they knew a thing or two.

On the other hand, all colors look alike to the ghost crab, though it readily perceives moving objects and is sensitive to large differences in the intensity of light. But it is deaf as a post, its so-called "auditory organs" being in reality organs of equilibration. In spite of its handicaps the ghost crab has memory and, like the gray snapper, can profit by experience, which is more than some people can do.

Prof. John B. Watson, making his headquarters at the marine biological station, was able to pry into the domestic affairs of the noddy and sooty tern on Bird Key. He reared the young birds and found that they could learn to find their way through a maze to their food. The adults could also learn to overcome obstacles in seeking to sit upon the egg. The noddy builds its nest in bushes, and in doing so is quite shy; but if an egg be placed in the nest it loses all shyness and sits upon the egg as if it were its own. Both male and female build the nest, but the male alone procures food for both during this period, the female constantly guarding the nest. After the egg is laid male and female fly away to fish, taking their turns at brooding the egg at intervals of about two hours. The egg hatches after thirty-two to thirty-five days of incubation. The noddy does not recognize its own egg but will cheerfully incubate anything that looks somewhat like an egg. It recognizes the locality of its nest and returns to the old locality if the nest be moved, but it will accept an artificial nest placed in the old locality without hesitation. The sooty tern nests upon the ground and recognizes the exact locality of its nest; if the nest be raised vertically, the bird readily alights upon it; then if, after an interval, the nest is lowered the bird attempts to alight in the air in the place where the nest was formerly. A slight horizontal movement of the nest causes great confusion to the bird.

Birds taken from Bird Key to Cape Hatteras, eight hundred and fifty miles



AT THIS PLACE WAS ANSWERED THE QUESTION: "HOW DOES A NEW-BORN TURTLE KNOW WHERE TO GO?"
Laboratory of the Department of Marine Biology, Tortugas, Florida.

away, and liberated, returned in five days, although it is believed that they flew along shore and not by an air line, which would make the distance at least a thousand and eighty-one miles.

A number of other sojourners at Tortugas station have found out various things which they have set forth at length in the publications of the Carnegie Institution, not one of which has yet appeared in the list of the six best sellers. However, what the publications of the Carnegie Institution lack in popularity they more than make up in quantity. Although the Institution was organized only nine years ago its publications in book form already aggregate 167 volumes, having more than forty thousand pages, or upwards of twenty million words of printed matter, while twenty-five volumes more are already in press, not to mention some twelve hundred articles a year contributed to scientific periodicals.

In the presence of such an inky deluge it does seem as if the wilderness of interrogation marks in which mankind has been wandering since the other deluge must inevitably be swept away. No doubt it will be, unless the truth itself should also be submerged.

But anyhow the spectacular quest of knowledge so prodigally endowed by Andrew Carnegie is worth the watching, for there was never anything like it in the history of the world. Until last January when the founder added $10,000,000 to his previous endowment of $15,000,000 the Carnegie Institution had an income of more than six hundred thousand dollars a year. Its permanent plant already includes a handsome administration building in Washington and fifty-eight other buildings, including two astronomical observatories and five laboratories, thirteen parcels of land and a fleet of ten vessels. Upwards of twelve hundred individuals have contributed in one way or another to the promotion of the researches and the publications undertaken by the Institution, while during each of the past five years about five hundred individuals have thus collaborated. With such an outfit and such an army of workers investigations have been carried on during the past year in more than thirty different fields of research, extending to more than forty dif-

A SHIP BUILT WITHOUT A SINGLE SCRAP OF IRON.
The *Carnegie*, used in the magnetic survey. Copper and brass were the only metals employed in her construction.

THE DOME FOR THE 60-INCH REFLECTOR, MOUNT WILSON SOLAR OBSERVATORY, PASADENA, CALIFORNIA.

Dr. Hale, the director of this observatory, has found ways to reveal 60,000 new worlds.

ferent countries scattered over every continent, not to mention the oceans and interstellar space.

Ten independent departments of research, together with divisions of administration and publication, each with its staff and assistants, have been organized and established within the Institution itself. In addition to these larger departments of work, numerous special researches, in aid of which upwards of seven hundred grants of money have been made, have been carried on by research associates and other individual investigators.

It is not to be understood from the foregoing that the Carnegie Institution is in a hurry to find out all there is to know; for President Woodward has suggested that in estimating the work of departments the decade instead of the year should be the unit of time. Indeed, the peculiar worth of the Institution lies in its ability to pursue with absolute thoroughness, regardless of time or expense, whatever it undertakes. Yet while working for posterity quite as much as for the present generation the Carnegie Institution is accomplishing practical results of immediate importance.

For example, the Department of Terrestrial Magnetism was organized to find, if possible, the answer to the questions, what is magnetism, and why is the earth magnetic? This is a pretty big contract, for the carrying out of which the largest, most comprehensive, and perhaps most expensive investigation ever undertaken in the name of science was begun. The first step was to organize a magnetic survey of the whole world, by sea and by land. This survey has been going on ever since 1905. While its ultimate object is the solution of a scientific problem the practical benefits of which can better be determined after it has been accomplished, results of the utmost immediate importance are being achieved while the work goes on.

THE NUTRITION LABORATORY, AT BOSTON, MASSACHUSETTS.

IN THIS BUILDING SCIENTISTS ARE TRYING TO FIND OUT HOW THE WORLD WAS MADE.
Geophysical Laboratory, Washington, D. C.

Frequent magnetic surveys are necessary to keep tab on the compass, which is the main reliance of the navigator. The compass is popularly supposed to point straight to the place where Dr. Cook didn't go, with an unfaltering fidelity that has become proverbial; but as a matter of fact the compass is as flighty and uncertain as a girl with two beaux. For instance, the compass on a liner leaving New York for Europe points ten degrees west of north; in mid-ocean the needle yaws thirty degrees west of where it should be, while at Southampton it is only seventeen degrees west of its proper place.

The north magnetic pole, by the way, is a different thing from the geographic north pole, for it is situated in latitude seventy degrees north and longitude ninety-seven degrees west, while the south magnetic pole is approximately in latitude seventy-three degrees south and longitude 156 degrees east. A straight line drawn through the earth from one magnetic pole to the other would pass about seven hundred and fifty miles to one side of the center.

It would be bad enough if the compass varied from place to place; but, not satisfied with that, it must also vary from time to time. Just when you think you have the compass it is most likely that you haven't, as many an unfortunate mariner has found too late to keep his ship off the rocks. In order to make such an eccentric instrument available for navigation it is necessary that the amount of variation at any given point should be known so that any given compass reading may be corrected to give the true direction. Compass variations are checked up from time to time by magnetic surveys made by various governments, the results of which are plotted on charts for the guidance of the navigator.

The Carnegie Institution began its magnetic survey of the Pacific Ocean in August, 1905, with the *Galilee,* a wooden brigantine of six hundred tons, from which as much iron and steel as possible had been removed to render the vessel as nearly non-magnetic as practicable. The *Galilee* covered sixty-five thousand miles of salt water in a course which, as plotted on the chart, looks as if it might have been laid out by a beetle with the blind staggers, for the *Galilee* crossed her own trail whenever practicable to check up observations. The results were important, for errors of one to three degrees were found on existing charts between San Francisco and Honolulu and errors of from three to five degrees elsewhere.

In order to attain a still greater degree of accuracy a non-magnetic ship which was christened the *Carnegie* was launched in June, 1909, at a cost of $115,000, to be used in the magnetic survey. On the very first voyage from Long Island Sound by way of St. Johns to Falmouth, England, errors of importance to navigators were found. In one instance the amount of compass variation at a certain spot in the ocean was given differently by each of the three standard charts published by the British Admiralty, the German Admiralty and the United States Hydrographic Office, and the *Carnegie* proved that all of them were wrong. Along the track followed by the Atlantic liners from England to a point off Newfoundland the present magnetic charts show too large a westerly declination by nearly a degree. From there to Long Island the charts give too small a westerly declination by about a degree and a half. The effect of these errors is always to set a vessel toward Sable Island or Newfoundland, where the facilities for a first-class shipwreck are unequaled. Cruising around the Azores the *Carnegie* gathered proof that the *Slavonia,* which was wrecked on a reef in 1909, though the four hundred persons on board were rescued through the help of the wireless telegraph, was in her proper course according to the Admiralty charts, but that there was an error in the charts of between two and three degrees or about a hundred and fifty miles.

The *Carnegie* is now at sea on a three years' cruise that will take her around the world. While the ocean survey is going on, field parties are busy with the magnetic survey in British North America, Central America, West Indies, Colombia, Ecuador, British, French, and Dutch Guiana, Africa, Persia, Turkey, Asia Minor, Southern Asiatic Russia, and China. All these parties send their observations to headquarters at Washington where they are reduced and prepared for publication.

No Chicago packer works up his by-products more carefully than the Carnegie Institution. The main purpose of the Department of Terrestrial Magnetism, as already indicated, is a magnetic survey of the earth. But it has been found that with a very small additional

WINGLESS CHICKENS HAVE BEEN PRODUCED HERE.
This is not done as a pastime, but as a most serious effort to peep into the mysteries of the Darwinian theory. Station for Experimental Evolution, Cold Spring Harbor, New York.

A STATION FOR PLANT STUDY IN THE DESERT.
Department of Botanical Research, at Tucson, Arizona.

expenditure of effort a by-product investigation of the relation between solar and terrestrial magnetism can be prosecuted. It has already been found that an increase in solar activity is apparently associated with an effect on the earth's magnetism equivalent to a decrease in the mean intensity of magnetism. To reduce this discovery to every-day terms it means that having learned how the activity of sun-spots, which are great electric vortices sweeping across the face of the sun, affect the earth's atmosphere, present theories may be so revised as to make weather predictions an exact science.

Two separate departments are studying the heavens. One of these, the Department of Meridian Astrometry, is established in observatories at Albany, N. Y., and San Luis, Argentina, on the eastern plateau of the Andes. The observers at San Luis are hard at work making accurate measurements of the position of the fixed stars visible in the southern hemisphere to be compared with corresponding measurements in the northern hemisphere, in the preparation of a complete catalogue of precision of all stars from the highest down to those of the seventh magnitude, inclusive, for the entire celestial sphere. The San Luis observatory is breaking all records in stellar studies, having attained a score of fifty-six thousand observations in a year.

The solar observatory on the summit of Mount Wilson, near Pasadena, California, has a most elaborate equipment for studying the sun. This includes the Snow horizontal reflecting telescope purchased from the Yerkes observatory, a tower vertical telescope one hundred and fifty feet high, and another sixty feet high, and a reflecting telescope sixty inches in diameter mounted equatorially. These telescopes are supplied with various spectographic, photographic and other devices for studying the sun and stars. In Dr. George Ellery Hale, Director of the Observatory, the Institution has found one of the geniuses it was created to discover. By introducing entirely new processes in photography and in other details Dr. Hale has been able to reveal sixty thousand new worlds, never before seen by man, some of which are ten times as large as our sun. Most of the work, though, consists in studying the sun, photos of which are made every clear day, and the spectra of the stars, the results being added to those accomplished by other observatories in working out various problems.

But to get back to earth again; the Geophysical Laboratory, which is located in the outskirts of Washington, has undertaken a novel line of research, for it is trying to find out how the world was made by manufacturing rocks experimentally out of the raw material by imitating the processes of Nature as closely as possible in everything except length of time required. While at the present writing there seems little hope that the information thus obtained can be utilized in the creation of a new earth in case we should all be driven off the present one by the ever-increasing cost of living, the investigation is, nevertheless, interesting.

Experiments in the creation of rocks are conducted by placing the raw materials in steel bombs capable of withstanding pressures of seventeen thousand atmospheres, which are then placed in electric furnaces where they can be subjected to the action of intense heat for weeks and even months. Temperatures as high as two thousand one hundred degrees, centigrade, or more than three hundred degrees above the melting point of platinum, have been attained in these furnaces.

It seems to be generally agreed that diamonds are produced by extreme heat at enormous pressure in the earth. The Carnegie Institution is better equipped for experimenting in the manufacture of diamonds than any one else ever has been; but instead of undertaking to find a way to place diamond necklaces within the reach of all it has elected to devote its time to such commonplace things as calcium oxide and silica, two constituents most frequently found in rock, which also happen to be the essential materials in Portland cement. The Geophysical Laboratory has demonstrated that these two things could combine only in certain ways and in certain proportions, and not in the way assumed by cement manufacturers. This being understood, the cement maker now has a scientific basis upon which to prepare his product instead of following a rule of thumb. Now that the formula has been discovered it is possible to produce cement anywhere that the necessary elements are to be found instead of in certain rare spots where deposits of materials in the right proportions exist. As enormous quantities of cement are used annually this discovery is of great importance.

The Geophysical Laboratory is also engaged in the study of ore deposits. Once the fundamental conditions under which ores are formed are understood, the range of practical geology will be widely extended and the quantity of ores available will be increased.

Some strange things are being learned about animals, birds, fish, insects, and plants by the Department of Experimental Evolution, all of which are to be applied for the practical benefit of mankind. Since Darwin's day the problem of the origin of species has taken on an entirely new form. It is now recognized that the whole problem of evolution lies in the origin, nature, and relations of characteristics. The production of a new "species" is the development of a new characteristic not necessarily new to nature, but in a new combination. Since the Department got its hand in, it has been able to produce some curious variations on stock of well known pedigree, such as poultry with short mandibles, with no comb, with one toe missing on each foot, with an extra toenail to each toe, with one wing missing, and with both wings missing. It is hard for an unscientific mind to understand why the Institution should fritter away its time on wingless chickens when any boarding-house landlady could have told it that if it really desired to fill a want long felt at economical tables it should try to produce a chicken composed exclusively of wings. Professor Tower, an associate of the Department, has been very successful in controlling new characteristics in the Colorado potato beetle, varying the colors and increasing the number of generations in the reproduction cycle. No farmer's boy who has had to break his back throughout a long, hot summer day "buggin' pertaters" will thank Professor Tower for that, though. Colorado potato beetles came along quite fast enough under the old schedule.

Making the Ostrich Over—and Why

by Coston Carver

THE American ostrich farmer, like his neighbor the alligator farmer, is distinctly a new species. A few years ago he coaxed an exotic business into his back yard and set about quietly to acquaint it with its new environments. The young industry took readily to its alien home, which resembled its native habitat, flourished from the outset, and—as they say in Arizona, referring to the time when hut and edifice alike were of earth construction—soon outgrew the cramped quarters of its adobe days. Less than fifteen summers old, it now ranges freely over thousands of the Lord's fenced acres.

The ostrich, taken at a commercial rating, is the biggest dividend-producer in the kingdom of birds. Appraised from any angle, he yields to none save the emblematic stork. His earning capacity, aided and abetted by feminine inclination to self-adornment, has become so marked that today, after having been persecuted for his plumage from the dawn of history, he finds himself pampered, made much of, and scientifically propagated—still for his plumage.

The crux of the movement to make the ostrich over is that *her* every wish must be gratified, without thought of cost or reckoning. And she, ably attended by the handmaid of fashion, reigns in every clime and zone. So it has come about that because her imperious tastes have decreed ostrich plumes a prime necessity rather than a rare luxury in her millinery wardrobe, she has stimulated a drooping occupation in the Eastern hemisphere and founded a new industry in the Western.

Ostriches have been captured for their feathers since earliest antiquity. The fleet bird, which "scorneth the horse and his rider," was lured into snare or pitfall. This mode of obtaining plumes was in vogue for centuries, and until ostrich farming was started. After the bird was captured, the feathers were either plucked or the skin and feathers were removed together and used in making robes.

Ranking close to the first sartorial incident of Eden is the theory of philosophers that modern dress had its genesis in the habit of certain ancient gentlemen, who lived, laughed, and loved before the sphinxes were built, of dazzling pretty maidens by sticking ostrich plumes in their hair and parading themselves before their admirers. Scientists hold to the belief that these capering persons, in their *affaires d'amour*, were simply carrying out the natural law which says the male shall be more showily equipped for his life bluff than his mate.

However that may be, certain it is that the whims of civilization recognize no such rule. Instance is witnessed in the change modern enlightenment has wrought in the primitive custom of the ancient peoples. The twentieth century citizen, whose tastes are simple, not only neglects to adorn his locks with feathers, but what is quite the opposite, leads chivalrous chase after ostrich plumes to the end that *her* newest headgear may be ornately decorated *a la mode*.

In response to his thought—and hers—for her attractiveness, ostrich farming has been established in the United States. The industry is carried on to a limited extent in Florida and Arkansas, more extensively in Southern California, and on a still broader scale in the Salt River Valley, in Arizona.

As regards size and scientific propagation, the flower of the industry are the farms of Arizona; and, unlike those of Florida, Arkansas, and some of the California aviaries, they are conducted rather for the revenues from the sale of feathers than for show purposes. There are twelve farms in the Salt River Valley. The Pan-American ranch, located thirteen miles west of Phoenix, is the largest ostrich farm in the world under an inclosure, not excepting the farms of Cape Colony. It is now stocked with 3,200 birds, or three-fifths of the ostriches raised in the valley, and has an area of 1,100 acres.

This part of the Southwest, though one of the oldest sections of the United States, having been trod by the Spanish padres from Mexico as early as the middle of the sixteenth century, has been slow of development owing to its aridity and isolation; and while ostriches have been raised with indifferent success in the United States for nearly forty years, the industry was not established in Arizona until the late nineties.

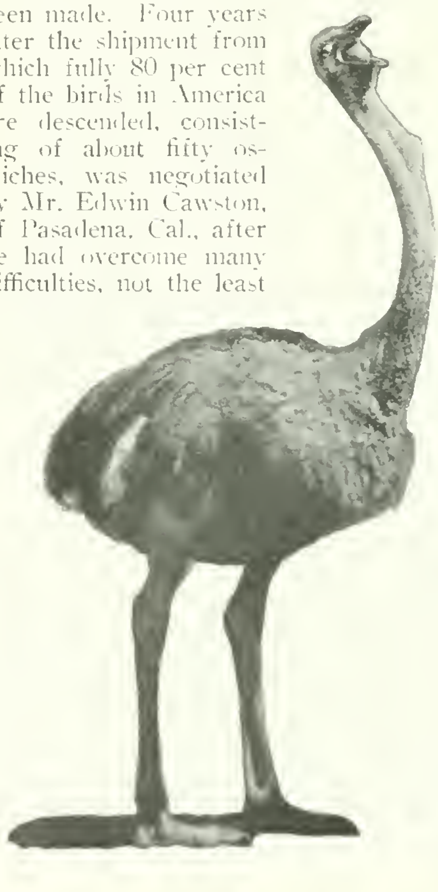
The climatic conditions here are very similar to those of Southern Asia and Africa—the native home of the ostrich. It is claimed, for instance, that the crucifixion flower is found nowhere outside of the Holy Land except in Arizona. On account of the dryness of the atmosphere, the scant rainfall, and the absence of fog, this is believed to be the best adapted region in the Western hemisphere for the propagation of the majestic birds of the desert.

The importance of the industry to the world's wealth and commerce is reflected in the jealous way in which England

A CROWD ALWAYS ASSEMBLES AT FEEDING TIME.

guards her ostrich possessions in South Africa. Ostriches have been tamed for centuries, yet it is only since the early sixties that an organized effort has been made to domesticate them with the idea of supplying the world's demand for feathers. In 1900 it was estimated there were between 350,000 and 400,000 ostriches in captivity in Cape Colony. England, foreseeing the golden future of ostrich breeding and desiring to corral the industry in her own possessions, saw to it that laws were passed absolutely prohibiting the exportation of either birds or eggs and imposing drastic punishment, in the form of fine and imprisonment, upon any person convicted of violating the statute. The prohibition now applies to all British colonies in Africa.

But far-sighted Yankees had stolen a march on the British government before its fences were completed. As early as 1882 a shipment of ostriches to the United States from South Africa had been made. Four years later the shipment from which fully 80 per cent of the birds in America are descended, consisting of about fifty ostriches, was negotiated by Mr. Edwin Cawston, of Pasadena, Cal., after he had overcome many difficulties, not the least of which was the opposition manifested by the South African government. The last ostriches imported came from Nubia for the Pan-American exposition at Buffalo in 1901. The Nubians of today have come largely from this shipment.



The progenitors of most of the ostriches in America are still to be seen at the Cawston Ostrich farm, at South Pasadena, near Los Angeles. This is the best equipped farm in the United States, with its rare plants, cobblestone ditches and paths, and beautiful terraces, and is visited annually by thousands of tourists, who delight in observing the interesting habits of the ostriches. The climatic conditions here are congenial, but it is claimed that the drier climate of Arizona is better suited to the raising of these alien birds.

The American farmer has approached the ostrich from the angle of science, and therein lies the basis of the revolutionized industry. Though scientific methods of hatching, feeding and breeding have been in use only three or four years, the results have been little short of astonishing. Evidence of this is seen in the fact that Arizona culturists are able to raise to maturity 75 per cent of their hatch, as against an average of 15 per cent which stands to the credit of African ostrich raisers.

The problem of feeding at first gave them no little concern. Originally the ostriches were allowed to bring forth in their own sweet way. Of recent years, however, incubation on the most progressive farms has been done by artificial means. The eggs, each weighing between three and four pounds, and of sufficient size to afford a meal for six hungry men, are turned in the incubators twice a day until at the end of six weeks the young chicks are hatched. The Pan-American farm alone has incubation facilities for 1,800 eggs—a sizable "clutch" indeed—and could hatch 7,000 or 8,000 birds a year.

After the chicks are released from the shells they receive the fostering care of experienced ostrich men until they are large enough to fend for themselves. A prominent Arizona farmer explained that they "require as much attention as babes." Men unfold their cots in the fields and spend the nights with the chicks, giving them such attention as occasion demands. As each chick is estimated to be worth twenty-five dollars, the reason for the special privileges accorded it is obvious.

The question of the best food for the ostrich, which baffled the farmers for a time, has been effectually solved. A balanced ration, consisting of chopped alfalfa and wheat, supplemented by a digestive diet of broken quartz, ground bone and other solid material, meets the food requirements of the birds. Alfalfa is grown on irrigated land in the valley the year round. Initially the birds were permitted to graze, but now they run at large in bare fields and are fed from wagons, each consuming from six to ten pounds of alfalfa per day.

Most important, and most complex, is the problem of inbreeding and cross-breeding. The solution of this problem has not been reached. But such progress has been made in the past three years that the farmers are sanguine of getting the results they desire through careful miscegenation of species.

Success has attended the experiments in crossing the South African and Nubian species, both of which are raised in the United States. The resultant bird not only is larger and more hardy, but its feathers are of a better quality than those of either parent. The plumes of the South African bird are typically long and broad. Those of the Nubians are heavier, finer and glossier. The feathers of the mixed ostrich possess the distinguishing characteristics of both species, and neither loses by the process of crossing.

But the application of Burbank methods to ostrich life is not to end here. A hope cherished by the scientific ostrich raiser is to be able to produce a white ostrich. Here is a parallel with the paradox of the white blackbird. Ostrich breeders believe it would be easier to hatch a white ostrich than a white blackbird, and that the problem is merely one of selective breeding. Greater wonders have been wrought—but then the ostrich growers consider this not a wonder but a scientific possibility.

The object? It is this—a higher standard of graded stock. Until they are a year old all ostriches, both male and female, are identical in color—a dull brownish gray—and are hardly distinguishable one from the other. The color of the female does not change, but after twelve months the plumage of the male turns black, and black and white. But the main layer of feathers on the wings of both sexes is white. This is the most valuable row, and is cut, not plucked, from the bird, being used chiefly in the manufacture of willow plumes. If the Arizona farmers succeed in producing a white ostrich, clearly the color line will not be drawn in the grading process.

The values of the individual birds vary according to the stock. Yearlings as a rule sell for about $150 each; two-year-olds from $200 to $250, and three-year-olds from $300 to $350. Breeders are sold frequently for $1,000 a pair. Still more giddy heights are reached, as is shown by the statement of Mr. William Cross, manager of the Pan-American farm and a "progressive," that "ten thousand dollars wouldn't begin to touch that bird"—meaning "Doc. Cook," a fine specimen of Nubian cock weighing about 375 pounds—and that "no amount of money could buy him if he couldn't be replaced by a similar bird."

The ostriches are classified according to age, caste and relative earning capacity. The advis-

THE BIGGEST DIVIDEND PRODUCERS IN THE KINGDOM OF BIRDS.

ability of plucking the breeders, which as a rule command the highest prices, is a question upon which the ostrich men are not agreed; but it is conceded by all that the feathers of the family birds are not of so high a quality as are those of birds untroubled by household cares. Some of the farmers "unfeather" the parent ostriches, while others do not.

The value of the annual yield of feathers per bird ranges from $30 to $75. The ostrich generally advances to a ripe old age, often passing the three-score-and-ten mark. Its plumage does not begin to deteriorate until it is about fifty years old. As it yields its first plucking at the age of six months and is deprived of its feathers every eight months thereafter, meanwhile eating only about one-fourth as much as the average steer, little wonder that it sometimes—using a phrase that trips easily—is worth almost its weight in gold.

What is the future of the industry?—is a question that naturally confronts the ostrich farmer. In order that the testimony may not seem *ex parte* it is only fair to state that the grower has certain problems to deal with more elementary than those of scientific breeding.

Perhaps that of raising the chicks presents the biggest obstacle. In spite of the precautions that are taken, about 25 per cent of the young birds die; and, as has been stated, this rate of mortality is considered abnormally low. The adult ostriches run at large, yet if the best results are obtained they must be given close attention. Then there is the danger of the bird's impairing the value of its feathers through accident—though, of course, this danger is somewhat remote. Or, as is sometimes the case, the bird, no matter how valuable, may die in its prime. And the greater its value the greater the loss to the owner.

On the other hand, the owner of any kind of livestock runs risks essentially the same as those just recounted. The fact is, as has been pointed out, the ostrich as a revenue producer holds decided advantages over the ordinary livestock, especially in the issue of food and repeated returns. Moreover, on the point of sustained attention, the same may be said of any animal on hoofs; and so far as the question of the bird's meeting an untimely end is concerned, this—when I visited the Pan-American farm, containing 3,200 birds, less than a dozen were

THE OSTRICH, NO LONGER HUNTED DOWN AND SHOT, HAS EXCHANGED LIBERTY FOR SAFETY.

confined in "hospital" pens for sickness or injury by accident.

The Arizona ostrich farmer, though conservative in his statements, sees a vista filled with potential opportunities. The farms are growing in number and the herds are increasing. At present practically all the feathers are shipped to New York factories, but the tendency is toward "home industry." The Arizona and the Salt River Valley Ostrich Companies maintain small factories of their own, and the Pan-American Company is preparing to make an additional investment of $200,000 on its farm, notably in the erection of a modern factory.

Certain it is that the industry is a likely "infant," full of promise in the health-giving climate of Arizona. When it is considered that there are hundreds of thousands of arid acres suited to ostrich raising, and that there is imported into this country annually in the neighborhood of $4,000,000 worth of feathers produced in Africa, the future of the ostrich business in the United States seems assured. For *her* demand for ostrich plumes wherewith to decorate her hat and fan and stole is not diminishing, with the increasing demand for all sorts of luxuries—it is constantly mounting higher.

The ostrich ought to feel highly indebted to the fair sex of our land, whose demands have stimulated the enterprising ostrich farmers to bring these huge birds to the United States. As a result, he is no longer hunted down on horseback, or

A Single Bird Yields from Thirty to Seventy-five Dollars' Worth of Feathers a Year.

ARIZONA OSTRICH FARMERS ARE ABLE TO RAISE SEVENTY-FIVE PER CENT OF THEIR HATCH.
African growers rear only fifteen per cent.

shot from ambush: though, in exchange, he has bartered his liberty for his safety.

The great disadvantage of his comfortable captivity is the rather painful indignity to which he is submitted every eight months, of having his sight blinded with a hood and his body stripped of his feathers. But everyone that enjoys the benefits of civilization must pay a price for it, and why should an exception be made of the ostrich? Besides, think of the women!

MENACE OF THE MONGOOSE

THERE is just one animal of which Uncle Sam is afraid. It is the mongoose—a small mammal native to southern Asia, which is especially famous as a snake-killer. Also, it is death on rats.

Because of this latter fact it was imported into Jamaica thirty odd years ago. But, unfortunately, the rats took to the trees, and the mongooses proceeded to feed upon other kinds of game—particularly chickens. They have also killed nearly all of the ground-nesting wild birds on the island, and sucking pigs are not disdained by them.

Many attempts have been made to introduce it into the United States, but unsuccessfully as yet, because the government authorities are always on the watch, and anxiously exclude any specimens that arrive at our seaports on shipboard.

The mongoose multiplies at a fabulous rate, and, if it once established itself in this country, it might easily do $50,000,000 worth of damage per annum.

CHEAPEST WAY TO REMOVE STUMPS

By

H. S. GRAY

ON thousands of ranches in our once wooded west the owners have cleared only ten or twenty acres out of one hundred and sixty during a long period of ownership; where the stand of timber was heavy and the stumps are three to six feet in diameter, only four or five acres; and development has been retarded. Pulling a big molar, whether dental or terrestrial, is usually a painful and difficult ordeal—and that is the difficulty. The stump is the thing!

The char-pit process, a new adaptation of an old principle in removing stumps, is at present attracting great attention in Oregon and Washington, where thousands of acres of logged-off lands have for years lain idle because the task of clearing them has heretofore been so formidable both physically and financially. Prof. H. W. Sparks of the State Agricultural College at Pullman, Washington, about a year and a half ago began to experiment with a new burning process. Since then he has been employed to teach the method at farm institutes and elsewhere in the Northwest.

I recently attended a stump burning demonstration at Vancouver, Washington, when the Development League of southwestern Washington held a convention there. Professor Sparks first removed the bark all around for about

THE OPERATION OF STUMP-BURNING CAN BE PERFORMED INTELLIGENTLY BY BOYS.

SMALL ONES MAY BE TORN OUT WITH HORSE AND CAPSTAN.
The cable is wound till either stump or capstan must yield, and usually it's the stump that yields

twelve or fifteen inches up from the ground. This is absolutely necessary, as bark is porous and a non-conductor of heat. If the stump is green, chop through the sapwood at that point where the fire is to be lighted. As it was rainy weather and he wanted to make sure the fire would burn, he dug a little trench around the tree and put some sawdust in the trench to absorb the oil he afterwards applied. Then he put on kindling wood. Over this he poured several quarts of fuel oil. Then he put on wood. Both wood and kindling he obtained from material lying around on the ground near the stump. The fuel extended to a height of twelve to fifteen inches. At the top of the bank of earth close against the stump he laid bits of rotten wood and bark to keep dirt from sifting down between the fire and the stump. With a soil that does not break up much, this would not be necessary. Then with a spade he laid clods of soil on the fuel all around the stump, making a covering about three or four inches thick, leaving an opening to start the fire on that side exposed to the wind. He laid each spadeful on carefully. If the covering is uniform, it settles down uniformly as the fire eats into the stump. After the fire was lighted, within fifteen minutes or a half hour it had got a good start and

When the Smoke Is White, You Know That the Stump Is Burning as It Should.

he covered over with clods the opening he had left.

This method has been tried on various kinds of soils. The soil that is the most porous is the best non-conductor of heat and reflects the heat back on the stump. Sand is a conductor of heat. With sandy soil, an artificial covering of clay as a binder or coal cinders can be used.

By the color of the smoke one can tell clear across a field which stumps need immediate attention. White smoke indicates that the fire is burning as it should. Blue smoke usually means that the fire needs more covering. If the fire is kept burning fast enough by allowing enough air to reach it, there will be no large quantity of charcoal left; nearly all of it will be consumed. Close covering means less air and slower burning and therefore more charcoal. If covered too much, the fire will be smothered.

It is not necessary to use oil in dry weather. If it is used, the kind used on locomotives and steamboats can be obtained at the rate of ninety cents per barrel, if bought in large quantities by a grange or commercial club. Kerosene oil should not be used, as it burns too rapidly.

Fire burns out the stump for the same reason that air circulates through a tunnel. If the air outside is cooler than in the tunnel, it goes in at the bottom and circulates through it. In burning stumps the air enters at the bottom. When heated, it rises and filters out at the top through the covering.

Chehalis reports stumps eighteen to forty-eight inches in diameter destroyed in from five to fifteen days. One man, with the help of two boys, in nine weeks took out 603 stumps that averaged not less than two feet in diameter, from sixteen acres and did his farm work besides. Large numbers of small stumps less than twelve to fifteen inches in diameter can be removed more quickly with horse and capstan. In the worst red sand soil, with two assistants and a team, Professor Sparks fired eighteen stumps in one day. Of these eighteen fifteen were burning the next morning. The others had been put out by a heavy rain. Of one hundred he fired in September in shot clay soil in dry weather, only three had to be refired.

He attended to one hundred stumps in half an hour, after they had been fired.

The Fuel in Place, Ready for Firing.

So one person could attend to several hundred or more in a day. Stumps should be fired in the morning. They should be inspected twice a day, morning and evening, and the covering replenished when necessary. In direct contact with the air, the coals soon break into flame and a large amount of heat is lost. The tops of the stumps finally fall over and are then gathered into heaps and burned. The attendant must keep putting earth around the tops so that when they fall over, the fire will not be exposed. Roots that are above ground must also be covered to a depth of several inches. The fire will follow along them underground way below plowing depth and destroy them.

Two advantages this method has over other methods: there is no big hole left to be filled up nor remnants of roots to be grubbed out, as is the case when powder is used; and the char-pit process fertilizes the soil. The places where stumps formerly stood are indicated in a field of grass or grain by a heavier yield that is apparent at a glance.

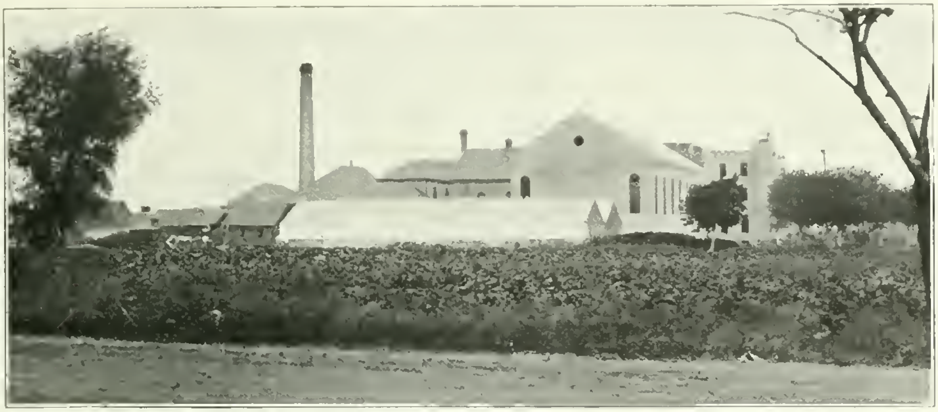
Near Chehalis Professor Sparks and an assistant took out one hundred stumps that averaged forty-six inches in diameter for something like forty cents apiece. They kept account of the time they spent at the work and charged twenty-five cents an hour. Mr. Yount at Woodland took out some of average size for thirty-five cents apiece with the same charge of twenty-five cents an hour made for his time. In one case at Woodland where the prevailing wind favored the work a man removed the stumps from a field at a cost of twenty-five cents apiece. Mr. J. W. McCutcheon, at Adna, near Chehalis, paid two dollars a day for labor and removed two hundred stumps at a cost of thirty-five cents apiece.

Where stumps are numerous and of average size, it has heretofore in the Northwest cost \$100 to \$125 per acre to clear the land, and, where the stumps are three and one-half to six feet in diameter, even more. To remove stumps of average size by the char-pit method costs \$14 to \$20 an acre and occasionally even less.

CONCRETE VIADUCT FOR EIGHTY DOLLARS

A CREEK on a farm at Lawn Ridge, Ill., was a constant source of trouble and expense. Wooden bridges were all the time rotting out, so the owner decided to put in one of concrete. He could get gravel for nothing by hauling it six miles, and did so, paying for the hauling. The arch for the water to pass through is 4 feet 2 inches in the clear in width and 5 feet 4 inches high, 12 inches thick, and rests on a solid base of concrete 6 feet 6 inches wide and 18 inches deep, all below the bed of the stream. The wings extend straight to the banks at right angles with the arch, making a roadway 14 feet wide, on a level with the stream's banks. The wings are 8 inches thick and are 32 feet long at the top, sloping in somewhat as they reach the level of the base, and go down to the level of the bottom of the base. The space between, and covering, the arch is filled with dirt, well surfaced with a coat of fine gravel. Thirty-four tons of gravel were used and mixed with it were 66 sacks of cement of 100 pounds each. A machine mixer for two days with two hands cost \$16.00. Other help cost \$18.00; damage to lumber used, \$5. The total cost was \$80.

CONCRETE VIADUCT BUILT BY ENTERPRISING FARMER AT LAWN RIDGE, ILLINOIS.



GREENHOUSE AND OTHER BUILDINGS HEATED AND LIGHTED WITH STEAM AND ELECTRICITY GENERATED FROM THE BURNING OF GARBAGE.

SOLVING THE GARBAGE NUISANCE

By

KATHERINE LOUISE SMITH

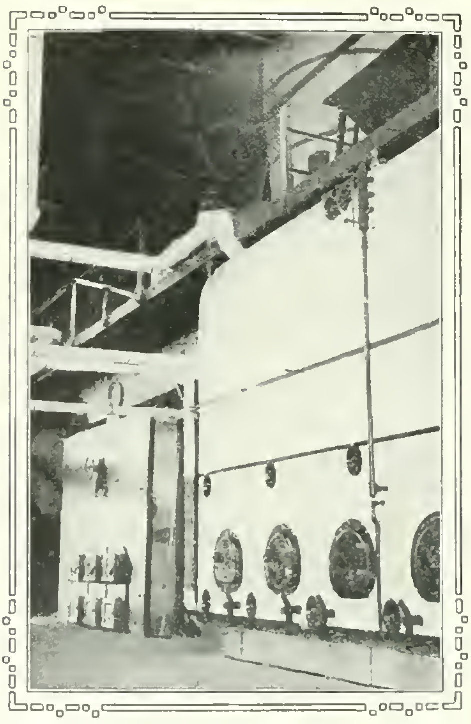
MINNEAPOLIS is blazing a new trail. She has found out that no city that wants to be a clean city can neglect its garbage handling, and she has gone to work to set a pace for the rest of us. The real beauty of it, too, is that she has solved the garbage problem—or more nearly solved it than has anybody else, up to date. She may be said to stand first in the list of cities in America in the solution of the sanitary disposal of refuse and other towns are sending delegations to inspect this garbage system. Winnipeg has already patterned after it.

The present method of collecting and disposing of garbage is due to the efforts of Dr. P. M. Hall, Commissioner of Health. Dr. Hall realized that popular methods in vogue in various places, such as dumping in land or water, pig feeding, and even incineration, did not entirely solve the problem of a clean garbage can or the utilization of the product. The handling of garbage should be a sanitary operation through its various transfers from the dining room table to the kitchen sink and the garbage can and incinerator. Minneapolis thinks it has solved this problem in part by adopting a way so that the can in the alley will for once fail the fly as a free lunch counter, and it has also planned up-to-date measures in the final disposal of waste matter.

Nearly four years ago this campaign to handle garbage without nuisance was started and today it is pronounced an unqualified success. No more are there foul, maggoty garbage cans and all because a city ordinance provides that every housewife shall drain the garbage of all moisture and wrap it in a paper before putting it in the can. This not only insures a clean can but the spaces between the paper allow the air to circulate and keep the garbage from freezing and adhering to the can in cold seasons. In other words, heat, moisture, and the fly are all eliminated. Any kind of paper can be used but as a rule there is plenty of wrapping paper that comes around packages from the grocer and butcher, as well as old newspapers, that the housewife is glad to get rid of. That all this may be done properly the Board of Health issues a printed card of directions for the housewife and advises that it be hung in her kitchen.

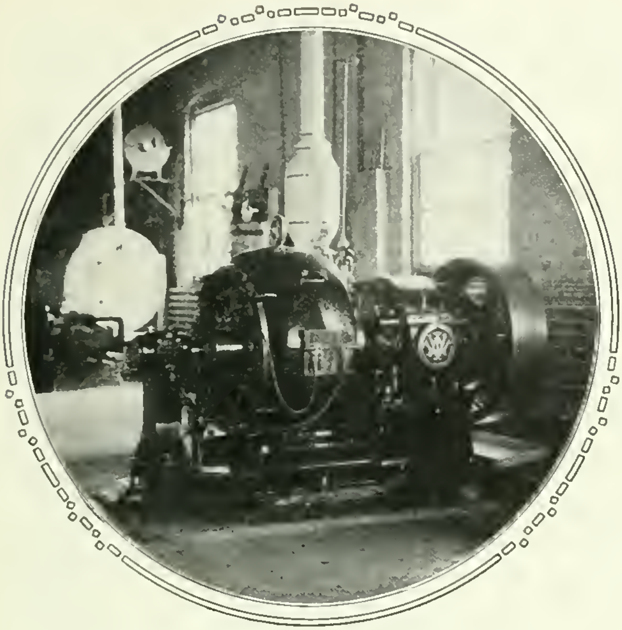
THE CREMATORY BUILDING AND STEEL RUNWAY FOR BRINGING UP THE GARBAGE

But this is only an important introduction to the story of the garbage system which is being adopted by a large city as a unit. When the garbage man comes around to collect his quota he finds a clean can, he is not faced with wet and dripping refuse, and in cold weather he does not take a pick and batter the can in order to lift the frozen material. He merely loads the prepared garbage into a large steel box, somewhat resembling a bath tub, and which has one hundred feet capacity. He hauls this to a central transfer station, where the tanks are lifted off the wagon truck by means of an electric hoist and placed upon flat cars which convey them to the crematory or disposal plant. A train of several cars soon reaches the crematory just outside the city, where the boxes are lifted from the cars by an electric hoist and dumped directly into the fire. In other words, from the time the garbage is rolled in paper by the housewife until the ashes are taken from the fire of the disposal plant there is no necessity for the refuse to be handled by hand. As the paper used to wrap the packages is, as a rule, waste material, this, too, is disposed of and the sanitary condition of the cans and reduction in bulk of the waste, because drained, make the necessity for collection less frequent—a saving in money to the city.



THE INCINERATORS THAT RECEIVE THE FUEL TO BE TURNED LATER INTO ELECTRIC POWER

Of course all ashes and rubbish that will not burn are placed in another can or barrel, and this with the garbage can takes care of all the waste material of the average household. But the package system is only a part of the garbage solution, for through the burning of this refuse enough steam is generated to operate all the machinery, and to heat and light the group of workhouse buildings, the superintendent's home, a tuberculosis hospital and two greenhouses. This service of heat and light is furnished to the city at a cost of eight mills per horse-power—equivalent to thirty pounds of water evaporated—for heat, and three cents per kilowatt for light. The cost of collection and disposal has been low, averaging less than twenty cents per capita to each citizen. This includes cost of collecting and handling



Dynamo for Generating Electricity from Garbage.

ashes and represents the gross cost without deducting anything for heat and light. It is the intention of the city to put near the crematory all hospitals for infectious diseases—one has already been started—that they may be heated and lighted in this way. The time will soon come when with additional equipment part of the street lighting will be done with the same plant.

In fact, the approved methods for collecting garbage in Minneapolis are no longer looked upon as a fad and housewives as a rule adhere faithfully to the first three of the following which have been prepared by Dr. Hall:

The Ten Commandments for Handling Garbage Without Nuisance.

Drain Out Moisture: Use detachable sink-strainer.

Wrap in Paper: Keeps garbage from heat and flies, prevents freezing and sticking to cans in winter.

Use Metallic Cans: Non-corrosive metal, over-lap self-locking cover, and free from holes.

Use Painted Steel Wagon Boxes: Constructed water-tight and to be mechanically dumped.

No Dumping on Floors: Box mechanically elevated, and contents emptied into incinerator hopper without nuisance.

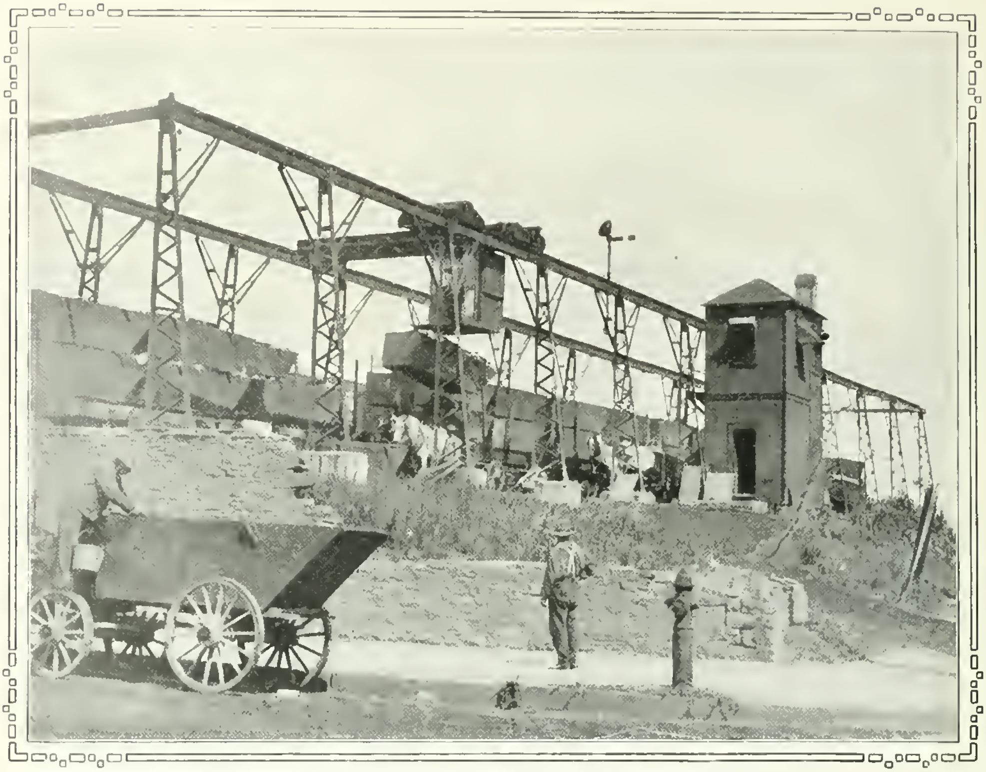
In-Draught at Hopper: Prevents escaping smoke and odors.

Mechanically Charged Incinerators: Eliminates the nuisance of exposed garbage and the emanation of foul odors.

Good Draught: Creates rapid combustion and high temperature, burning everything of obnoxious nature.

No Residue Left Over: Nothing to make a nuisance around the plant—nothing left but ashes.

HOPEWELL TUBERCULOSIS HOSPITAL, HEATED AND LIGHTED BY THE CREMATORY PLANT.



CENTRAL TRANSFER STATION FOR GARBAGE, WHERE THE STEEL WAGON-BOXES ARE LIFTED FROM WAGON TRUCKS.

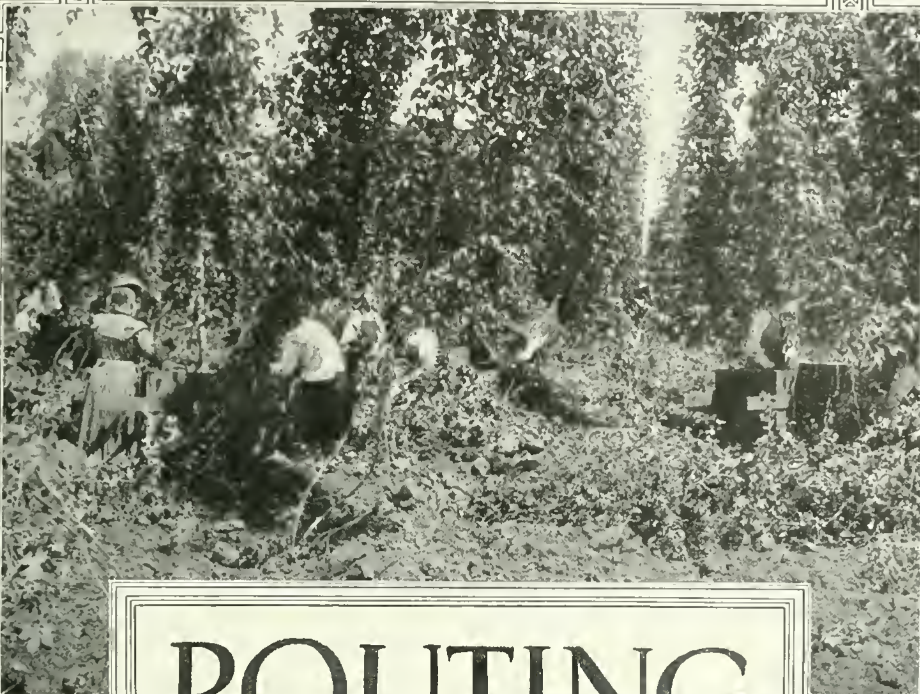
An electric hoist is used for this purpose, which loads the boxes into flat cars, to be hauled to the incinerating plant.

Generate Steam: For self-operation and sell surplus heat, light and power to make plant self-sustaining.

So in earnest is the Health Department that if a collector finds garbage not properly drained and wrapped in paper, he can refuse further service until the rule is complied with, and if this is not sufficient the householder can be brought into court and fined. It has been demonstrated that a twenty gallon can will suffice for the average household, and this size is easily handled by the collector. Of course it is essential that all cans must be water tight and some have an appliance on the cover which makes them self locking. This is quite a consideration when there are dogs in the neighborhood. No obligatory rules are laid down as to the location of the can.

By this system the back yard can be made to look as clean as the front, and the saving in cost to the city can be largely diminished. Offensive odors are avoided and waste is turned into productive energy. The same package system can be employed by housewives in small towns where there is no collection of garbage, for in such places there is usually a coal stove which can be used to burn the drained and rolled garbage. It took some time to educate the housewives of Minneapolis so that they saw the benefits to be derived from this plan.

We talk much of late about the fly as a disease carrier, but so far as known, never before has there been a systematic attempt to prepare garbage so it will not act as a fly breeder. In letters received from hundreds of cities in the United States and Canada, the questions of receptacles—whether covered or handled—size, material, location and frequency of collection were dilated upon, but not one city seemed to think of the part the housewife can play in preparing the refuse from her table so it will be sanitary before reaching the can.



ROUTING the HOP PICKERS' ARMY

by Walter V. Woehlke

"PLICE allee same?"

A deeply-wrinkled, sly, brown face appeared in the half-open door. Upon noiseless felt soles the Chinaman stole into the aromatic office, pungent with the odor of fresh hops.

The man at the desk did not look around.

"Give you sixteen and a quarter, John." He flung the answer carelessly over his shoulder. Keeping close to the wall and chuckling without a sound, the Chinaman pattered to the bulletin board, attentively scanning the market quotations and the weather and crop reports from the European hop districts. With another inaudible, half-malicious chuckle directed at the hop buyer's broad back he sidled back to the door. Feet and body vanished out of the room, but the wrinkled face stayed.

"Me got t'lee hundled bales. Me takee eighteen."

A BATTERY OF HOP PICKING MACHINES

"Come around again when you're willing to sell for sixteen and a half, John. By-by, bless your yellow soul."

The hop dealer swung around as the soft footsteps died away.

"They're wise ones, these Chinks are," he grumbled. "Day before yesterday I could 've had the old devil's three hundred bales for fifteen, but like a fool I didn't take 'em. He knows I got to have his hops to fill my contracts, and he'll squeeze me for eighteen, at least."

A bale of hops contains approximately two hundred pounds. By matching his knowledge of the hop market against the guessing ability of the white trader, this Chinese hop grower of Salem, the political and hop capital of Oregon, profited to the extent of three cents a pound or eighteen hundred dollars in a few days. A few months after this episode, not at all uncommon in the hop districts, one of the largest hop firms in the Pacific Northwest, driven into a corner by the rampant hop bulls, was squeezed bodily through the wall into the hands of a re-

THE ARMY THAT MACHINERY HAS ROUTED.
An encampment of hop pickers.

ON A RANCH AT WHEATLAND, CALIFORNIA.

ceiver. This firm had expected to see the usual slump in hop prices and had agreed to deliver 4,000 bales at about fifteen cents a pound, without, however, having the hops to fulfill the contracts. When delivery time came around, a flood destroyed a portion of the firm's storage, and the end came when it was discovered that only 1,700 bales of hops were left in the growers' hands on the Pacific Coast, whereupon the owners put the price out of sight.

In the fall of 1909 the man who would be the hop king of Oregon fell into a similar trap of his own digging. Relying upon his knowledge of market conditions, he bought 1,200 bales around 25 cents, expecting to unload at 30 or 35 cents a pound. Unfortunately the hop price took one of its sudden tumbles, sagged to fifteen cents, and the would-be hop king wound up with debts aggregating $90,000.

Growing hops is like a poker game. The hope of a big killing keeps the producer at it through the numerous years of low prices, and all the while, high prices or low, the kitty, in this instance the cost of picking the crop, takes its fixed rake-off. Whether the market price be five or twenty-five cents a pound, the cost of producing, picking, and curing the crop of the Pacific Coast never varies from nine or ten cents a pound. Should the price go too high, many brewers turn from the expensive natural ingredient of beer to cheap chemical substitutes—"dope," the growers say—and at all times the brewmasters, the rotund beer experts of German extraction, are willing to pay, for some occult reason, three times the prevailing price of Pacific Coast hops for the imported product of the Fatherland.

With all these factors gnawing greedily at their pocketbooks, the Pacific Coast growers producing annually 90,000 bales of hops have been trying for years to reduce the cost, especially the expense of picking. Hops must be picked in a hurry, as soon as the crop reaches maturity. If the crop is allowed to stay on the vines too long, it loses in flavor and value. Late in the summer, when the call for harvest hands is loud and insistent everywhere, the country is scoured for hop pickers. Armies of them are needed. The railroads put on special trains to move the regiments from the big cities into the hop yards, vast encampments spring up, camps filled with men, women and children who receive a cent a pound for the green hops picked by them off the thorny vines. Since everybody having two hands with which to pick is pressed into service, the efficiency of the average picker is low. Now and then an industrious schoolmarm runs up to four and five dollars a day, but the average daily output does not go far above a hundred pounds, to the dismay of the grower who would rather see his crop harvested in half the time.

For years attempts were made to find a substitute for the army of pickers, to use mechanical appliances in garnering the crop, but all attempts failed because the hop growers insisted upon an

IN CALIFORNIA THE HOP VINES GROW ALMOST AS TALL AS TREES.

apparatus that could be taken into the fields. Only when E. Clemens Horst, the largest hop grower in the world, owning some ten thousand acres in hops along the Pacific Coast, decided to follow Mahomet's example and go to the mountain, did success reward the efforts. The problem of mechanical hop picking was solved by taking the hop-laden vines to the machine instead of trying to work the machine between the rows of tall vines.

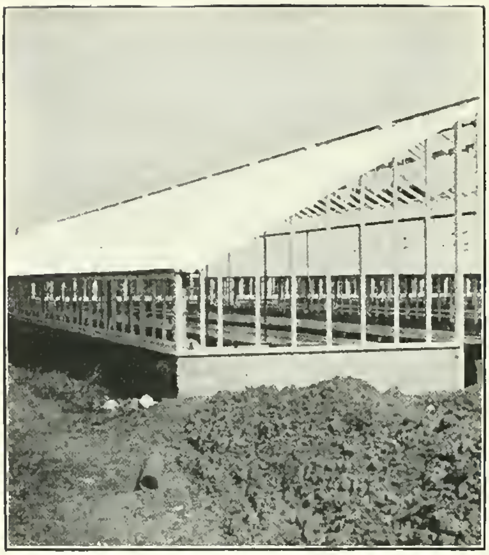
Under the old system hundreds of pickers invaded the hop yards, swarming among the vines in each other's way until the stalks were bare. Under the new system three men cut off the vines close to the ground, load them upon wagons and take them to the battery of machines

CARTING THE HARVESTED VINES TO THE PICKING MACHINES.

erected close to the dry-kiln and storage houses. The vines are placed upon carriers which run them between revolving drums studded with V-shaped projections or picking fingers which tear the hops and many leaves off the vines, dropping them upon a conveyor which deposits them in a revolving cylinder. Through numerous small openings the hops and small leaves fall upon a belt traveling upward at an angle of but four or five degrees. The light leaves travel up with the belt, but the heavier hops roll down the slight incline, thus separating themselves from all trash.

According to Dr. W. W. Stockberger, the hop authority of the Bureau of Plant Industry, the machine-picked hops are cleaner even than the product of trained pickers employed by the day in order to pick exceptionally clean hops for experimental purposes. These trained pickers will average 200 pounds a day. With the aid of a machine five or six men pick a minimum of 20,000 pounds a day, and the quality is higher than the product of the best hand pickers.

Twenty-four machines have been built and successfully operated upon the 10,000 acres of the Horst Company scattered through California, Oregon, Washington and British Columbia. At the Wheatland ranch, in California, one hundred men, with the aid of the machines, in the fall of 1910 gathered the crop of an area which in former years required the services of an army of two thousand hop pickers. By concentrating the machines upon the districts farthest south and moving them north with the maturing crops, the grower is enabled to get the hops off the vines at the precise moment when they are ripe. By reducing the time and the cost of harvesting and by enhancing the quality of the product, the mechanical hop picker should prove of very great benefit to all hop growers throughout the world.



AN ENTERPRISING BOY'S FIRST GREENHOUSE AND HIS SECOND.
The new building is 140 feet long.

BOY WITH A PAYING IDEA

By

CHARLES DILLON

THIS is the story of a boy with a $2,000 idea—and perhaps more. He was seventeen and just out of the Manual Training High School in Kansas City when the great thought came to him.

There was no especial necessity for his going to work immediately; he might have gone on with his studies, or found a place in someone's store, or he might have loitered around home for a year or two. His father didn't care to force him into any set plan at the time. But S. Bryson Ayres had his mind fairly well made up about the future when he left school; and the influence that created this condition was peculiar. Bryson had noticed that the florists evidently made money rapidly. He reached this opinion after buying flowers for a few select young friends. The experience gave him the idea.

"I shall grow sweet peas for the city florists," he told his astonished parents, "there's money in that business."

Happily for Bryson's idea his father owned several acres of unused land ten miles from the city and in close touch with rapid transportation. Bryson borrowed about 100 feet of it, got enough money from the bank—backed by his father—to build the necessary greenhouse so that winter should not interfere with his work, and buy seed and tools. This seed he bought from the best florists in California. He did most of the work himself because, you see, he had learned carpentry in the manual training school; and he studied at night every catalogue and all the botanical books he could get. It took some nerve at this period to go ahead because the boy's school friends and a few of the neighbors laughed at his project. When they learned that he had cleared $100 and had paid back some of his borrowed capital they quit laughing.

One hundred dollars was a mighty pile in Bryson's opinion, that fall. He had learned something valuable about the dignity of labor and also he had a few pertinent ideas about money. He learned that with a good reputation one had good credit and with credit he could do many things. Therefore he rented more land from his father, borrowed a little more money, signed up a few more customers and went to work more eagerly than ever. At the end of the year—the second—he had paid his last note and had $400 to his own account. By this time he had two people working for him. Incidentally, Bryson's father was willing by this time to back him in anything. The boy cleared $800 the third year.

A year ago last spring the young florist rented more land—two acres in all—from his father, enlarged his greenhouses and made them thoroughly modern, employed more help and bought a large delivery wagon and a first class pair of horses.

This boy, now twenty-one, has not given all his time to sweet peas, but these were his principal product. He grew violets and lilies-of-the-valley also, but sweet peas were by far the most successful flowers on the little place. He sold and still sells his products almost exclusively to city dealers in wholesale lots. He received prices ranging from $25 a thousand at Christmas to $5 a thousand for his sweet peas in the summer midseason. Early in the spring, before the snows had gone, he got $7.50 to $10 a thousand and sold from five to ten thousand a day. The sweet peas were arranged twenty-five to the bunch. Bryson has from ten to fifteen girls for the picking and employs six or seven laborers and gardeners for the setting out and care of beds.

It wasn't boy's play, this sweet pea idea. It required something more than front yard cultivation. The seed had to be right; the largest blooms had to be saved to reproduce and the earth had to be fertilized properly and brought to a rich, loamy condition. The peas were planted in rows four feet apart and brush was plentifully used to "stick" the plants after they were a foot and a half high. Wood, he learned, did not heat the tendrils as wire had done.

HOT SPRING MAKES LAND VALUABLE

QUESTION has arisen as to the title to a barren island in the Rio Grande, situated about forty miles south of Sierra Blanca, Texas. Whether the little isolated, rocky possession belongs to Mexico or is a part of the public domain of the state of Texas is yet to be determined. The island's only claim to value and distinction is that there is located thereon a famous hot spring which is said to have remarkable medicinal properties for the cure of certain kinds of disease. The hot water flows in a bold stream from the spring, and, notwithstanding the long and rough overland road that must be traveled to reach the spot it is patronized by throngs of health-seekers. These pilgrims live in tents or sleep upon the bare ground with the broad canopy of heaven for a covering. The fact that title to the island and spring is uncertain has prevented any attempt being made for the accommodation of the people who visit the spot. At this particular time the main channel of the international boundary stream is on the Mexican side of the island, but any big rise in the river may shift the channel to the American side.

Is This Texan or Mexican Soil?

SUSIE OPENS THE LIDS OF BOXES OF VARIOUS COLORS, SELECTING THOSE DR. GARNER NAMES.

EDUCATING A CHIMPANZEE

By

J. PRESTON

YOU haven't forgotten Susie, the little Chimpanzee that Professor Garner brought from Africa with the avowed purpose of endeavoring to make the little lady as accomplished as any child of the same age! Well, Susie's education has been going on steadily at the University of Pennsylvania, where she has a room to herself and every attention and it is time now to report progress.

Susie now wears rompers. As she romps every moment of her waking time, when not busy with her studies, it is appropriate that she should wear rompers, but it was not without patient persistence that this first step in her education was accomplished. Susie objected strenuously to the rompers. Now she not only wears them from the time she gets up in the morning until she retires to her own special little couch at night, but she insists on wearing them and puts them

As Directed by Her Master, She Will Hand a Cube or a Ball to the Visitor.

on and takes them off herself like any other well regulated little girl of her mature age.

Susie was rather a wild little girl when she first came to the university. Now she sits in a chair and eats her dinner with a fork, opens and closes doors when she walks around her little domain, says good-bye with a shake of her little paw in the conventional child way and advances to greet visitors with her hand extended in the most lady like manner imaginable. Susie is now over thirteen months old, with the intelligence, alertness and sense of a child of twice that age. The monkey in comparison with man develops fast.

The sense of color distinction of the little chimpanzee has improved with her education, so that now she never makes a mistake when told to open the red, the blue or the white lid of a row of varicolored boxes. She will hand with unerring accuracy a cube, a ball or a square to the visitor, when told to by her owner. She will take the lid off her little box of "jacks," spread these out before her and select one, two or three, and gravely hand them over as told to.

The favored children of the neighborhood who have been permitted to come in and play with Susie are delighted with her and Susie is no less delighted with them. She plays their games with wonderful intelligence. Hide and seek came naturally to Susie. She plays this game with perfect regard for the rules and will play it tirelessly as long as a child remains with her. She will chase them round and round, run and dare them to follow and in a word has every attribute of the "kid" in her antics and her mannerisms. Only one thing seems to puzzle Susie. She cannot understand why the children are unable to climb the posts up which she darts, to slide quickly to the bottom. She tries to pull a playmate by the hand and when she has got the child near the posts endeavors to drag him or her up by main force. Then she will climb rapidly to the top, slide down, repeat the operation a few times and again try to drag the child playmate up the post. She evidently thinks the youngsters clumsy rompers, far inferior to a chimpanzee in athletic accomplishments.

NEW WEALTH FROM WASTE

IN California, "pressed wood" is a new fuel that is rapidly becoming popular. Fuel for domestic purposes has always commanded exorbitant prices in southern California, bituminous coal selling at retail at from twelve to fourteen dollars per ton, and wood cut to stove lengths at about the same figures per cord. In the high price of fuel, some one perceived the opportunity to win wealth from waste by utilizing a part of the enormous quantity of shavings and sawdust that is annually wasted, or at best used to poor advantage, in sawmills, planing mills and similar establishments. So he patented a machine for pressing shavings, and sawdust into molds. A string through the center of the mold helps hold the material together, and the heavy pressure to which it is subjected is all that is necessary to accomplish the rest.

TO FREEZE BOILING WATER

By

BENJAMIN H. BROWN

WHEN steam is pouring out of the spout of a teakettle of boiling water, it may be noticed that for an inch or two beyond the opening of the spout, the steam is invisible. The reason for this is that, in the invisible portion, the water has been scattered by the heat into such very small particles that the individual pieces cannot be seen. When the steam has become slightly cooled, by coming into contact with the air, the particles begin to gather together again and form drops large enough to be visible.

A drop of water consists of a great number of these tiny particles, called "molecules," which have an attraction for one another. These molecules of water are always in rapid motion, vibrating like little bells, only many times more rapidly than sound bells, and each one probably hits its neighbors many millions of times every second. There is a great contest going on all the time among the molecules, the attractive forces tending to draw them together, and their motions tending to carry them further apart. When water is being heated, the molecules are being made to move faster and faster. If, under ordinary conditions, the molecules are heated to a temperature of about 212 degrees, by the kitchen thermometer, they will be moving rapidly about and bumping one another with such force that their attractions can no longer hold them together, and some of them will fly off out of the tea-kettle as invisible steam.

Water is made to boil because the hottest molecules, going away in such hurry, cause a big commotion among those left behind, and sometimes they even push some of the slower ones out of the kettle, i. e., the kettle boils over. It is not the boiling of the water that makes the steam, but rather it is the escaping steam that causes the water to boil.

The water molecules are bumping one another promiscuously on all sides and it must happen that sometimes a molecule will be struck by several others in succession in such a manner that it will move faster than any of its neighbors. This molecule will be hotter than the others, and while the water as a whole is still cool enough to quietly remain in the kettle, this particularly active one may be able to pull away from the others and go off into the air by itself. This is exactly what happens on every dry day when water stands in a vessel which is open to the air. The hottest molecules are getting away at the rate of many millions every second from each square inch of water surface. The water would evaporate more rapidly still were it not for the fact that the air presses down upon the water and helps the attractions to hold the molecules together. Thus, there are two forces holding the water together, the natural attractions of the molecules, and the air pressure. It is impossible to interfere with the attractions, but it is comparatively easy to remove the air pressure from the water. The fourteen pounds per square inch of air pressure has much to do in keeping the general balance of things on the earth, and it will be interesting to note what happens when water is relieved from this weight. We will now undertake the experiment.

Take a glass vessel shaped like that in the illustration. Fill the top bulb half full of water, connect the tube with an air pump, see that all the joints are airtight, and start the pump. As the pump removes the air, the air presses less and less upon the water. The hottest molecules, that is, those that have the greatest motion, begin to force themselves out of the mass of the water in greater and greater numbers, and so the water evaporates faster and faster till the vacant spaces of the vessel contain multitudes of water molecules flying about with tremendous velocities.

If this were all, the evaporation would soon cease, for the evaporated molecules would become so numerous that, moving about as they are with great speed and knocking one another in every direction, they would push down on the water with sufficient force to hold in the remainder of the water, just as the air did at the beginning of the experiment. If a few more molecules should happen to get free from the rest of the water, they would force some of those already out back into the water and the process of evaporation would be again brought to a standstill. But, happily, by some forethought the lower bulb has been filled with sulphuric acid which will absorb the water as fast as it may come down into the bulb and strike the surface of the acid, and so in the presence of this acid evaporation may continue for some time, or until the acid has all the water it can readily hold.

By the time that the air is about 99½ per cent removed, there are a great number of molecules scattered throughout the water which are active enough to tear themselves away from their neighbors and the water is so agitated by the escaping molecules that it "boils." The acid receiving the hot molecules becomes warmed, and the water, always losing its hottest molecules, becomes, on the average, cooler with the loss of each one. As the boiling proceeds, the water grows cooler and cooler until it reaches the freezing point and begins to turn to ice. Often, as the ice is forming, the water boils so violently that great drops of the liquid and small pieces of ice are scattered all over the inside of the vessel by the miniature but savage explosions. And thus water may be made to boil and

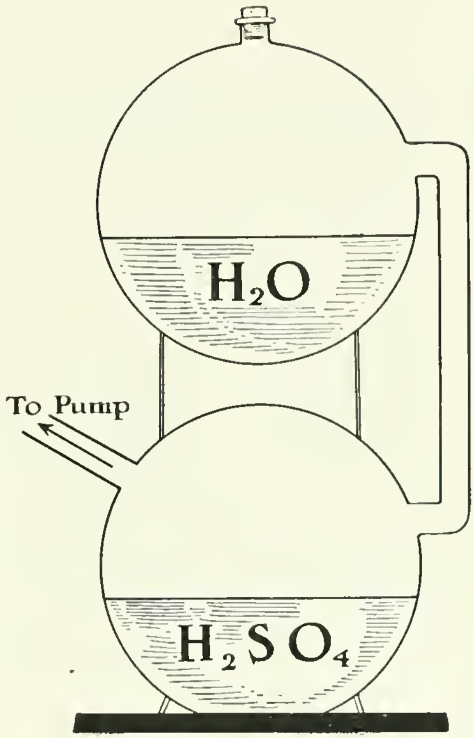


Diagram Illustrating How Water May Freeze and Boil at the Same Time.
The text explains the drawing.

freeze at the same time and in the same dish, simply by relieving it of the pressure of the air.

The molecules of the ice, though locked tightly in the crystals of the solid ice, are still in very rapid motion, and some of them are able to break away from the solid mass, even at a temperature far below zero. Under these circumstances, when the pressure of the air and of the vapor of the water is maintained sufficiently light, the solid ice evaporates rapidly, the ice changing to vapor without stopping to be liquid water at all. The equipment, as described, is really an ice manufacturing plant on a small scale.

HOUSEHOLD ELECTRICITY METER

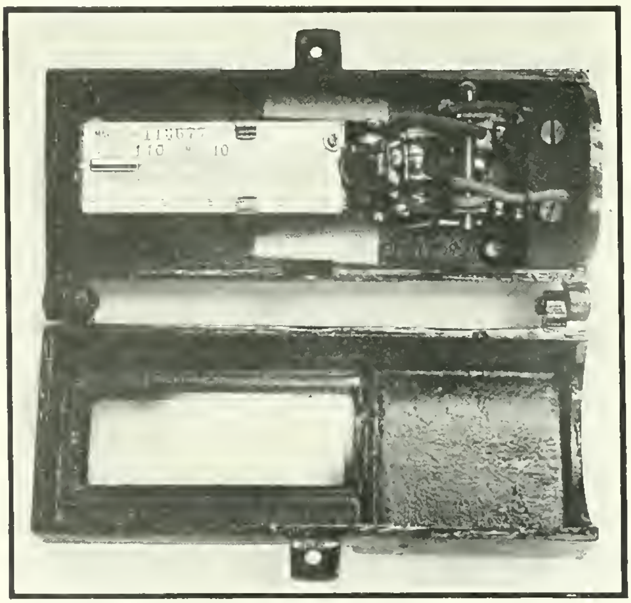
By

JOSEPH B. BAKER

THE private consumer of electricity often feels at a loss to know how much "juice" his lamps or motors or electric heating devices are taking. He does not know how to read the meter which records it, and the bill that comes in at the end of the month seems to him like an arbitrary tax, variable but always high, levied by the electric light company without any understanding of it on his part.

If he complains that his bills are exorbitant the company will obligingly send and test his meter and then give him an imposing official report on its accuracy; but he finds little satisfaction in being convinced against his will that his household or his office or factory really did consume so many dollars' and cents' worth of electricity during the month last past. The company assures him that the energy was delivered and used, and he is not in a position to gainsay it. If he could only have some means of checking, at the time, the amount taken by a too-lavish illumination, or due to the careless waste of light by members of his family or his employees, he would have the same "line" on this item of consumption that he has on his milk or coal in the home or raw material at the factory.

The little device shown in the accompanying illustrations is a recent English invention designed to supply this genuine need, by registering the quantity of electricity taken during any interval of time as plainly as an ordinary thermometer shows the temperature of the room in which it hangs. Indeed, the household electricity meter looks like a thermometer — or perhaps still more like the electric thermostats that are installed in modern buildings to regulate the heating. It consists of a little glass reservoir of mercury and a chemical solution, forming an electrolytic cell, connected in the electric wiring.

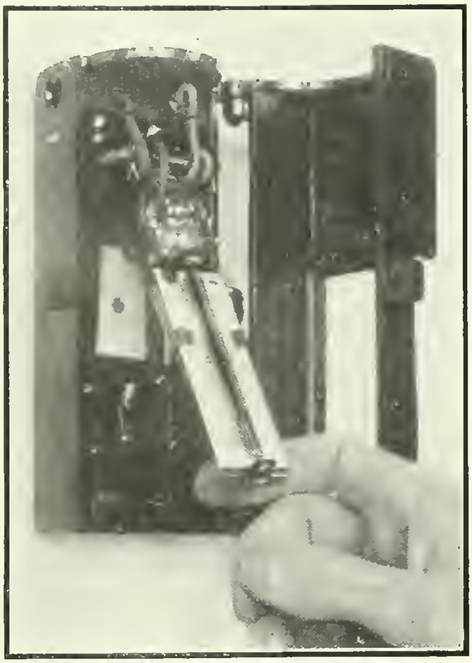


THE HOUSEHOLD ELECTRICITY METER, WHICH REGISTERS ELECTRICITY CONSUMED.
This is done by the rise of a column of mercury in a graduated glass tube. The meter is ordinarily sealed, and read through the glass.

In operation, it is simple and ingenious. When a single lamp is turned on, for example, the current passing through deposits a little of the mercury constituting one electrode of the cell, on the other electrode, a platinum wire. But mercury will not amalgamate with platinum, so the deposit as it takes place does not "stick," but falls—by infinitesimal globules—into the bulbed lower end of a graduated glass tube or column. If two lamps are turned on, this deposit of mercury takes place twice as fast, for by the law of electrolysis the amount of a metal thus transferred is strictly proportional to the quantity of electricity passing. The mercury representing the flow of current thus accumulates in the graduated column, its level rising gradually in proportion to the number of lamps turned on and the length of time they are left burning; so that a glance at the column at any time shows how much electricity has been consumed.

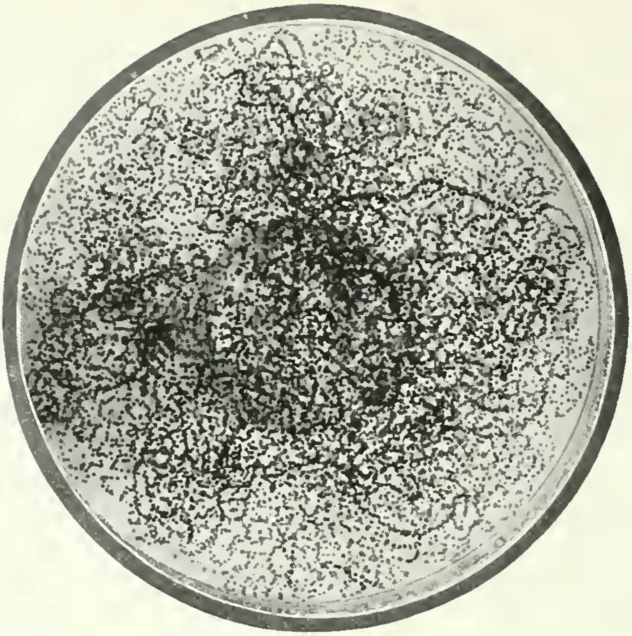
We will suppose the electricity meter to be installed in an apartment, where the head of the family pays for his electric light separately from the rent just as he does for gas used in cooking. Wishing to keep tab on the current consumption day by day, he consults the meter every morning before going to his business, afterward re-setting it for another twenty-four hours' use. The height of the column of mercury, on its scale of lamp-hours, tells at a glance whether there has been any waste. For instance, if the mercury stood at thirty-six lamp-hours, notwithstanding that the family had been out all the evening before, he could safely surmise that the servants had kept the two lamps in the kitchen and the four in the dining-room—or their equivalent elsewhere in the house—burning for six hours. Thus by daily observations he could get at the facts, and be able not only to call a 'halt on waste but check his bill from the electric light company when it came in.

The re-setting of the electricity meter is as simple as reading it. The mercury reservoir, with the graduated column and the bulb below, are mounted on a vertical plate which is hinged at the top. By unlatching the plate at the bottom it may be tipped upside down so that the mercury which has accumulated in the column will run back into the reservoir. The latter is formed like the well-known "non-spillable" inkstands, that is with an annular cavity into which the mercury runs when the column is tipped up but from which it cannot run back when the latter is lowered into place. It is a moment's work, after reading the meter, to reset it in this way ready to begin again recording the consumption of energy.



Resetting the Electricity Meter by Tipping Up the Mercury Tube.
This allows the deposited mercury to run back into the reservoir at the top of the tube.

Many persons are deterred from putting in the electric light by fear of its excessive cost. This little electricity meter, easily installed by the consumer to be a watchful guardian against waste of current, is likely to overcome this stumbling block and boom the use of electricity by many families who now feel that they cannot afford it. It is probable that electric heating devices, also, would be used far more generally than they are at present if their consumption of current could be watched and regulated more directly. The convenience and safety of these devices could then have real consideration by the people at large. The "electric kitchen," equipped with the great variety of cookers, toasters, broilers and ovens which may now be bought, would have a separate electricity meter connected in its main wiring, and the housekeeper could tell just how much current it took to cook a meal, or to run the kitchen for a day or more, as easily as she can now tell how much fuel she burns in her coal range.



EGGS—15,835 OF THEM BY ACTUAL COUNT—ALL LAID BY ONE TOAD.

TOADS AS INSECT DESTROYERS

By

RENÉ BACHE

SCIENCE offers a new solution for the bug problem. It is to employ, in its professional capacity, so to speak, the toad—the ordinary hoptoad of the field and garden—as an insect fighter.

In this business the humble batrachian is unequalled by any other living animal. He is the greatest bug fighter in the world. It is entirely practicable to utilize his services on an extensive scale, employing him systematically as an ally, to keep in check the insects which levy an annual tax of over $800,000,000 upon our agricultural resources.

With this idea in view, Dr. Newton Miller, of Clark University, comes forward with the suggestion that toads be regularly bred for the purpose in question. He thinks it would pay to establish toad-hatching plants, somewhat on the pattern of the government fish hatcheries, and possibly in connection with the latter. Nothing could be easier, inasmuch as toads can be bred as readily as any kind of fish.

There is no reason, however, why the farmers of the country should not hatch and rear their own supply of toads, for local service. With a pond, or even a small pool insured against drying up during late spring, the creatures will breed of their own accord in any desired numbers, up to the limit of the food supply available in the shape of insects. But one thing absolutely essential is that they shall be protected against their natural enemies—on which point something will be said more definitely later on.

Dr. Miller says that probably there is

not a farm in all the United States which, though suffering from insect pests, makes any provision for the breeding of toads—even to the extent of encouraging their natural propagation by forbearing, with this end in view, to drain the ponds to which they resort at mating time. In fact, reports on the subject from various districts in the Middle West seem to indicate that this part of the country is almost entirely destitute of toads.

To meet requirements satisfactorily as an ally of the farmer in the bug fighting business, an animal should be one which man can breed in any desired numbers, and which, when it is desired to check a sudden plague of insects, can be multiplied with great rapidity. It must also be one which, no matter how large its numbers, is absolutely harmless. These specifications are perfectly met by the toad, which, while an active and even voracious feeder in times of abundance, is a patient faster during periods of scarcity. Anything it comes across in the shape of bug, worm, or slug suits its appetite.

It is estimated that an average toad is worth to the farmer five dollars a year for the cutworms alone which it destroys. But this is only one item. The amount a toad will eat is astonishing. A large specimen has been known to devour 100 rose beetles at a single meal. In the stomach of one toad seventy-seven myriapods—the common household "centipede"—were found; in another, fifty-five army worms; and in yet another, sixty-five gypsy-moth caterpillars. A post-mortem in still another instance showed that the batrachian, of only medium size, had just lunched upon thirty-seven ants, nineteen sowbugs, three spiders, one caterpillar, and ten plant-lice. One toad was seen to eat thirty-five large and full-grown celery worms in three hours, while another accepted eighty-six flies, fed to him, in less than ten minutes.

TOADS KILLED AT THE EDGE OF A POND—THE SUNDAY SPORT OF BOYS.

It is a common thing, when the occupants of an ants' nest are swarming, and the insects are emerging in large numbers, to see an enterprising toad sit at the entrance of the burrow and snap up every ant that comes out. The slaughter he accomplishes under such circumstances is frightful. But, of course, most ants are not reckoned as insects injurious to man; and the toad unquestionably destroys some species which are beneficial to the farmer. But, on the whole, as proved by a painstaking study of the contents of thousands of stomachs, the batrachian is immensely useful, devouring countless numbers of the very worst bug foes of the crops.

YEARLING TOADS, MALE AND FEMAL

Toads are less numerous in the rural districts, unfortunately, than in the neighborhood of towns. Pasturing and tillage kills a great many of them, and the drainage incidental to agriculture deprives them of breeding places. No ponds, no toads. The

TOAD WATCHING AT AN ANT HOLE.
He snaps up every ant as it comes out.

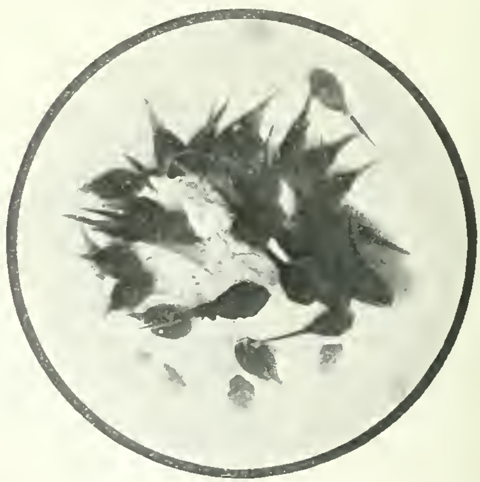
humble batrachian is a land animal, but the female must lay her eggs in water, because her offspring during the early days of their existence are aquatic—tadpoles, in short, much resembling those of frogs. At the same time, and again unluckily, the towns destroy immense numbers of toads, though accidentally, by trapping them in sewers. Sewer-cleaners, in the regular course of their business, collect dead ones by the bushel, especially in fall and spring, and an examination of the manholes in Worcester (Mass.), by Dr. Miller, in the month of May, showed an average of four toads in each. At this rate, 24,000 had been caught. Dr. Miller says that, in a city, more toads are killed by this means than by all others combined.

During the summer the toad leads a solitary life, and in the daytime seeks concealment in damp and sheltered places. At night, and on rainy days, he comes out and forages. Every few days he changes his clothes, being a cleanly animal by instinct, and takes off his skin as if it were a shirt, over his head. No wash-basket being conveniently at hand, he swallows the cast-off garment. The whole performance is accomplished in a couple of minutes. But, when winter arrives, he digs a hole in the ground, and buries himself below frost-line, where the cold cannot get at him.

The first warm days of spring bring out the toads from their winter quarters, and soon a peculiar trilling sound is heard from the near-by ponds. It is the song of the males, which are summoning the females to attend to the most important business of life—that is to say, the reproduction and perpetuation of their species. Toads, as will presently be seen, are no advocates of race suicide. The females soon respond, and before long spawning begins, the eggs being laid when practicable in a place well out in the pond, where dead grass or weeds come to within three or four inches of the surface of the water, forming a sort of overflowed bed of vegetation suitable for the reception of the ova.

Only the males trill, by the way, or make any kind of sound audible to the human ear. Dr. Miller says that the he-toad, while trilling, keeps his mouth and nostrils tightly closed, but the pouch under his throat is much inflated. The note he utters—that of the spring love-song—is high-pitched and tremulous. All of us have heard it many a time, though not knowing whence it came.

The female lays her eggs in long strings. If there be no place available such as that above described, a shallow spot near the edge of the pond will serve —the important point being that there shall be weeds or grass, overflowed by water not more than four inches deep. The eggs are encased in a continuous, cylindrical, gelatinous strand—the jelly-like covering being added while they are passing through the oviduct in the proc-



COURTESY DR. H. MILLER

TADPOLES FEEDING ON A PIECE OF MEAT.

Mature Female Toad.

ess of laying. This is for protection. The gelatinous substance, absorbing water, swells greatly, and thus the string of eggs will weigh perhaps five times as much as the toad which laid them.

Such a string may contain anywhere from 4,000 to more than 15,000 eggs, and may be as much as 124 feet in length. They develop rapidly, and the tadpoles emerge from them in from two to six days, depending upon the temperature of the water. Odd creatures they are at this stage of their being, without a mouth, but having on the under side of the head two small sucking disks, by which they attach themselves to objects. The mouth appears within three to seven days, and they begin to feed voraciously—largely upon the slime (containing a good deal of organic matter) on the bottom of the pond and on the surface of sticks and plants. Meat, fresh or putrid, if it happens to be supplied, they eagerly devour.

Young Toad, Two Days Out of the Water.

When the tadpoles are about twenty days old, their legs—which are to be—begin to appear as small knobs or buds. Both pairs are fully formed in ten days. Meanwhile the tail has shrunk to almost nothing; the eyes have become enlarged; the mouth broadens; the "gill-slits" close, and the lungs mature. The creature is metamorphosed from the likeness of a fish into an air-breathing terrestrial quadruped. It has become, in a word, a toad, the whole process of change, from the egg to the finished batrachian, occupying about thirty-two days.

One thing the baby toads cannot endure is hot sunshine. After emerging from the pond, and before taking up the duties of life as full-fledged toads, so to speak, they are obliged to remain in damp and sheltered places for a few days—among grass or under stones. Thus it comes about that at night, or on cloudy days, while completing their transformation, the vicinity of ponds is often fairly alive with young toads migrating from the water. Dr. Miller says that such migrations at rainy periods have given rise to the widespread popular belief in the notion that toads, at times, "rain down" from the skies.

When any kind of animal under normal conditions produces great numbers of young, one may take it for granted that it has many natural enemies—this being Nature's method of providing for the perpetuation of the species, despite obstacles. It might be assumed, then, that toads have numerous foes; and such, when the matter is investigated, is found to be the case.

From the moment when the little tadpoles wriggle out of the protective gelatinous sheath, they are a prey to fishes, newts, crayfish, and the aquatic larvæ of certain insects, such as the dragonfly. Chickens, ducks, and various wild birds pick them up greedily. Crows are extremely fond of young toads. Hawks eat the adults; so likewise do skunks and raccoons. Many snakes, including garter snakes and the common water snakes, gobble the toads and tadpoles. And by no means least destructive of the many enemies of these valuable batrachians are small boys, who, as a matter of mere habit, slay toads whenever they get a chance.

A VINE WHICH PRODUCES TEN TONS OF GRAPES ANNUALLY.

LONGEVITY OF THE GRAPEVINE

By

H. F. STOLL

ALTHOUGH the people of the Pacific slope began the planting of grapes hundreds and hundreds of years after the vine had been brought to a high state of cultivation in foreign lands, California lays claim not only to as fine a quality of grapes as are produced in other countries, but to the most remarkable individual vines in the world.

In Carpinteria Valley, about ten miles south of Santa Barbara, is "La Vina Grande," a viticultural marvel that stands in a class by itself. Its location is somewhat secluded and as a result, the exact whereabouts of the largest grapevine in the world is known to but few outside of the residents in the vicinity. The massive trunk of the vine is nine feet seven inches in circumference and suggests an oak rather than a grapevine. Its branches, some of which measure four feet in circumference, are trained over a ponderous frame covering a space of ten thousand square feet. It is still in a good, healthy condition and would undoubtedly attain much greater dimensions if it were not cut back every year. The frame over which the vine is spread is very strongly built, as it is required to support the tremendous weight of grapes which La Vina Grande annually yields. Sixty strong posts uphold the frame which supports the fruit-laden branches. In 1895, out of sheer curiosity, a record was kept of the amount of grapes yielded by this wide-spreading vine and it was a real surprise to find that the grand total was a fraction over ten tons. This did not include almost innumerable clusters carried away by sightseers and neighbors. The estimate of the whole crop was about twelve tons.

This remarkable Carpinteria grape-bearer is of the Mission variety and is twice as large as the famous vine in the conservatory at Hampton Court, England, which has been regarded as one of the horticultural wonders of the world and is claimed by many to be the largest in existence. During the World's Fair Exposition, at Chicago, a large sum was offered for La Vina Grande and an offer of $1,000 from the San Francisco Mid-Winter Fair was also received, but both were declined.

In 1842, seven years before the discovery of gold brought people from every section of the globe to California, the vine was planted by a Spanish woman named Joaquina Lugodi Ayala. Under her care the little Mission grape cutting flourished and grew to unusual proportions, although it was cut back year after year. She retained ownership until 1877, when she sold it. Joaquina Lugodi Ayala died at the age of eighty-four years and to the last took great interest in La Vina Grande.

Beneath the heavy branches of this wonderful vine, seven or eight hundred persons can gather and find protection from the sun's heat. Picnic parties make this their place of rendezvous and eat lunch under the welcome shade. Years ago it was used for public meetings and on several occasions served as an election booth. In fact, it is claimed, the first election in Santa Barbara County was held beneath its ripening fruit. A journey to La Vina Grande during the summer months, when it is covered with leaves and fruit, will repay any one, for

A VINE OVER A CENTURY OLD.
Photo taken in the spring, just as vine was getting its leaves.

its present owner, J. R. Peterson, takes a special pride in pointing out the unique points of his monstrous vine to visitors.

In the patio of an adobe hotel, near the San Gabriel Mission, is another remarkable vine, considerably older than La Vina Grande. It covers nearly five thousand square feet, is over five feet in circumference and its roots extend more than two hundred feet in every direction. It is composed of one stalk and three branches, and was in early days known as "El Paron de la Trinity"—Trinity Vine. It never received irrigation or cultivation. Owing to these facts and its dense foliage, the grapes are small, but the crop is abundant. The leaves, some of which measure twelve inches, are used by natives for fevers and headaches. It was said by Senor Pico, father of Don Pio Pico, the last governor of California under Mexican rule, to have been an exceedingly large vine as far back as 1800. Trinity Vine is only a few minutes' car ride from Los Angeles and is visited by thousands of tourists annually.

San Bernardino County, the cradle of the viticultural industry of the Pacific Slope, boasts of one of the oldest bearing wine-grape vineyards in California. At Cucamonga, there is a stretch of Mission vines that were planted more than three generations ago. These sturdy veterans still yield valuable crops each year. The trunks will reach the chin of the average man and are at least three feet in circumference.

Despite the fact that the vineyards in Central and Northern California have been sadly ravaged by the destructive phylloxera, there are many vineyards that have escaped the dreaded scourge. In Sonoma County, where the greatest difficulties have been encountered, there is a fifty-year-old vineyard owned by Marcelin Gaye, which is a marvel of beauty in the summer months when the luxuriant vines are covered with a wealth of dense foliage and luscious berries.

These old-timers are of the Mission and Rose of Peru varieties, some of them being twelve inches in diameter and standing four and a half feet high.

ONE OF MARCELIN GAYE'S GIANT VINES AT SEBASTOPOL, CALIFORNIA.

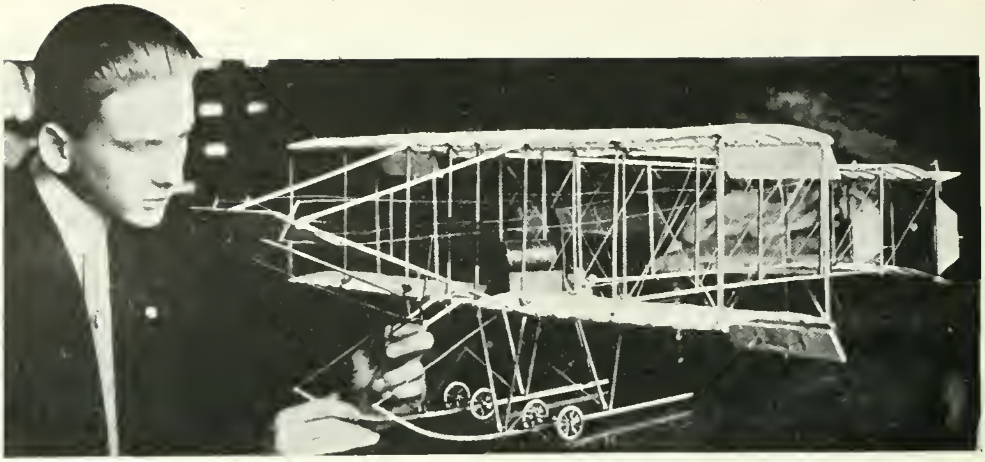
THREE QUARTERS OF A CENTURY OLD.

They are planted from ten to twelve feet apart, in sandy land with a clay subsoil, are today free from phylloxera or other diseases, and promise to live long after we have passed away.

The hill at Sebastopol, on which these aged vines are growing, commands an entrancing view of the beautiful Sonoma Valley. Looking northeast for a distance of about twenty-five miles, one's eyes rest on majestic Mt. St. Helena, in Napa County, which, before the advent of the phylloxera, was surrounded by thriving vineyards which contained thousands of these Giant Mission vines. They were introduced into California by the Franciscan Fathers, who established the first civilization on the Pacific Coast in 1769. The origin of the variety of grapes planted by the padres of old around their adobe houses of worship, which has since come to be known as the Mission Grape, has been lost, but it is supposed to have come from Spain.

It is difficult to estimate accurately the age of vines by the usual method of counting the rings, because the yearly growth is not distinctly marked. Some authors state that the vine equals, and even surpasses, the oak in point of age. Pliny mentions a vine six hundred years old. Miller tells us that some of the vineyards of Italy held good three hundred years, and that vines one hundred years old were accounted as young. Professor Bose states that some of the vines of Burgundy were four hundred years old and more. The famous Hampton Court vine is nearing the century and a half mark and Lord Breaddalbane's immense vine in Scotland is over seventy years old.

In America we have been unable to ascertain the age that planted vines will attain and the time that has elapsed since the coming of Christopher Columbus would not be sufficient had the experiment been begun the day he landed, in 1492. There is a wild grapevine upon the shores of Mobile Bay, about one mile north of Daphne, Alabama, that is commonly known as the "General Jackson Vine," from the fact that General Jackson pitched his tent under it during his campaign against the hostile Seminole Indians. This vine in June, 1897, was reported to have a circumference of six feet one inch at its base. Its age was estimated at that time to exceed one hundred years.



A MODEL-MAKER'S BIT OF CLEVER ART.

NEW ART OF MODEL-MAKING

By

HENRY R. JEVONS

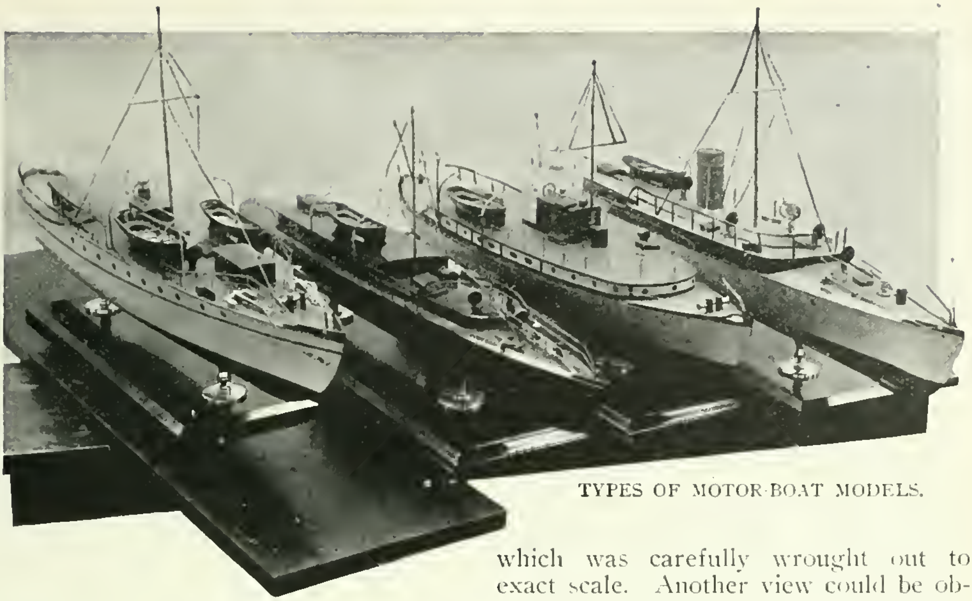
HAVING discovered models at last, America is taking very kindly to them. In view of their usefulness, the popularity of models is not surprising, but considering their expensiveness it is, for a fine model may cost as much as a comfortable house. Perhaps the most astonishing thing about the matter is our tardiness in adopting an idea the value of which was demonstrated in Europe long ago, for it is only in the last few years that they have been used here at all.

"Model" being a word comprehending such a great variety of things, it should be explained that the particular kinds of models herein referred to are the reproductions in miniature of structures designed by architects of both the landlubber and the marine varieties. In any case these scale models, so-called from their being proportioned in some exact ratio to the real structure, serve the same purpose that the sculptor's clay study does; that is, they embody ideas in concrete form, thus revealing faults which may the more readily be corrected before work on the actual structure is undertaken.

Model-making for the marine architect and for his land-going colleague are handicrafts as widely different as are the elements on which ships and houses rest. The marine model-maker works in wood and metal, while the architectural model-maker employs such mussy materials as clay, plaster, and gelatine. Both require an equally high degree of skill, delicacy of touch, and minute accuracy, but neither could do the work of the other.

Of architectural models there are two kinds: the scale models in which a building or any part thereof is reproduced on a small scale, and the full-sized models made for the guidance of the stone-cutter or the wood-carver in work of the higher grade. Both are made of the same material, plaster of Paris, direct from the architect's drawings.

The biggest job of architectural modeling on record was that in connection with the building of the New York Public Library, now approaching completion. Modelers have been at work on this great task most of the time for the last eleven



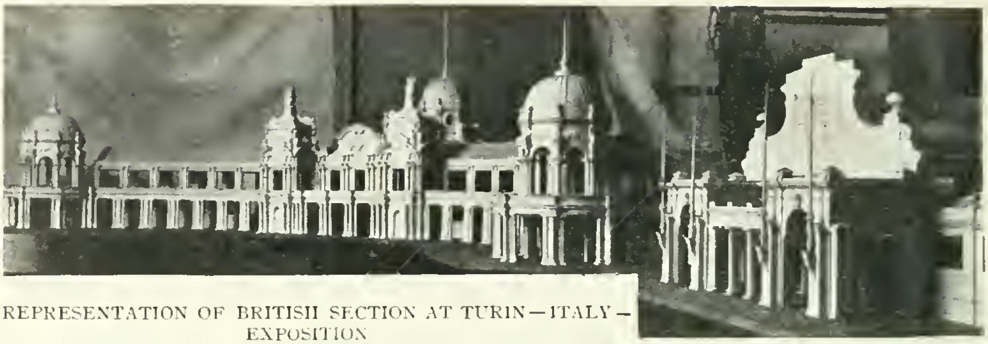
TYPES OF MOTOR-BOAT MODELS.

years, while at some periods as many as twenty of them have been engaged at once. Altogether $125,000 was spent on models for this ten-million-dollar structure. First of all, a model of the entire building on a scale of one-eighth of an inch to the foot was made by three men who worked four months to do it. Next a larger model on a scale of three-fourths of an inch to the foot was made. After the outer shell had been disposed of each detail of the interior was worked out in a small scale model. When it had been developed to the satisfaction of the architects, Carrere and Hastings, a full-sized model of each panel or capital or whatever it was, had to be made for the stone- or wood-carvers.

In planning the New Theater in New York, Carrere and Hastings called in Neuman and Even, a firm of famous modelers, to construct the interior of the proposed theater in miniature. In this model, which is about three feet in diameter, the stage was amputated just back of the proscenium arch leaving an opening the full size of the curtain through which the observer could look into the auditorium, every detail of which was carefully wrought out to exact scale. Another view could be obtained through a glass panel in the ceiling and still another by lifting up the entire top, by which means the beautifully wrought ceiling could be seen to better advantage.

This toy theater cost the very respectable sum of $2,000 to produce, but it was put out of the way at no expense whatever. Being requested to exhibit the model in Boston, the makers borrowed it from the architects and shipped it, carefully packed, by express. When it was unpacked it was found to be reduced to powder. As the express company modestly declined to foot the bill, the model-makers had to do the costly job all over again. Fortunately they had saved the molds, so the labor was not so great as upon the original.

THE PERFECT HOUSE MODEL.
The roof lifts off to show each floor separately. Every part is complete to the smallest detail of lighting and plumbing.

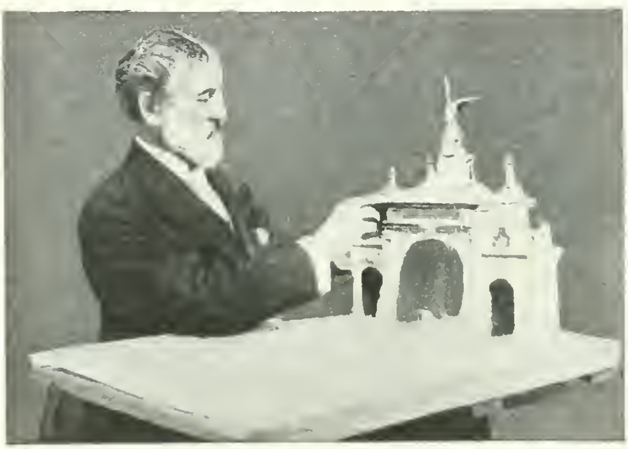


REPRESENTATION OF BRITISH SECTION AT TURIN—ITALY—EXPOSITION

The model of the New Theater was made for the enlightenment of a building committee quite as much as for the convenience of the architects. Indeed, ten minutes with a model will explain more to a client than ten days of oratory over a set of drawings, for the non-professional eye can get but little satisfaction from an architect's drawings. In an undertaking of sufficient importance to warrant the expense, therefore, a model is useful to all concerned.

In order to make clear the arrangement of the grand stairway in the Edwin Gould mansion, just completed on Fifth Avenue, New York, Carrere and Hastings had a model of a section of the interior, including the stairs, made. It not only served the purpose of enlightening the client, but it also gave two young Italians, the Menconi Brothers, a start. The two brothers worked together on the model in a tumble-down shed on West Twenty-fourth street. They did their work so well that it brought them more orders. Now they have spread their workshops out through three buildings and employ thirty skilled workmen.

Other models of notable buildings made in New York were those of the Brooklyn Institute, of which McKim, Mead and White were the architects, and the Connecticut State Library by Donn Barber. It is hardly worth while to model a sky-scraper, for the principal thing required in erecting such a building is a hoisting engine powerful enough to transport material to the top; but in the case of important public buildings or the more elaborate bank structures, where the directors are anxious to get rid of some of the surplus, a model is necessary. The model of the Toronto bank, which was about three feet by two feet, cost $1,000. The Cleveland Trust Company's new building was another of the few business structures considered of sufficient importance to be reproduced in miniature.



CARVING A MODEL FOR AN ARCH TO SERVE AT KING GEORGE V'S CORONATION.

The architectural model-maker first works out the architect's idea in clay, using his fingers to daub so much of the clay as he cannot contrive to smear on his clothes or drop on the floor, upon a board. By patting, pinching and pulling he works the clay into shape, occasionally using a few carving tools or a loop of wire to finish off with. Usually his instructions are to make a rather free interpretation of the ornamental features, and even of some other details, for the original drawings are likely to be more suggestive than specific. To a limited extent, therefore, the modeler does creative work. Indeed, the higher class modelers regard themselves as artists rather than craftsmen. The heads of the firm make annual trips to Europe to brush up their artistic ideas and they are very particular about those from whom they accept orders. Some of them will tell you that there are only about fifteen architects in New York for whom they care to work. One architect with a big contract on his hands wanted some scale models made, but when the firm to which he applied had seen his plans he was invited to go elsewhere as the modelers did not care to do that grade of work.

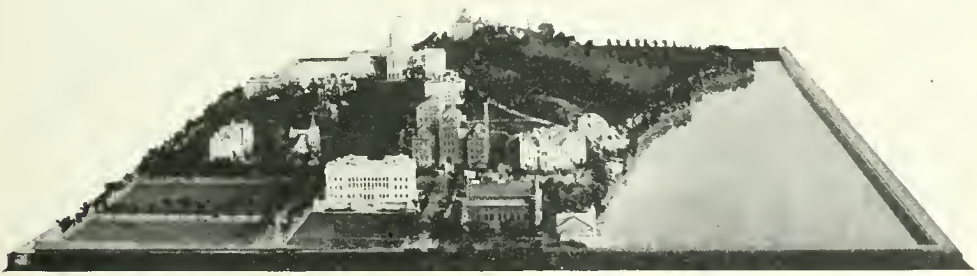
After the clay study has been approved by the architect it is treated to a coat of shellac, then to a light coat of grease. It is then encased in a rough plaster form so that a melted preparation of gelatine, or "glue" as the modelers call it, may be poured upon the face. When cold this glue is as elastic as rubber, so that it may be pulled from the irregular face of the model without injury. After being face-hardened with alum this glue impression serves as a mold into which plaster of Paris mixed to a thin paste is poured. Burlap or jute fiber is scattered over the wet plaster to hold the brittle stuff together, after which another coating of plaster is poured on. In making scale models wires or strips of metal may be used as reenforcement. Whenever a detail, such as a column, or a capital or a window or a decorative detail is repeated the modeler makes a mold for a single unit and then casts as many pieces as are required. These are then assembled and cemented in place with fresh

THIS MODEL IS DISPLAYED IN A WINDOW AS A BUSINESS FIRM'S WAY OF ADVERTISING ITS NEW STRUCTURE.

plaster. The sections are then assembled and the model is finished by "pointing up," or dressing down the rough parts and filling up imperfections.

Architectural model-makers are among the highest paid of craftsmen for they get $50 or $60 a week. They have things pretty much their own way, for there are barely two hundred of them in America, nearly all being in New York City.

In the art of making marine models we are as far ahead of England as that nation is ahead of us in building full-grown ships. In mere quantity of output, to be sure, England is as far in the lead as in turning out real ships. One reason is that marine model-making has become such an extensive industry over there that some concerns make a specialty of

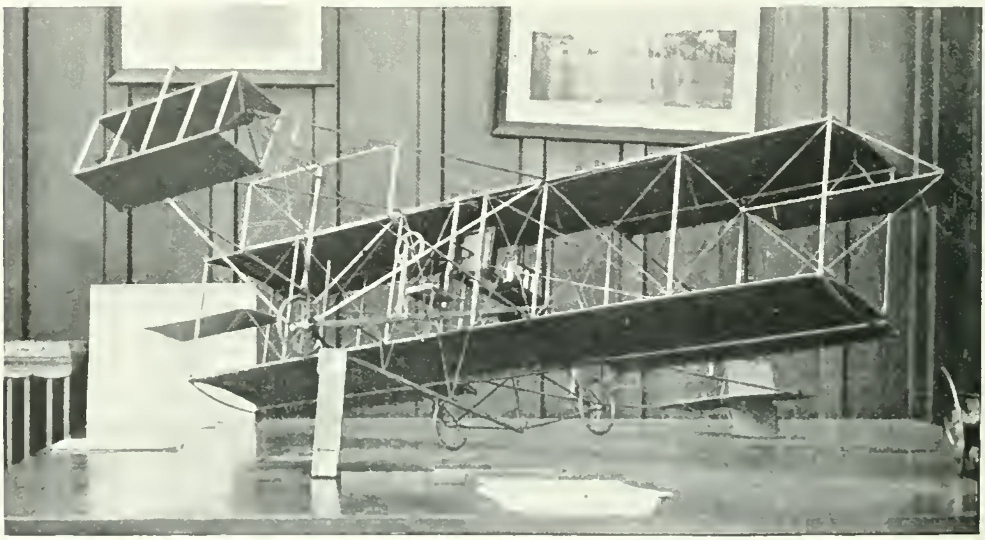


A PORTION OF THE UNIVERSITY OF WISCONSIN CAMPUS.
The smooth surface at the right is water.

MODEL OF THE NEW YORK PUBLIC LIBRARY.
Altogether $125,000 was spent on models for this $10,000,000 structure.

turning out parts for models, which are assembled by the various makers. This use of stock parts is deceptive, for they often differ from the originals they are supposed to represent. In Great Britain, too, model-making is a mere trade in which one man generally makes the complete model from beginning to end, except for the stock parts which he buys ready made. Thus the work is slow and costly and when it is done is not always a faithful reproduction of the original.

But in America, on the other hand, model-making has become an art in which brains, machinery and specialists are all employed to produce a mathematically exact copy in every detail of the original at reduced cost. A striking example of this difference is afforded by the model of the White Star Liner *Olym-*



EXACT MODEL OF THE CURTISS AEROPLANE—SIX FEET ACROSS.

MINIATURE REPRODUCTION OF THE *SEVERN*, THE SCHOOLSHIP FOR UNITED STATES NAVAL CADETS.

pic, now on exhibition in New York. This, the largest model ever built, is eighteen feet six inches long and cost $12,500 in England. The foremost American maker of marine models offered to build a model of the same ship of the same size for three-fourths of this sum. Some idea of the character of such an undertaking may be gathered from the American's estimate that it would take twenty men six months to build a miniature *Olympic*.

Lest anyone should underestimate the importance of the marine model it should be explained that they perform many useful services. For one thing marine models have played an important part in making England mistress of the seas. Marine museums, the principal features of which are models of ships, are numerous in England. Landlubbers there have abundant opportunities to become familiar with the appearance of vessels of all kinds before they ever smell salt water, and this familiarity inspires a determination to follow the sea for a livelihood. America, on the other hand, has no marine museums. The nearest we ever came to having one was three years ago when Senator Heyburn introduced a bill to present a model of each ship in the United States navy named after a city or a state to such cities and states. But the bill was quietly smothered in committee and our first marine museum is yet to be established. American boys who might grow up into seafaring men and do their share in rehabilitating our merchant marine are thus cheated out of their careers, since they never have an opportunity of seeing what a ship looks like. Still, we can boast that the finest collection of marine models in the world, that of the New York Yacht Club, is to be found on American soil, even if it isn't open to the public.

Models are also often useful to the man who has decided to build a ship or a yacht but is not sure about the details. To the unpracticed eye the blue prints of the naval architect convey but little meaning. In such a case the model-maker is called in to construct the vessel in miniature from the architect's drawings. Then the prospective owner can see his future craft just as it would look if viewed through a reducing glass. With the concrete object before his eyes he can have changes made to suit his ideas, thus making sure that he will not be disappointed in the vessel itself.

Models, too, play an important part in admiralty suits sometimes, though this happens oftener in England than in America. Models of the splendid new trans-Atlantic liners also do effective work in drumming up trade for the steamship companies. The White Star Line and the Cunard Line have each more than a hundred thousand dollars invested in models of their crack ships, which are kept going the rounds of the more important cities. They wear out in the course of their dry land voyages and have to go into dry dock just like their full-grown counterparts, particularly if they happen to be English built.


This Concrete House May Be Cleaned by Simply Turning on the Hose.

Lastly, marine models make attractive collections for those in search of novelty. Henry A. Morss, a Boston yachtsman, has recognized the opportunity by gathering a fine private collection.

A marine model may be of any dimensions required from life-size down. Visitors at the Chicago World's Fair in 1893 will recall the life-sized model of the battleship *Illinois*, done in wood and staff, in one of the lagoons in Jackson Park. At the St. Louis

World's Fair in 1904, a life-sized model of the forward third of a typical cruiser was constructed in the Government building. This full-sized model was surrounded by a most interesting collection of warship models of conventional size from the Navy Department, that is, a quarter of an inch to the foot. The entire collection, including the full-sized model, was the work of H. E. Boucher, of New York, the world's foremost marine model-maker.

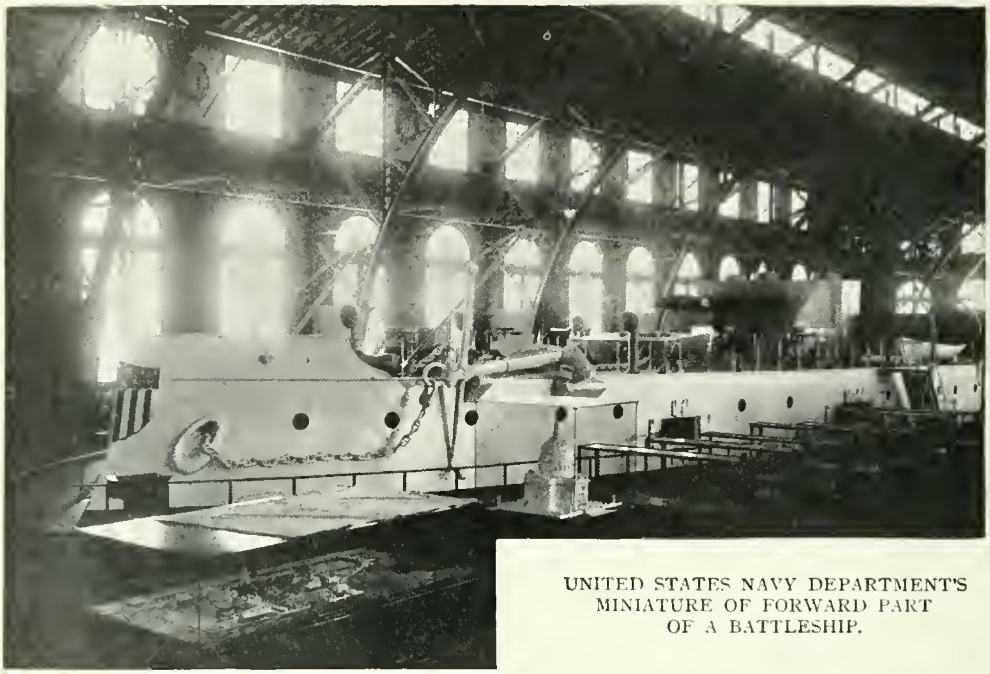

Model of an Ancient Chinese Music Barge.

Mr. Boucher was employed as a naval architect at the Brooklyn Navy Yard for a number of years. Barnum and Bailey, the circus men who had secured permission from the Government to make models of eleven warships for exhibition, engaged Mr. Boucher to superintend the construction of the models after hours. The models were so fine that they won the admiration of Naval Constructor Bowles, who secured the transfer of Mr. Boucher to the Navy Department's model shop at Washington. Boucher reorganized the shop, put it on an efficient basis and reduced the cost of model-making one-third.

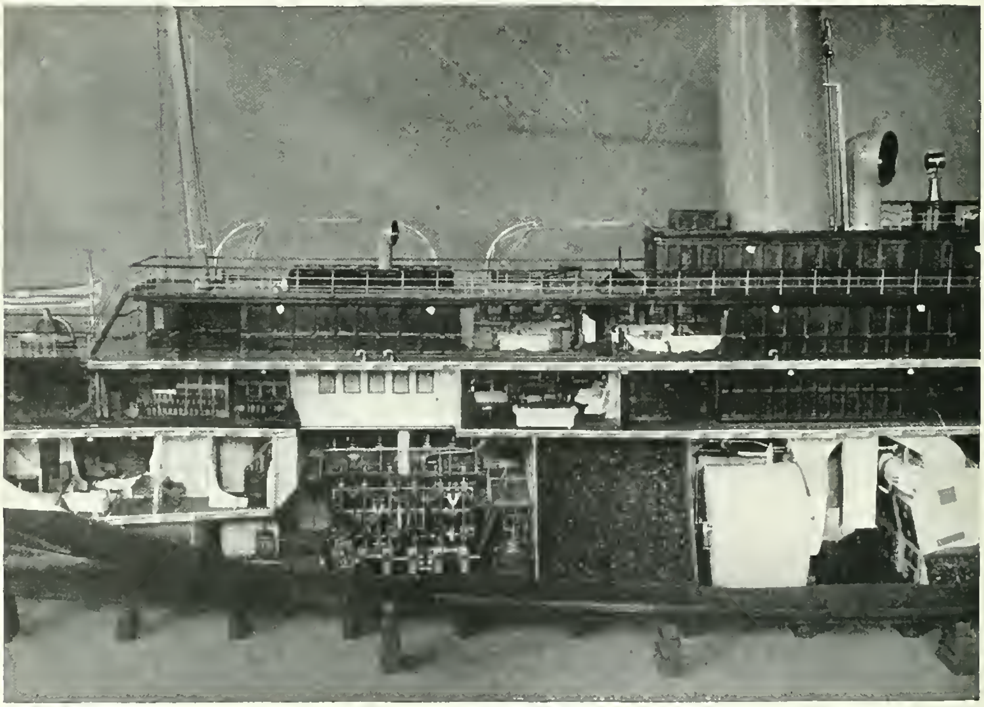
When the time came he was assigned to the task of building the big model at the St. Louis Exposition. At the Seattle Exposition in 1909, he built for the War Department a model to show harbor defense by submarine mines. In a little bay filled with real water and commanded by fortifications complete in every detail, were a number of submarine mines so disposed as to protect the entrance. A tiny ship steaming about the harbor came in contact with one of the mines at regular intervals, causing a light to glow in the mine to attract the spectators' attention. At the same instant there was an explosion accompanied by a puff of property smoke. Then the unfortunate ship sailed on to meet her doom again.

One notable piece of work by Mr. Boucher was to epitomize the history of the United States Navy in a series of twenty half models for the New York Yacht Club. The series began with Paul Jones' ship, the famous *Bonhomme Richard,* and included the *Constitution,* the *Powhattan,* the first sidewheel man of war, the corvette *Kearsarge,* the *Maine* and the *Oregon,* and concluded with the *Connecticut.* As all were on the same scale the increase in size as well as progress in other features could be comprehended at a glance. The collection was regarded as so important that the maker was requested to duplicate it for the Navy Department. Six years ago Mr. Boucher resigned from the Navy Department and set up business for himself as a model-maker in a little shop in Maiden Lane, New York, with two assistants. Soon he was obliged to move to larger quarters. Now he employs thirty-two expert mechanics and is looking for still larger shop space.

Some of the most interesting marine models turned out by Mr. Boucher are



UNITED STATES NAVY DEPARTMENT'S MINIATURE OF FORWARD PART OF A BATTLESHIP.



A SHIP'S ENGINE ROOM IN DETAIL—AN EXCELLENT PIECE OF ENGINEERING WORK.

those showing interiors of vessels. A model of the transport *Sherman* seen from one side shows the ordinary exterior view. The other side shows the interior on the center line of the ship. Every detail is there and everything is carefully made to scale, from the chart room and the cabins to the bunks for the troops, the coal in the bunkers, the machinery, cargo, and the quarters of beef in the cold storage room.

Models of the *Iolanda*, Mortimer F. Plant's yacht, and the *Vanadis*, owned by C. K. G. Billings, show the exterior on the port side, while on the starboard side the shell plating is removed to show the interior, from the luxurious furnishings in the cabin to the boilers and engines. The quadruple expansion engines of the *Vanadis*, which, of course, are accurately built to scale, are five inches long by four inches high. Every bolt head, oil cup and other detail is there in its proper proportions and the whole is beautifully finished. It took one man six weeks to build the engines.

Some of the details of a marine model are very small. Just to give an idea of them it may be said that they include turnbuckles with right and left hand threads that work just as well as the full-sized ones, yet are only half an inch long over all. Cleats three-eighths of an inch long and blocks one-sixteenth of an inch long may be found. For cordage Japanese grass line, which is not only extremely strong but is twisted in exact imitation of ordinary rope, is used.

Watchmaker's work seems crude when compared with the delicate nicety of skill required in the model-maker. Men competent to build the tiny engines and do the other metal work get from $4.50 to $4.75 a day, while ordinary machinists are glad to get $3 a day. The woodworkers are equally well paid. Model-makers are not to be had whenever needed; they have to be trained to the work. As the demand for models fluctuates and as it would not do to lay off these trained specialists lest they might not be found when needed, general machine work of the higher grade is taken in to keep the plant going.

SHOWING THE CAPITALIST FARMER HOW TO LAY OUT HIS ACRES.

Unless it is desired to show the details of its construction the hull of the marine model is carved out of a solid mass of wood. This is not one piece as it grew in the tree, for that would warp and check and be utterly worthless, but a built-up block of one-inch or half-inch boards accurately fitted and glued together. The exterior is first shaped up to the proper lines, then the interior is hollowed out as much as may be required. Finally the superstructure and top hamper are put on. For the superstructure, the English model-makers use thin strips from a single board. This material will not stand rough usage nor changes of climate but soon warps and splits so that the models find their way to Mr. Boucher's dry docks where the worthless material is replaced by sheets of wood built up by gluing half-inch strips together. This built-up lumber never warps nor checks and it will stand remarkably rough usage for such frail material.

When the model is intended to show the structure of the hull a section, usually amidship, will generally suffice. In this case bits of metal and wood finished exactly to scale are put together precisely as the larger pieces go in the full-sized ship. The work is done directly from the naval architect's drawings, which are on a scale of a quarter of an inch to the foot. If a craft is already in existence a model may be made from photographs of it. The scale is obtained from the photographs by laying a number of rods divided into inches alternately black and

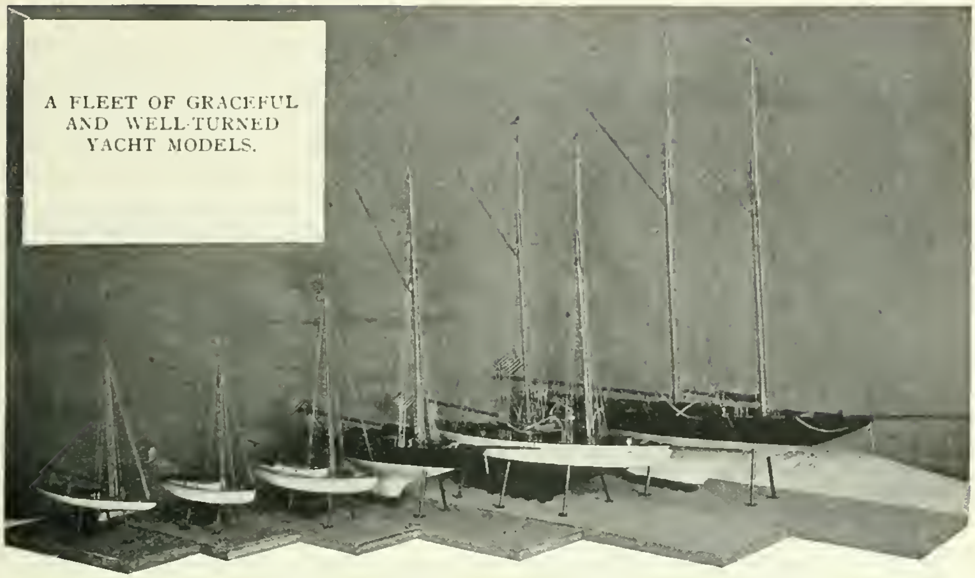
A DAINTY STRUCTURE IN PLASTER WITH A FRONTAGE OF SIX FEET.
Model of the Cleveland Trust Company's new building at Cleveland, Ohio.

white, wherever measurements are required. No matter how the camera may be placed the correct measures show in the photograph.

Marine models are costly luxuries. A model of a fifty-foot sloop, if made to the conventional scale, would cost $300. The model of the *Iolanda*, seven feet long, cost $5,000.

Mr. Boucher has views on the subject of models and education that are worth hearing. "My bent for model-making," said he, "may be due in some degree to the fact that my father never would give me any toys. But as he willingly supplied me with tools and materials I never lacked playthings. I have often thought it would be a great blessing if other boys were treated the same way. Girls are well provided for. They are given toy houses, all sorts of toy furniture, dolls, dolls' clothing, needles and thread and everything else that will familiarize them with housework from their earliest infancy. But the poor boy is given a ball and bat and turned out into the street. Balls and bats may be very well in their way, but they certainly are not prolific in ideas. Boys should be taught to shift for themselves in the matter of amusement as soon as they are able to handle tools.

"We need a nautical museum, or rather a good many of them. We used to be considered a maritime nation. Whether we ever were or not, we have gotten bravely over it now. The greater part of our population is too far from salt water to know anything about maritime commerce, and not knowing, they care nothing about it. They never can be educated up to a due appreciation of our



A FLEET OF GRACEFUL AND WELL-TURNED YACHT MODELS.

marine interests and opportunities through the newspapers nor by pictures. They must see the ships, either by journeying to the ocean, or by sending the ships in miniature to them. A good model discounts everything else as a means of instruction."

Although architects on land and sea are the principal users of models they by no means exhaust the list. A recently developed use for models, which is rapidly extending, is in selling goods. Some manufacturers of special machinery employ no salesmen. When an inquiry for a machine is received a working model is sent. This tells its own story more convincingly than the most eloquent words. The inquirer returns the model with his order, whereupon it goes to the next prospective customer. Express charges on the "silent salesman" are cheaper than railroad fares for the more loquacious kind, and there are no hotel bills to pay.

Often, though, the silent salesman goes along with the ordinary kind to help him out. The salesmen's models cover a curiously wide range. Perhaps the model may be nothing more than the working part of a rock crusher about the size of an ordinary fruit cake cut in half to show some special feature, which can be carried in a grip or a sample case. Or it may be a working sectional model of a valve movement the size of a postal card and a quarter of an inch thick, including the glass cover, which can be carried in the pocket. Mr. Boucher has made several working models of boilers of glass with alcohol lamps in the furnaces, in which the whole process of generating steam may be seen. These glass boilers will safely carry a pressure of twenty pounds to the square inch.

Real estate salesmen in England not infrequently use models of properties to effect sales. This is too expensive a method, though, except in the case of costly mansions. But one instance is known in which an American real estate man used a model. In this case the interior as well as the exterior was shown, the top being removable. Enterprising manufacturers who support city salesrooms sometimes have models of their plants made for exhibition in the show windows. This class of models, together with relief maps such as are shown at expositions, is regarded as "cheap work" and as such is rather looked down upon by the leading modelers.

Models of street corners, roadways, bridges, buildings and the like are often used in litigation in English courts, for they make clear to a jury as nothing else can the locale of an accident or a crime. But in American courts models have rarely been used.

ONE OF THE COUNTRY RESIDENCES OF GENERAL LUIS TERRAZAS.

WEALTHIEST MAN IN MEXICO

By

W. D. HORNADAY

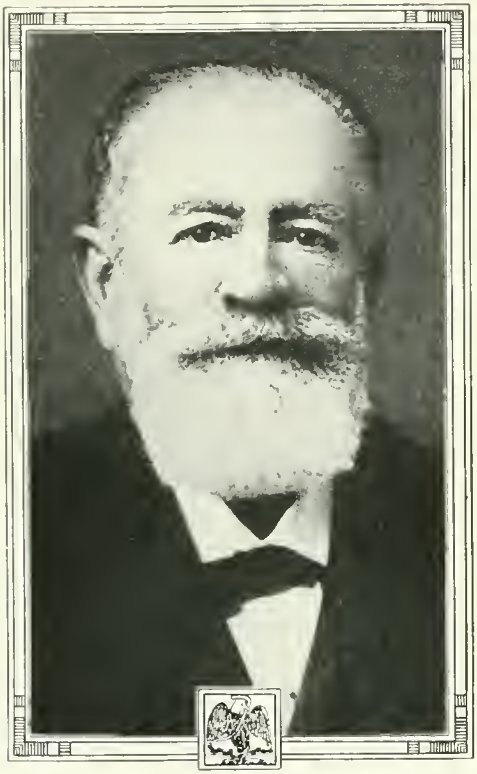
GENERAL LUIS TERRAZAS, who is said to be the wealthiest man in Mexico, rules over a princely domain. While his land and livestock interests form a considerable part of his fortune he also possesses much other property. His wealth has been estimated as high as $150,000,000 gold, but it is probably very much less than that sum. He owns many millions of acres of land in the state of Chihuahua, upon which almost countless numbers of cattle, horses, sheep and other livestock contentedly graze. His several ranches are cut up into large pastures some of which are of themselves from one hundred thousand to two hundred thousand acres in area. It has been stated that General Terrazas owns two-thirds of the buildings in the city of Chihuahua. He has enormous investments in banks, in railroads, in manufacturing establishments and various other profit-making industries.

While General Terrazas' business interests are varied and widely scattered they are all under his personal control, in spite of the fact that he is eighty years old. He takes the keenest pleasure in looking after his ranches and farms. For many years he has been the foremost man in Mexico in improving the breed of his cattle and other livestock. He has imported many thoroughbred animals from the United States and placed them upon his ranches. Of late years he has also given considerable attention to scientific farming. His ranches are situated in an arid part of the country and irrigation is necessary in order to raise crops with much degree of success.

This remarkable man is essentially self-made. He was born in the city of Chihuahua where he has made his home during his whole lifetime. In spite of his childhood poverty and disadvantages he managed to obtain a fair education. From the early days of his youth he has held to the belief that education was the great uplifting power of the people of Mexico. So strongly was he imbued with this idea that he devoted his spare time when a young man to teaching night school in his native city in order that the poor youths might be given a start towards bettering their condition.

In the days of General Terrazas' young manhood and up to the time that General Porfirio Diaz ascended to the presidency and established permanent peace, Mexico was the scene of wars and disorders. While General Terrazas entered upon a mercantile career he found it necessary to frequently respond to the military call of duty. On one occasion the city of Chihuahua was captured by a force of several hundred bandits. The governor fled to Juarez. Terrazas organized a volunteer force of men and recaptured the city of which he was at that time the jefe politico or mayor. In recognition of this service he was made governor of the state. He served several terms in that capacity and when he finally decided to retire to private life the reins of government were turned over to his son-in-law, Enrique C. Creel, who afterwards became Mexican ambassador to the United States and is now minister of foreign affairs of Mexico.

General Terrazas lives in unpretentious style. He has a large and comfortable residence upon one of his ranches where he spends part of his time. He has traveled extensively in the United States and Mexico. He has always been active in the development of the natural resources of his native state and welcomed the advent of American capital.



Mexico's Wealthiest Citizen.
General Luis Terrazas, who owns vast estates in our turbulent neighboring republic.

It was largely through his efforts that the educational system of the state was placed upon a high plane. Strict saloon regulations and anti-gambling measures are also in effect.

FACE PAINT FOR THE COMPLEXION

THE native women of the Portuguese province of Mozambique, in Africa, paint their faces with a peculiar paste, made by grinding a certain kind of wood on a wetted stone. It is most refreshing, according to the account of those who use this odd cosmetic, and greatly improves the complexion, removing wrinkles, and keeping the skin free from eruptive blemishes. When dry it turns a dazzling white, so as to give to a woman decorated with it the effect of wearing a ghastly mask.

Some of the wood from which the paste is made has been sent by our consul at Mozambique to the Bureau of Manufactures at Washington, which will furnish samples of it gratis to any chemist wishing to investigate its properties.

Such a material placed on the American market might be popular as a wrinkle-remover only.

A Mask of White Paint.

AN UNATTENDED LIGHTHOUSE

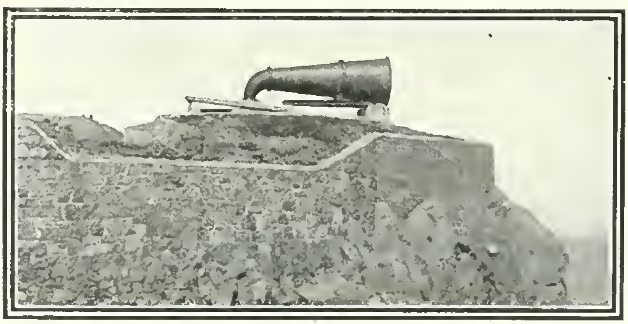
By

F. A. A. TALBOT

A NOVEL and interesting lighthouse, the main feature of which is that it requires no manual attention, has recently been completed in the English Channel. The situation is off the coast of Guernsey, Channel Islands, and some sort of warning has long been considered necessary by shipping circles. These islands are very rockbound, and scattered submerged reefs and masses of rocks extend for some distance from the mainland. Under these circumstances the entrance to St. Peter Port, which has only one navigable channel, and that somewhat narrow, is extremely difficult in rough and foggy weather, and numerous disasters have occurred in the vicinity of the entrance.

The problem, however, offered tremendous difficulties. The only possible situation for a lighthouse was an isolated detached rock known as the Platte Fougère, about a mile seawards, which marks the entrance to the channel, but the prevailing conditions were such that a lighthouse of the conventional type at this point rendered it impossible for lighthouse-keepers to live in the tower. Nor could an automatic beacon or whistling buoy meet the requirements, for the site is very exposed and subjected to the full fury of the Atlantic. To assist in their task of solving the problem, the authorities sought the assistance and experience of Messrs. D. and C. Stevenson, the well-known lighthouse engineers of Edinburgh, who have been associated with many of the most important lighthouses on the exposed parts of the Scottish coast. These consulting engineers as a result of their surveys proposed the novel structure which is illustrated herewith.

The lighthouse erected on the rock comprises a tower, carrying a light, and a powerful siren for use in foggy weather. The siren is driven by compressed air, and the electrical power is transmitted from a station on the mainland. So far as marine requirements are concerned the siren for foggy weather was most particularly desired by captains so as to enable them to pick up the entrance to the narrow channel which leads to St. Peter Port, and under these circumstances the light is in reality a secondary consideration, though it has, since it was inaugurated, proved highly serviceable to navigation.



THE DUPLICATE SIREN ON THE SHORE STATION, ONE MILE FROM THE UNATTENDED LIGHTHOUSE.

The rock selected is one of a large scattered group and is particularly dangerous for the reason that it lies very low in the water, and is completely submerged at high tide.

Under these circumstances the engineers evolved the novel solution illustrated herewith, which is probably the only lighthouse installation of its type that has yet been carried out. It was found that a tower of small diameter would have to be erected, and under these circumstances an irregular octagonal structure to conform with the foundation surface available had to be built. The lowest portion is of Portland cement placed inside of wrought-iron molds. The tower is fixed to the rock by heavy iron bars driven into the granite to secure a firm foundation, and steel beams are built in at frequent points to consolidate the structure and to secure greater rigidity where tension is most likely to be imposed upon the fabric. The upper part of the tower is wrought in concrete.

At the height of 46 feet above low water the tower is entered by a door. Up to this level the structure is solid, and the entrance is gained by a ladder up the side of which the cable is carried.

The Unattended Lighthouse at Low Water.

SPIDERS THAT FLY

By

DR. W. H. ALBRIGHT

FLYING spiders is the name given to a number of species of spiders that use their web as an aerovehicle to convey them to other feeding grounds. Their webs are seen during the warm autumn days floating in countless numbers through the air, and even then we see but a small per cent of the real number as those we see represent only the failures of attempts to get into the air, the webs having caught on some obstruction. It is estimated that on uncultivated grass land there are upwards of fifty million of these spiders to the square mile, and they represent nine-tenths of all the spiders found in the temperate zone.

There are many varieties of spiders, but their numbers are few compared with the numbers of flying spiders.

I have studied the habits of these spiders for upwards of twenty years and the accompanying photo silhouettes represent, as far as I have been able to determine, nearly all the spiders that migrate, and only three of these are especially good fliers; the other one, a "Lycosid" or "wolf" spider—the largest of the four—enjoys a trip occasionally but is not in it with the other three.

"Found from Maine to the Rockies."

The family of "Thomisid" or "crab" is an ugly specimen looking as much like a louse or tick as a spider. It can travel backward, sidewise, or diagonally with equal facility, which is decidedly snail-like; but he is a good aviator and I have seen full-size spiders of this variety take flight with apparent ease. It is understood that, as a rule, only the smallest of spiders, seldom larger than a pin, are fliers, and to see these fat, ugly gourmands enjoy such a sport makes us think that we as beings of super intelligence, are unquestionably slow.

Tibellus oblongus, and Pardosa, are found in nearly

THE WOLF SPIDER.

"AN ACTIVE AND EXCELLENT FLIER."

"AN UGLY SPECIMEN."

equal numbers from Maine to the Rockies. They are both very active and excellent fliers even to the youngest specimens. Full-grown ones, however, are seldom, if ever, found in flight.

When we know that, were it not for spiders, hardly a blade of grass or a tree leaf could survive the onslaught of the larval horde that would sweep over the earth, it should be the aim of agriculturists to handle their work in a manner to preserve these creatures. We believe that subsoiling and surface work could take the place of deep plowing with better results both in crops and in the destruction of pests. It is found that many crops like onions are grown more successfully without the annual plowing, and as we cannot domesticate spiders and raise them in hatcheries we should make some provision for allowing them to escape the plow. We know that a large part of the United States is now under the plow and that there are comparatively few spiders found on cultivated soil; the plow, no doubt, has a great deal to do with this by covering the young so deeply that they cannot liberate themselves.

Remembering that these photos are greatly magnified, if the reader will consider that the Pardosa is smaller than the head of a pin, that he is bright, active, and wary, that his airship might land him on the ocean 300 miles from land, as he has been found, the interest in him will be specially keen.

OLD METHOD OF TRANSPORTING COAL—BY CAMEL.
Picturesque, but slow and expensive.

REMARKABLE CHINESE CABLEWAY

By

DR. ALFRED GRADENWITZ

TO the west of Pekin there extends for some distance a mountain range rising to ever greater heights, and which in the Liao-ou-tai Chan reaches to approximately 10,000 feet.

In these mountains are found many ancient monuments and temples, as well as Imperial castles inhabited only in summer, and these heights afford a welcome refuge to European residents of Pekin, anxious to escape the heat and dust of the plains in order to enjoy some fresh air, at least in the evenings. The Pekin-Han-Kevu Railway, with a branch line to To-li at the foot of the mountains and on the banks of the Liou-li-Ho, leads in this direction. The Liou-li-Ho comes from the western part of these mountains traversing a valley full of the most variegated landscapes, cut deeply into the high mountain range. This valley is worth coming far to see.

The horseman proceeding uphill will meet on his way thousands of camels, mules and donkeys carrying heavy loads of coal sacks from the coal mines to the railway station of To-li. The narrow path is taken up by an endless file of beasts of burden among which the camels stalking majestically behind one another produce an especially odd impression. Each camel driver guides six to ten camels, the front one being connected for simplicity's sake by ropes with the noses of those following behind so that the driver may confine his attention to the first camel. This in conjunction with the mud and dust, and the swarms of flies attracted by the enormous heat, makes the transport of coal a torture to those poor beasts.

THE NEW METHOD OF TRANSPORTING COAL.
Cableway through the Chang-Fan-Chan Mountains, China.

THE TERMINAL OF THE CABLEWAY AT NANTZIOU.

This pitiable state of affairs will, however, soon disappear, as the Chinese coal miners and merchants have united with a view to increasing their production and sales at Pekin by the aid of improved means of transport, and the cableway recently constructed will do away with all previous drawbacks. As the narrow valley with its many sinuosities did not allow of the installation of any ordinary railway, a cableway freely suspended above valleys and heights obviously was the only solution of the problem.

About six hours' ride up the mountains commences the coal district, where many villages are spread over the more or less precipitous valleys. The coal mining is carried out on a system quite novel to western travelers. Whereas in Western countries large mining companies are formed which, in order to get at the veins, have to sink expensive shafts hundreds of feet deep, keeping an army of miners at work below ground, the anthracite in the rocky valley of the Liou-li-Ho comes to the surface, so that each peasant is able to carry on his mining separately with the assistance of his sons, by furrowing tiny mole-like galleries into the mountains. The coal is mined in a most primitive manner without any working funds or machinery, being taken to the surface on sledges with wooden runners. As a rule, four to eight men are found working alternately in the same gallery, the coal being accumulated in large heaps, whence formerly were loaded the camels and mules transporting it to the railway station. Here now begins the cableway which extends down to the valley city.

While the means of transport have now become thoroughly modernized it will be long before any up-to-date methods may be introduced into the exploitation of these coal mines as foreigners are not so far allowed any share in the mining business of the interior of China. The fact that European engineers have at last, for the first time, been admitted into these secluded districts is significant of the new spirit in China.

SUPERVISING THE CONSTRUCTION OF THE CABLEWAY.
The arrival at Nantziou.

LOCUSTS AND THEIR PUPA SHELLS.

Seventeen Year Locust Back Again

Emmett Campbell Hall

DURING the coming summer the Atlantic seaboard, from Connecticut to North Carolina, will suffer from the visitation of the seventeen-year locust. In countless millions the cicada will sing their shrill song and devour young fruit trees. The locust swarms, though appearing at happily long intervals, may be depended upon to arrive on schedule time. In Connecticut they have been regularly reported every seventeen years since 1724, and in New Jersey since 1775. The last appearance was in the year 1894, when scientists made careful studies of the insect.

The appearance of the cicada in great numbers naturally causes considerable alarm for the safety of shade trees and orchards. The actual damage done in the past, however, has been comparatively slight, except in the case of young orchards, and even then, by vigorous pruning after the insects have disappeared, much of the injury caused by the egg punctures can be obviated.

Ordinary repellent substances, such as kerosene emulsion or carbolic acid solutions, seem to have little effect in pre-

A MAGNIFIED PHOTO OF THE SEVENTEEN YEAR LOCUST.

venting the oviposition of these insects. Recent experiences seem to indicate that trees thoroughly sprayed with Bordeaux mixture or lime wash are apt to be avoided by the cicada, especially if there are other trees in the neighborhood on which they can oviposit. The best method of protecting nurseries and young orchards is to collect the insects in bags in early morning and late evening, when they are somewhat torpid. Such collections should begin with the appearance of the locust and continue until the swarms have disappeared.

CUBA'S FRENZIED GAMBLING GAME, JAI ALAI

JAI ALAI, the great gambling game of Cuba, is unique among all other gambling contests in, that it calls for as high a degree of bodily skill as mental. One who has seen the game describes it as "a superb display of human agility and high training." The successful Jai Alai contestant must accustom himself to sustain a strain of continuous violent exercise. "The Jai Alai player," says the same authority quoted above, "dies young."

In Havana, the contests are scheduled for every Tuesday and Thursday nights and Sunday afternoons. Thousands of spectators, the most of whom are there to gamble, often witness the game at one time. The prices of admittance range from $2.50, each person, down to $1.00, according to the fame of the contestants. High walls of stone enclose the Jai Alai court on three sides; the floor also being paved with stone. Metal markers against the wall designate the limits within which the ball must strike. The ball used is one of India rubber covered with leather, and weighs about one-quarter of a pound. The ball is thrown to the wall from a small curved basket attached to the wrist of the player, and is caught again in the rebound by means of the basket. A failure to catch the ball on the rebound, or the throwing of it outside the proscribed limits is counted a miss, and scores one for the opposing side. The scores, as fast as made, are registered in sight of the spectators. The score runs to thirty. When it is nearing completion, the spectators go into a frenzy of excitement. Some have gone insane on the spot from losses; others have committed suicide. It is now played under police restrictions, but still many scenes of horror occur. The more morally inclined Cubans have made frequent attempts to have the game suppressed by law. In a speech in the Cuban Senate some time ago, Senator Sanguilly scathingly pronounced Jai Alai "a social cancer, whose results are the ruin of many persons, the cause of commercial failures, and of the suicides of fathers of families and of youths of brilliant promise."

THE BROOKE MOTOR FITTED WITH A PROPELLER FOR DRIVING AN AEROPLANE.

TO STOP AEROPLANE AND AUTO ACCIDENTS

By

HENRY M. HYDE

WHAT makes an automobile skid? What is the cause of the terrible accidents to machines running at high speed, occurring chiefly on the curves of race tracks?

Why is it that most of the fatal accidents in aeronautics have occurred just as the aeroplanes were turned into the horizontal plane, after a long sweep down from the heights on a sharply inclined plane?

In all these cases the accidents are most frequent and most dangerous just at the moment when the direction is suddenly changed. What is the nature and the cause of the force which tends so strongly to resist this change of direction that, often, the whole fabric is upset or even torn to pieces in the conflict?

Studying this problem, Thomas Preston Brooke, the well-known musician and band-master, has been led to certain radical conclusions. In defense of these conclusions Mr. Brooke has prepared certain experimental apparatus which seems to demonstrate the truth of his contentions. He has also invented and built an eighty horse-power motor, for use in automobiles and aeroplanes, in which the danger of such accidents is—in the opinion of the inventor, at least—entirely eliminated.

In brief, then, Mr. Brooke claims that a majority of automobile and aeroplane accidents of the destructive type are due to the gyroscopic force exerted by the revolving fly-wheels and clutches of their motors. When, in obedience to the steering wheel, the direction of a fast-moving car or flying machine is suddenly altered, the gyroscopic force of the fly-wheels and clutches continues to be exerted in the old direction. Hence the whole machine skids or even turns a somersault.

For the purpose of demonstration, Mr. Brooke has mounted a couple of gyroscopic tops on a small-wheeled framework, which may represent the chassis of an automobile. The two tops are set to spinning on their axles in a plane at right angles to the direction of the little car. The slightest attempt to change the direction of the car invariably results in its rearing up on its hind wheels like a bucking broncho. So strong is the force exerted by this upward leap that it takes a pressure of twelve or fifteen pounds to put the front wheels back on the ground.

How, Mr. Brooke asked himself, would it be possible to neutralize this destructive force of the necessary fly-wheel and clutches?

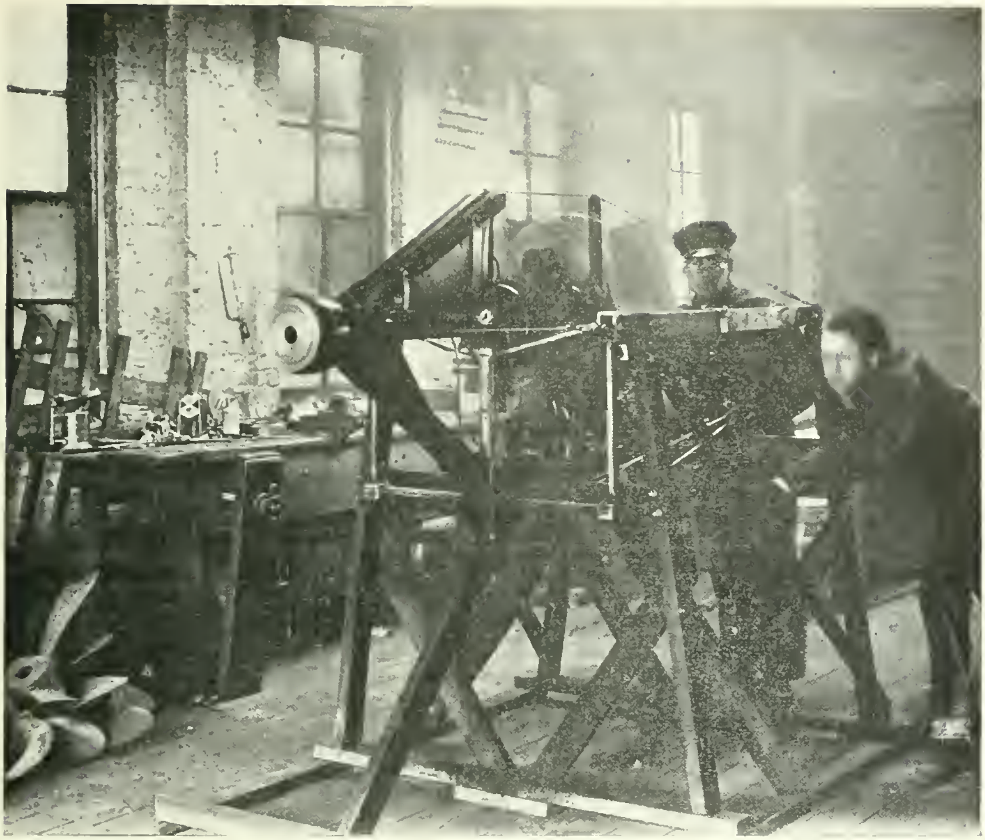
In the course of his experiments he one day set the two tops mounted on their small framework spinning in opposite directions—one from right to left, the other in the opposite direction. To his surprise the problem—from an experimental standpoint, at least—seemed to be thus simply solved. With the tops spinning in opposition it became at once possible to alter the direction of the machine as suddenly as one wished without developing the slightest inclination to skid or somersault. The gyroscopic force exerted by each of the spinning tops was exactly balanced by that of the other.

In his effort to prove the practical force of this discovery Mr. Brooke made many experiments and built a large number of models. He has finally constructed a large motor on this principle, which develops about eighty horse-power and which, in actual operation, seems to give the final proof of the correctness of his theory.

In the Brooke "non-gyro" motor there are ten cylinders. They are mounted in sets of five on two circular bases, which revolve in opposite directions when the motor is in operation. The essential point in this motor, wherein it differs from all other revolving cylinder motors, is the fact that the bases carrying the cylinders revolve in opposite directions, the gyroscopic force developed by each being thus exactly neutralized by that of the other. In this way, while the fly-wheel of the ordinary motor is entirely eliminated and all the advantages of the revolving cylinder type retained, there is absolutely no danger from what Brooke calls the destructive action of gyroscopic force.

The Brooke motor, which is now apparently perfected, develops about eighty horse-power when all the ten cylinders are in operation. But, at the will of the operator, either half—containing five cylinders—may be disconnected, the remaining section developing forty horse-power, which is quite sufficient for the ordinary aeroplane or motor car. It is to be noted that when the gasoline is cut off from one section it still continues to revolve, thus still serving to neutralize the gyroscopic force of the other. At the same time the disused section is being thoroughly cooled, thus eliminating the danger of overheating and furnishing a motor which should be almost ideal for long-distance flights or runs.

As an engine for airships, especially, Mr. Brooke makes many other important claims for his new motor. It is said to be the lightest motor ever constructed in



MAKING A TEST OF THE BROOKE MOTOR.

proportion to the horse-power developed and to be stronger, at the same time, than any of its rivals. It is also fitted with new devices for delivering gasoline under an absolutely constant pressure and through a straining mechanism which insures the perfect cleanliness of the fluid. The carburetor, electric and lubrication systems also contain many novel features, as was recognized by the Patent Office at Washington, when twenty-two broad claims were allowed to go to patent, without a single existing patent being cited against them.

Mr. Brooke's career has been picturesque and interesting. When a boy he ran away from home and joined a circus. Connected with the show was one of the old-fashioned aeronauts, who after ascending to a considerable height in a balloon, daily thrilled the natives by cutting loose from his support and dropping back to earth with the aid of a parachute. Being of a daring and reckless disposition Mr. Brooke occasionally took the place of the aeronaut and did the parachute leap on his own account. Thus early did he get an interest and some practical experience in the problems of aeronautics.

In later years he turned his attention to music and for fifteen years he was the conductor of a well known band and orchestra in Chicago. During this period, also, he composed the music of a couple of comic operas and more than a hundred quick-steps and waltzes. But all the time he retained his interest in mechanics as applied to rapid transportation. When the internal-combustion engine was invented, bringing in its train the aeroplane and automobile, more and more of his attention was given to the resulting problems. Finally, with a number of profitable contracts in sight, he deliberately gave up his career as a band conductor and has since then spent every energy in the perfecting of his "non-gyro" motor.

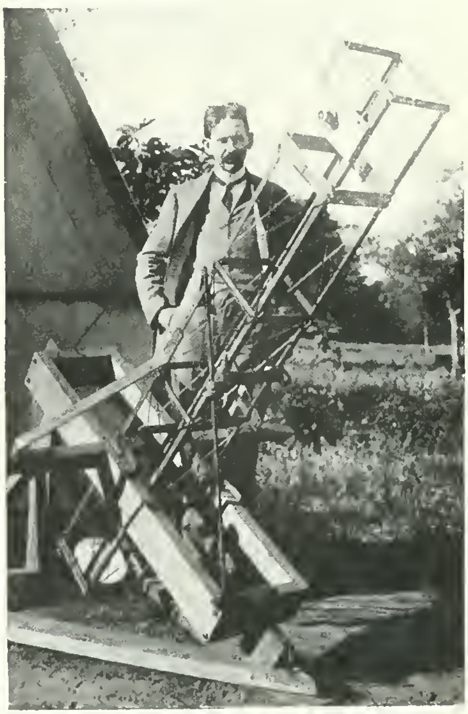
Mr. Brooke's theories and discoveries as to the dangers of gyroscopic force in aeroplanes and automobiles do not conflict at all with the views held by Brennan, inventor of the famous mono-rail gyroscopic railroad system. Mr. Brooke points out that there is a great difference between a vehicle running free in the air or on the road and in one which is anchored in one plane by the grip of its wheels on the rail.

That there has been a widespread popular delusion about the almost miraculous effect of the gyroscope as a safety appliance in vehicles of all descriptions there can be no doubt. Mr. Brooke's views as to the dangers of this popular superstition have recently received high endorsement by M. Bouchaud-Praecig, an eminent French engineer, who in recent lectures and magazine articles has taken exactly the same position.

Mr. Brooke has invented and is now completing the construction of a new aeroplane, which will be fitted with his "non-gyro" engine and in which he hopes and, in fact, expects, to fully demonstrate the correctness of his radical views in mechanics.

TELESCOPE BUILT BY PRINTER

AMATEUR astronomers thrive in Pasadena, Cal. Inspired in most cases by the new five-foot reflecting telescope of the Carnegie Solar Observatory on Mt. Wilson, which was constructed in the observatory office in Pasadena, a number of Pasadenans have made eight-inch replicas of the great sky searchers, and with them are doing much research work. An organization with a membership of about a dozen has been formed.



One of Pasadena's Enterprising Astronomers and His Instrument.

E. H. Morse, a linotype operator, whose telescope is pictured herewith, made a complete set of machinery, with the aid of which his eight-inch mirror was ground to a degree of perfection in a few months. His experience seemed to disprove the contention of a colleague, Wendell P. Hoge, a railroad man, that it is impossible to construct a machine which will not, in the course of grinding a mirror, repeat the same motions at intervals, thus working the inch-thick plate of glass into zones which would destroy the efficiency of the mirror. Mr. Hoge began his mirror a dozen years ago in the East and completed it entirely by hand, placing the glass on an upturned barrel and walking around and around it as he rubbed the glass with fine emery and jeweler's rouge, to secure the desired parabolic surface.

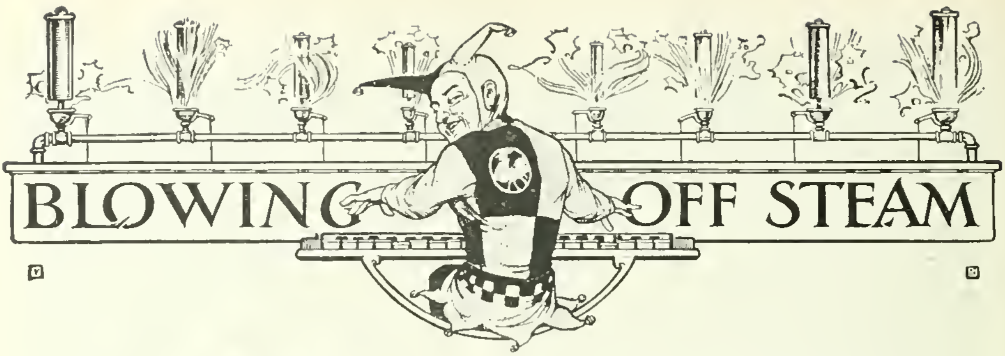
Other small telescopic mirrors are now in process of construction, while Prof. G. W. Ritchey, expert of the solar observatory, who directed work on the five-foot mirror from which results were secured, said by scientists to be the best yet recorded, has made a nine-inch reflecting telescope for the students of the Pasadena High School.

The "Nature Man" Cultivating the Cocoanut Palm.

The "Nature Man" Climbing a Papaw.

THE NATURE MAN IN TAHITI

SAN FRANCISCO and Los Angeles still remember vividly the physiognomy and prophetic pose of W. Ernest Darling, the little-clad advocate of the simplest life, uncooked food and most simplified spelling, whom unceasing troubles with the police courts forced to leave the continent in search of a more suiting climate and less sophisticated environments. But the same prejudice which Darling found in his own home, in the university he attended for a time, and in the communities where he preached his "sermons on the Mount," awaited him in Hawaii and gave him in the end the choice of a jail sentence in Honolulu or of leaving the islands of his own "free will." The Nature Man took the offer of a leave, and crossed the line in his search of Eden, finding it in Tahiti, the main island of the Society Group, near the capital of French Oceania, Papeete. The booklets of the steamship companies abound, to be sure, with pictures of almost nude natives; but Darling found, to his sorrow, that even if there are people still to be seen in Tahiti, clad only in "pareus," Papeete's decorum requires as rigorously the antiquated pants as the old-fashioned shirt. After a short stand, the Nature Man had to give in; and so, on his way from the plantation to the town, he is wont to gradually acquire such articles of attire as the law imposes on him. He has his pants-limit, his shirt-limit, his bicycle station; and the said articles are deposited, in the reverse order, on the same places whenever he is returning, the bicycle having served only as a beast of burden for his bananas and mummy apples. High above civilization, out of the sight of the curious, on his premises, the Nature Man comes to his own and disembarrasses himself of all, if he is alone, and keeps the native pareu around his loins, if he happens to have visitors.



Prompt Action

MARIE—"When you spoke to papa did you tell him you had $500 in the bank?"

TOM—"I did."

MARIE—"And what did he say?"

TOM—"He borrowed it."

Foolishness

CONDUCTOR TO PASSENGER—"We ran over a cat down the line."

PASSENGER—"Was the cat on the line?"

CONDUCTOR—"Why, of course not. We chased up an alley after her."—*Chicago Daily Socialist.*

Taking No Chances

"IF you were to live abroad, where would you settle?"

"In Sicily, on account of the nice people there."

"What makes you think there are only nice people in Sicily?"

"The other sort have all emigrated to America."—*Toledo Blade.*

A Mining Fraud

"I THINK you said, 'Rastus, that you had a brother in the mining business in the West?"

"Yeh, boss, that's right."

"What kind of mining—gold mining, silver mining, copper mining?"

"No, sah, none o' those; kalsomining."—*Everybody's Magazine.*

Righteous Indignation

"SO YOU want a divorce, do you?" said the lawyer, peering over his glasses at the worried little man in front of him.

"Yes, sir. I've stood just about all I can. My wife's turned suffragette and she is never at home."

"It is a pretty serious thing to break up a family, you know. Don't you think you had better try to make the best of it for a while? Perhaps it is only a passing fad."

"That's what I have been doing, but there are some things a man can't stand. I don't mind the cooking and I haven't kicked on washing the dishes, but I do draw the line at running pink ribbons in my nightshirt to try to fool the children."—*Success.*

Poor Papa

"AND what did papa say when you asked him for my hand?"

"I'd gladly tell you, but I'm afraid you'd never respect his opinion any more."—*Cleveland Plain Dealer.*

Like all of Us

HIGGS—"Are you not indulging in a good many luxuries for one in your position, old man?"

BIGGS—"Yes, but, Great Scott! the necessities are all so thundering high."

A Mean Reply

"TALK about man!" exclaimed the suffragist. "What has man ever done for woman?"

"He's furnished her with a model she's trying durned hard to imitate," came a voice from the rear of the hall.—*Boston Transcript.*

Two Souls With But a Single Income

"I'm thinking of getting married."

"Then you will be. Congratulations."

"But how much will it cost us to live?"

"That's simple. Add about $5 a week to what you get."—*Cleveland Leader.*

If Wishings Were Havings

Shop Assistant (to purchaser of widow's bonnet)—"Would you like to try it on before the glass, madam?"

Customer—"No, thank you, miss; it ain't for me. I wish it was."—*Stray Stories.*

Her Bashful Beau

An intensely bashful young man was driving one evening with a young lady whom he had been calling on for some time previous. The stillness of the evening and the beauty of the scene around him inspired his courage, and, sitting stiffly erect and with his face forward, he asked suddenly, "May I kiss you?"

"Surely," she coyly replied.

"Aw," he said, his face scarlet, and larruping his horses to a run—"aw, I was only foolin'."—*Lippincott's.*

Explicit

At the Brooklyn Bridge—"Madam, do you want to go to Brooklyn?"

"No. I have to."—*Life.*

The Top of the Medical Ladder

"Has the doctor a large practice?"

"So large that when people have nothing the matter with them he tells them so."—*Pittsburg Post.*

Utterly Useless

"Pa, what is a futile remark?"

"The one a man makes for the purpose of changing the subject when his wife complains because he has forgotten their wedding anniversary."—*Chicago Record-Herald.*

Unanimous

Modest Suitor—"I am going to marry your sister, Jimmy, but I know I am not good enough for her."

Candid Little Brother—"That's what Sis says, but ma's been telling her she can't do any better."—*Baltimore American.*

His Training

"My husband is just awful when he wants to find anything. You never saw a man throw clothes around the way he does."

"Where did he learn to be so untidy?"

"Why, he was in the New York custom house for four years."—*Cleveland Plain Dealer.*

A Connoisseur in Guile

Mr. Blinks (in art museum)—"I didn't know you were such an admirer of curios, Mrs. Blunderby."

Mrs. Blunderby—"Oh, yes, indeed. I just delight in iniquities."—*Boston Transcript.*

Would Be Reported As It Was

"Officer," demanded the horrified lady, on beholding a curious mob following up a pretty girl, "if you don't arrest that woman in that disgraceful harem skirt I'll report you at headquarters!"

"Begorry, Oi'll be reported as it is," replied the gaping officer, abruptly turning back. "Be following wid th' crowd, Oi've strayed five blocks away from me beat."—*The Widow.*

POPULAR · SCIENCE & MECHANICS SUPPLEMENT ·

MACHINE MEASURES INTELLIGENCE

MOST of the methods of measuring intelligence at present in vogue are personal estimates by teachers or others who are acquainted by long experience with the mental character of the person to be tested. These methods have been found to be only very rough approximations, as there is by no means good agreement between the results obtained by different observers.

Mr. John Gray of the Anthropometric Bureau, London, has recently invented a remarkable apparatus which is capable of measuring the value of the human brain in an interesting manner by means of a rapid succession of flashes of colored light before the eye.

MEASURING INTELLIGENCE BY A SUCCESSION OF FLASHES OF COLORED LIGHT.

This persistence of a color sensation after the stimulus has stopped is identical, or very closely related to, a quality of mind which the psychologists call perseveration. The amount of this perseveration is probably inherited from our ancestors. The growth of the mental character of an individual as he passes from childhood to maturity is greatly influenced by the amount of his perseveration. Persons therefore with high perseveration would form new associations with great difficulty, and persons with low perseveration would form them with great ease and rapidity.

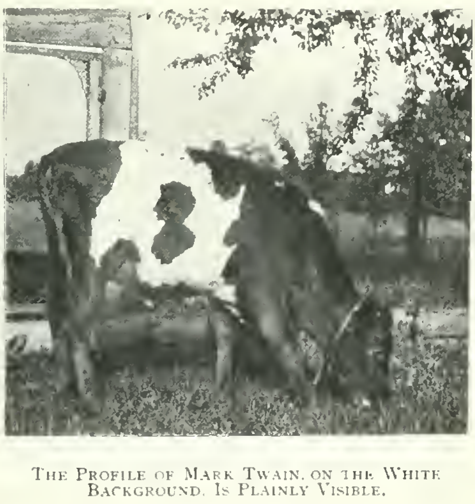
At the center of the scale we have the average amount of perseveration, which is associated with the practical common sense of the average man. When the perseveration is below the average the speed with which ideas flow through the mind is quickened, and the readiness with which the mind receives external impressions is also increased. The first category below the average, therefore, contains persons with witty, brilliant, and suggestive minds, persons of great tact, presence of mind, and daring; all of which imply quick response to external influences. To this class would belong

REMARKABLE GYMNAST WHO IS ASTONISHING GERMANY.
Berhardt Mohr jumping over a row of twenty soldiers.

the majority of persons who are popularly considered to be geniuses.

MARK TWAIN CALF

ON April 21, 1910, at practically the identical moment when Mark Twain died at Redding, Conn., there was born, on the farm of W. F. Walker near Alburtis, Penn., an Alderney-Holstein calf on whose side there appears the profile bust of the great humorist. The color of the calf is snow white and medium dark brown. As the months have passed the Twain bust has become more and more distinct, until today it stands out so plainly that the most casual, fleeting glance reveals it beyond all doubt of identification. Because of the striking resemblance the calf—now a cow—was named Mark Twain. The marking is quite unusual, also, because of the fact that the white on the calf forms an almost perfect map of the United States.



THE PROFILE OF MARK TWAIN, ON THE WHITE BACKGROUND, IS PLAINLY VISIBLE.

A MONUMENT TO THE TROPIC OF CANCER.
This is the "visible" line of demarkation between the Temperate and Torrid zones, on the plains of Mexico.

THE TROPIC OF CANCER

IN our study of Geography most of us have learned that the Tropic of Cancer is an imaginary line that makes a business of running round and round the earth 23½ degrees north of the equator. It may, therefore, be considerable of a surprise for travelers speeding down through Mexico to come unexpectedly upon an imposing monument labeled "Tropic of Cancer" rising in the midst of a dreary treeless plain. The engine as shown in this picture is in the North Temperate zone while the rear coach is still partly in the tropics—an unusual experience for the traveler.

WHAT A HAT FOR THE MATINEE!
A snapshot of Bridget, daughter of Lady Dorothy D'Oyly Carte of England.

BURRO'S QUEER LOAD

THE overloaded and cruelly abused little burro is still one of the common sights of the streets of Mexican towns. He is not only the one freighter of the poorer class, but many of the building firms are yet making use of the donkey in preference to regular teams for the transporting of their building supplies. Sure-footed, patient, of a dogged perseverance, he can bear his burden to points wholly inaccessible to a wheeled conveyance.

TRICYCLE USED IN THE TROPICS.
It has a tent-like cover to protect the rider against the sun's rays.

THE MEXICAN BURRO IS MADE TO CARRY EVERYTHING.
It is not often, however, that he is seen burdened thus.

SOMETHING NEW FOR THE BABY—TWO CHAIRS IN ONE.

TWO CHAIRS IN ONE

A CHICAGO inventor has perfected a novelty in the form of a double chair which will serve grown-ups and children equally well, and can be changed into a child's high chair, or *vice versa,* in a moment.

The seat, which is hinged, is so constructed that when lifted it rises from its base on a pair of "lazytongs" and folds against the back of the chair, at the same time bringing with it a secondary seat, which is fastened on a transverse bar supported by the lazytongs. Above the secondary seat is a tray similar to that found on the ordinary baby high chair.

The chief advantage of this article, outside of the fact that it can be used either by adults or children, is that as a high chair the tongs form a barrier over which a child cannot pass and at the same time they have enough spring in them to absorb small shocks such as would overturn the ordinary high chair.

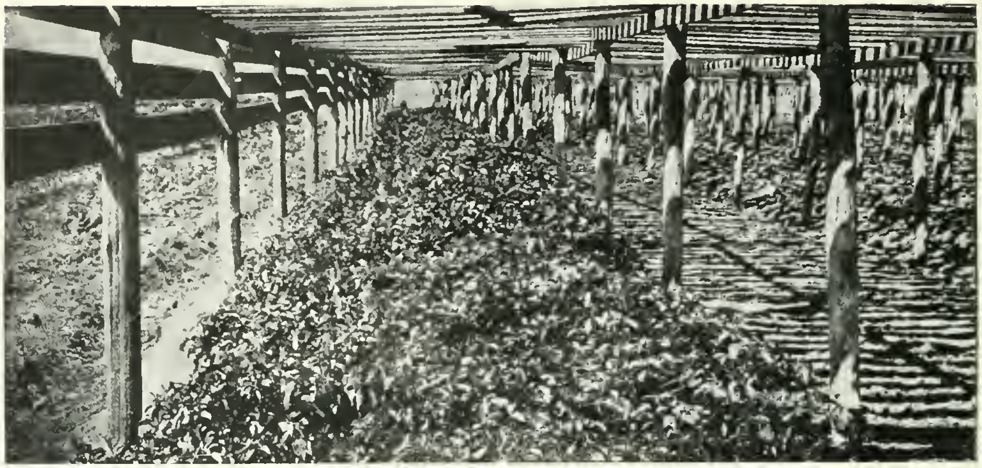
A CHINESE PRINTING OFFICE.
Chinese script is complicated and consists of 1,000,000 different characters.

BERLIN BOYS' MARINE SCHOOL

MOST marine schools take their exercise in oar and sailing boats on water, but the boys of the Berlin public schools have erected a large man-of-war, with rigged masts, with battery, etc., on the land and they have messes for the officers and the crew, with compasses, with cutters and, in short, with all the

REEFING IN THE SAILS.
Part of the drill of Marine School for boys.

GERMAN BOY SAILORS MARCHING BEFORE A "HIGHER OFFICER."
The Teutons, with characteristic thoroughness, have taken to drilling the boys in the art of naval warfare. May they not have in mind their neighbors across the North Sea?

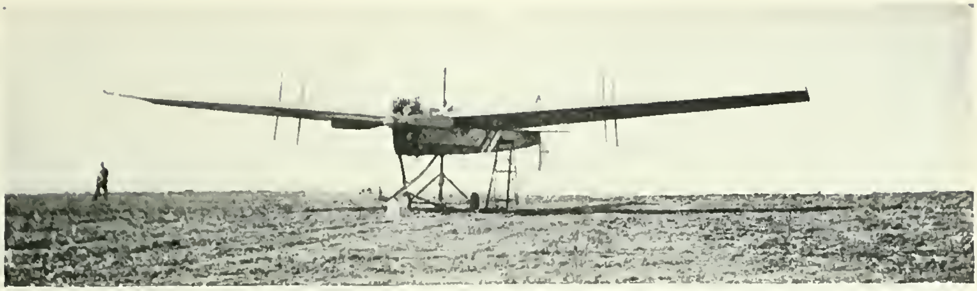


GROWING CAMPHOR PLANTS IN TEXAS.
The annual profits of the industry are said to range from $300 to $450 an acre.

arrangements of a true man-of-war. At present there are in Berlin three such immovable men-of-war and our pictures show the exercise of the garrison of the Berlin *Iltis*, which consists of 120 boys and their officers. On several days of the week, exercises are held, which consist of maneuvers with sails and cannons, drills, etc. The captain and warrant officers have attractive uniforms which are like those of the real German marine-officers and the crew have sailor garments and caps bearing the name of the ship. Although the *Iltis* is lying at some distance from Berlin, between the villas of the *Grunewald* there are many spectators at the regular exercises. His Excellency, Herr Knorr, and many other important German marine officers attend these exercises from time to time.

LARGEST LEATHER-BACK TURTLE IN THE WORLD.

It weighs 1,000 pounds and is six feet and one-half long, from tip of beak to tip of tail. It was captured off the coast of Block Island by a fishing schooner. As no net could hold the immense form, he was harpooned. A striking idea of the monster's size may be imagined from the photograph showing two little girls snugly seated on one side of the animal's back. The huge creature has just been mounted at the Museum of Natural History, New York.



MONOPLANE USED TO OUTFLY AND HUNT DOWN DUCKS IN MIDAIR.

HUNTING BY AERO

HUBERT LATHAM STARTING ON HIS AERIAL HUNT.

A NEW pace has been set by the startling feat of Hubert Latham in shooting wild ducks in flight from his monoplane. In response to the invitation of the Bolsa Chica Club members, Latham took his gun with him in his *Antoinette* monoplane. In a few minutes he was flying over the game preserves when he sighted a flock of ducks about a mile over the ocean. Instantly he turned his air craft seaward and started in pursuit. The ducks flew their best, the flock dividing into two parts. Latham, however, was able to outfly them, to fly all around them in fact, and succeeded in bringing down one of the birds. The remarkable part of this feat is that the airship had to be guided without hands for the moment necessary to aim and fire. It is claimed that the *Antoinette* is the only airship which can be left without control of the aviator's hands for that purpose.

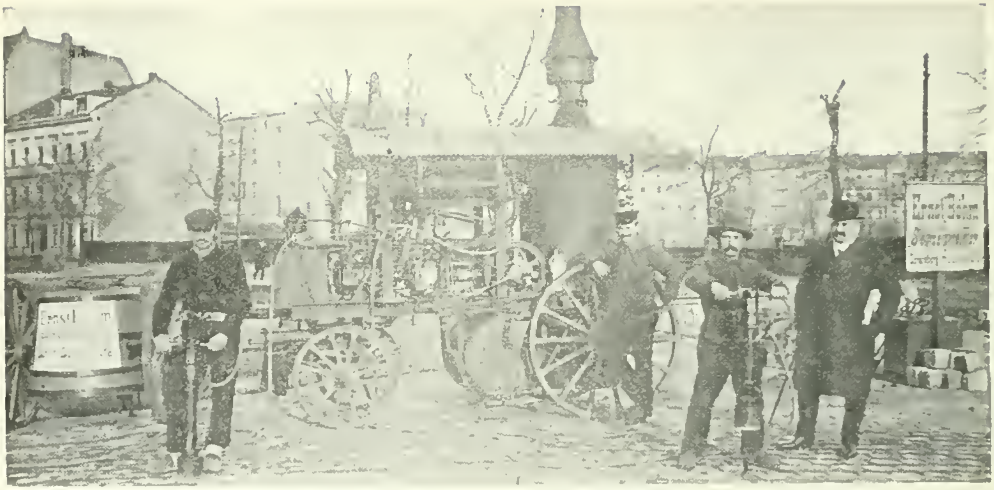
AUTO CLIPS HORSE

THE application of the power of a motor car to horse-clipping is one of the unusual uses to which this pleasure vehicle has been put at Portland, Oregon.

The quadruped was clipped in a very short time and in a most satisfactory manner. The motive power of this same automobile has been utilized to advantage for sawing wood and other similar service.

The horse apparently shows no resentment at the familiarity of his successor in thus trimming his hair.

CLIPPED BY HIS RIVAL—THE CROWNING INDIGNITY FOR THE HORSE.



MECHANICAL STREET-PAVING PILE-DRIVER—THE NEWEST INVENTION FOR THE ROAD.
This device does five times the work of a hand pile-driver.

EQUAL TO SIX TEAMS OF HORSES.
Automobile which proved its efficiency by excavating for a 5,000 gallon gasoline tank. There seems to be no end to the uses to which this pleasure machine may be put.

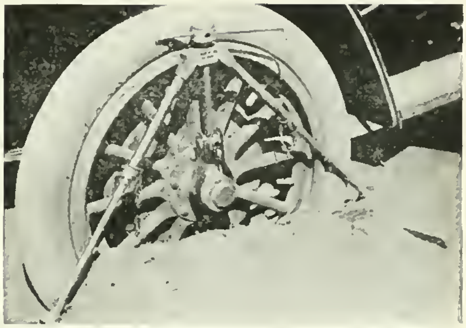
English Grotto Lined with Sea Shells.
Supposed to have been the tomb of one of the Northern sea kings. The work was evidently laid out and executed with the most painstaking care. The work is artistic enough to serve as a chamber for a living, instead of a grave for a dead, monarch.

GROTTO ADORNED WITH SEA SHELLS

JUST beyond the popular English watering resort of Margate there is a cave, the walls of the inner chambers of which are adorned with thousands upon thousands of sea shells. This grotto or cave was discovered a few years ago by accident and it is clear that access was gained to it from the sea shore. The shells are arranged in beautiful patterns. No one knows who carried them there or the artists who worked them into such artistic designs. Some have declared it is the work of the ancient Druids, while others are of the opinion that the cave is the resting place of some old hero of the Northern Sea Kings.

AUTO JACK FOR ROAD SERVICE

An auto jack has been devised which appeals to the overland driver who has been sunk in the mud or sand and has worked under an automobile with an ordinary jack to raise and plank under a wheel. The legs of the jack are adjustable as to length and the device may be used under the axle to change a tire on a pavement or good road if desired by dropping the lower leg and removing the hub band, the operation being the same as with an ordinary jack.



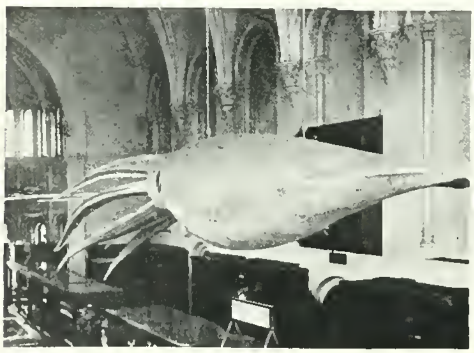
New Way to Get Autos Out of the Mud.
A friend indeed to the touring autoist.

HOW THE GERMANS MAP PARKS.
The array of little buildings, appearing, on first sight, like some child's wooden play-village, is that of Max A. Brunner, the civil engineer of Berlin, whose project for the future King's Square at Berlin, so shown, has just been accepted.

COTTON MILLS AT ORIZABA, MEXICO—AMONG THE LARGEST IN THE WORLD.
About 140,000 bales of cotton are used annually for manufacturing purposes throughout Mexico.

CHRISTMAS AND CHARITY STAMPS TAKEN FROM A COLLECTION MADE UP EXCLUSIVELY OF THIS SORT.

The legs of this jack may be extended to any length desired within their limits, and the car easily raised.



GIANT SQUID IN THE SMITHSONIAN INSTITUTION, WASHINGTON.
This monster sometimes attains a length of 100 feet. When swimming it proceeds backwards.

CURIOUS STAMP COLLECTION

THE most curious collection of stamps in the world is in the possession of a Philadelphian, Percy McGraw Mann, of 1708 8th Street. It is made up entirely of Christmas and charity stamps. They make one of the prettiest as well as the most interesting collections of the kind in existence, as a glance at the accompanying photograph will show. In the collection are stamps bearing inscriptions in many foreign languages, all with a history that associates them with a philanthropic effort to raise money. The most expensive stamp is the one sold at Stratford-on-Avon to provide funds for the care of the birthplace of Shakespeare. This stamp sells for one shilling or about 25 cents. Every stamp in this collection has a story.

VESSEL ALL STERN AND BOW

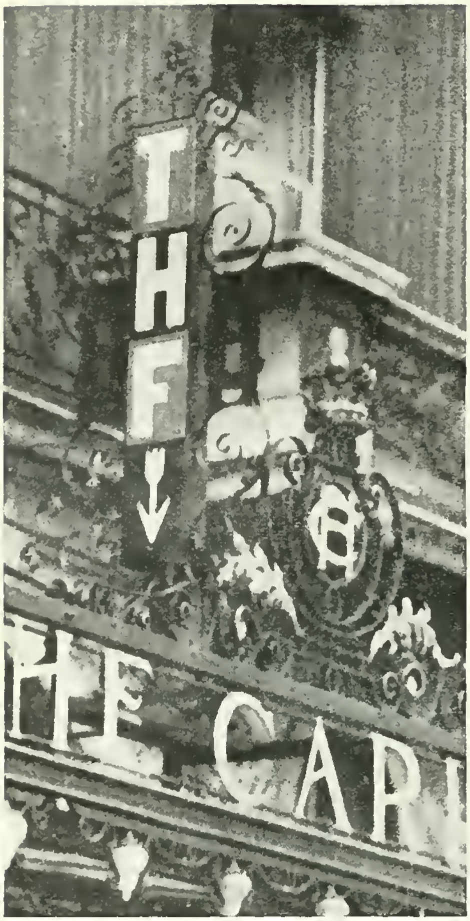
FOREIGN ship manufacturers are getting the hurry-up idea in building for their trade. One of the most curious of recent constructions is the ferry-boat, *Skyros,* now in dock at Breslau, Germany. This craft has neither bow nor stern, or it may be said to be all bow and stern. As a matter of fact it has a propeller at each end, so that all necessity of turning the ship about is obviated. The craft will be used at some Turkish port.

Boat That Has Propeller at Each End.

FOR CIGARETTE SMOKERS

AN enterprising tobacco merchant in the West End of London has hit upon a decided novelty for the cigarette smoker. This is a cigarette which can be lit upon the box much in the same manner as an ordinary match. The box is provided with a strip of the necessary material for producing the light when it comes in contact with the prepared end of the cigarette. The preparation in no way impairs the delicacy of the tobacco. The idea is one that has commended itself to motorists, aviators and the like and the *jeunesse doree* of London to a man have adopted the new idea in odd and "correct" smoking material.

CIGARETTE THAT STRIKES UPON THE BOX LIKE A MATCH.
A curious London novelty.



Silent Caller for a "Taxi."

How They Clean the Sewers of Paris.

Letting down a hollow ball, six feet in diameter which is sent through the sewers to keep the garbage in motion and remove any obstacles that may have lodged.

Putting Together the Hollow Wooden Ball for Cleaning Paris' Sewers.

Remains of Iceberg, off the Norwegian Coast, That Took the Form of a Pair of Beautiful White Lilies.

CAB CALL THAT'S NOISELESS

ALTHOUGH London boasts of being the quietest city in the world, such is of course far from being the truth. There are many anti-street noise societies who try to make it so and one of the latest ideas is the sign which has just been erected by the Carlton Hotel. Instead of hailing visitors' cabs with a shrill blast on a whistle as is usually the case an electrical device now shows "H" if a hansom is required, "T" a taxicab and "F" for a "four-wheeler." The expectant cabby has his eye on the sign and directly his initial is displayed he races to the hotel for his fare.

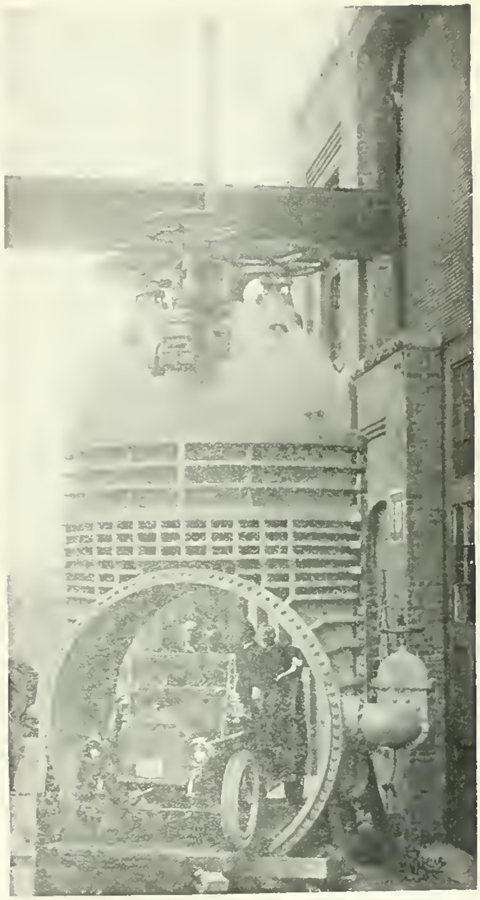
It is a neat idea that does away not only with noise, but with much confusion as well.

French Collapsible Boat in Use

Taking apart the Folding Boat.

BOAT THAT FITS INTO VALISE

HERE is a boat, the invention of a Frenchman, that every traveler on the water, especially if he can not swim, should carry with him. It is one of the most ingenious contrivances in the nautical line that has ever been devised. The idea is based on the pneumatic principle. The chief parts are a pair of cigar-shaped air containers, and a very light, but stout wooden frame. The air containers, when collapsed, of course take up very little room, and are easily stored away with the rest of the necessary apparatus in a valise or suit case. Two air containers are used in order that the boat may be in equilibrium. The air compartments are pumped up through a valve in the middle of each. An ordinary automobile pneumatic pump is used for the purpose. The whole affair may be put together or taken apart in a very



How's This for a Valve?
Said to be the hugest of electric valves—manufactured at Springfield, Massachusetts.

New York Apartment Building for 175 Families.
Each flat contains from nine to twelve rooms. It is considered the largest structure of its kind in the world. It is also unusual in the fact that it has play grounds for children. The total cost was $3,000,000.

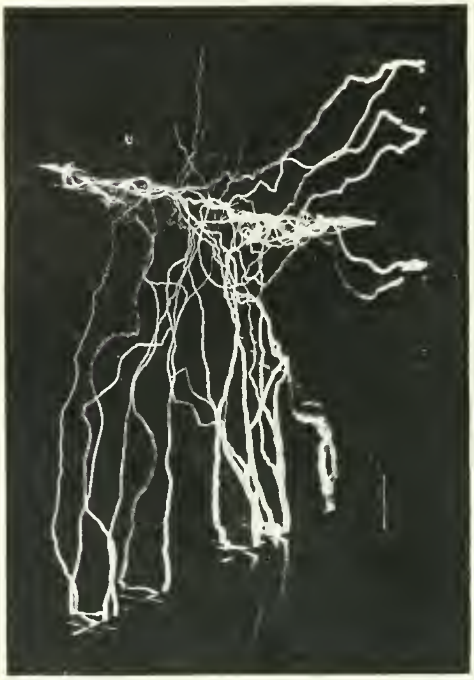


PHOTO OF HUGE ELECTRIC SPARK.
This was formed by the discharge of 325,000 volts.

few minutes. The entire equipment, including paddles and seat, all find some place in the valise. Such a device as this would be invaluable in saving lives on a steamer that was sinking in a calm sea, or on a river craft imperiled through fire.

GIGANTIC ELECTRIC VOLT

THE curious photograph printed herewith has puzzled many expert electricians. Few have correctly guessed what it represents. It is not a snapshot of freak lightning nor is it part of a Chinese tree. It is the image of one of the greatest electric sparks ever generated, formed by discharge of 325,000 volts at Schenectady, New York.

This remarkable discharge was obtained by connecting in series two high-potential alternating-current transformers giving 60 alternations per second, the photograph having been taken with an exposure of one-ninetieth of a second. The electrodes were placed 19 inches apart, with two half-inch sheets of plate glass, 36 inches square and two inches apart, set up between the electrodes on a polished plate of ebonite. It is interesting that most of the discharge passed down the surfaces of one of the glass sheets, around the bottom edges, and up the outside faces of the opposite sheet, although a part of the discharge doubled around the right-hand side of the plates. The lines of contact with the surface of the ebonite plate at the bottom can be seen in faint reflections. This spark was of almost blinding brilliancy, and crackled like a discharge of musketry.

FASHION'S LATEST FREAK

WEARING a watch on the ankle is the latest fad among fashionable women in London and the smart set in the English provinces, a style far more striking than most of the importations from Paris. The watch on the wrist, as a bracelet, has been in use for some time but some society leader with an exceptionally slim ankle evidently thought that a time piece encircling it would attract still more attention and the photograph shows the result.

WATCH FOR THE ANKLE.
A new way to keep tab on time.

THE FARE-HEIGHT MARK

HERETOFORE the wisdom of Solomon was required of all street car conductors many times a day when the question of a child's age arose. If the child in question was under five it was supposed to ride free, otherwise the conductor was required to collect regular fare. But who was to decide the question of age? If the fond mamma stated that a big husky youngster who looked to be seven was really only four years and eleven months old, what proof could the harassed conductor produce? This delicate problem has just been solved by the Cincinnati Car Company in a manner that would make the author of the Book of Proverbs look to his laurels as a shrewd judge. By careful computation it was ascertained that the average height of five-year-olds is 41 inches and accordingly a mark was painted at that height from the floor in their cars. Hereafter there can be no insinuations regarding the veracity of parents who desire to save that nickel. If dispute arises, the youngster is marched up to the fare-height mark and the answer is obvious.

How High Is the Child?
A new way to prevent feminine equivocation, and, incidentally, trouble for the car conductor.

Electric Light for Every Occasion.
A simple method of regulating the length of the cord.

THE TAPE MEASURE LIGHT

THIS new extension electric light is very much on the principle of a carpenter's tape line.

A cord fifteen feet long is contained in the case, having a mechanism for rewinding on one side and an incandescent lamp socket upon the other. When light is desired at some distance from the regular fixtures, a plug on the end of the cord is screwed into the regular socket and the cord drawn out to the required distance. A catch holds the cord from unwinding at any desired point, so that the lamp may be suspended a few inches below the fixture if one desires. It is also provided with a leather strap by which it may be hung up.

Many uses for such an extension light are easily found. If carried as a part of the traveling equipment it is not necessary to carry a lamp, as the socket and plug are of standard size and will fit any fixtures in common use.

Egg of the Extinct Moa, Giant Among Birds.

Boat That Rolls Over the Water—a Curious Craft at Sioux City, Iowa.

The Engine That Stops and Starts in Mid-Air—the Invention of a Resident of Los Angeles, California.

BIGGEST BIRD THAT EVER LIVED

THE moa, a species peculiar to New Zealand, is supposed to have been the biggest bird that ever lived on the earth. Probably it was no taller than the giant ostrich of Madagascar (the original of the fabled "roc"), but it was much heavier, a full-grown specimen weighing as much as 1,000 pounds.

The moa was extremely stupid, and very slow and clumsy in its movements, its legs being enormously heavy and bulky. Not only was it incapable of flight, but it could not even run fast.

Apparently, the species was wholly wiped out, about 500 years ago, by an extraordinarily cold winter. The birds gathered about hot springs in flocks, for warmth, but perished in great numbers—the result being, that at the present time, their bones are dug up by the ton in some places, particularly swamps.

A few of the eggs of this remarkable bird—not more than half-a-dozen—exist today. One of them, in the Museum of Natural History in New York, actually contains the bones of an unhatched moa. It is as big as six ostrich eggs, and a silk hat would just about make a suitable egg-cup to hold its contents.

STARTS MOTOR IN MID-AIR

A RESIDENT of Los Angeles, Cal., is the inventor of a new style of engine for aeroplanes. The engine is a true rotary. In the case of the Gnome—French—engine, generally known as a rotary, the cylinders simply revolve around the shaft. In this new invention the engine including the shaft, revolves. Also the cylinders, instead of being placed at right angles are parallel to the shaft; therefore, the centrifugal motion tends to distribute the lubricant, rather than to concentrate it in the end of the cylinder where the explosion will crystallize and foul the plugs.

Another innovation is a variable length of stroke, giving variable compression. This feature makes it possible for the operator to stop and start his motor in mid air.

MORNING GLORIES COVER A HOUSE

A DWELLING so completely covered by a morning glory vine as to be entirely hidden, stands as a demonstration of what California vegetation will do if it is given a chance.

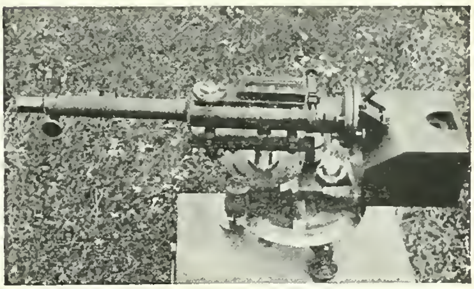
The morning glories were planted by previous occupants of the property, presumably to give a touch of color to the bare walls, but as the growth was not checked they rapidly spread until the walls and even the roof were enveloped in a mass of foliage and flowers. Before the tenants moved out, enough pruning was done to keep the place looking like a house but after they abandoned it, the morning glories had things their own way until even the outlines as well as the doors and windows have disappeared.

House Converted Into Morning Glory Bower at Long Beach, California.

The Spine of a Whale.
The remnants of an unfortunate cast up on the coast of Norway.

NEW INSTRUMENT FOR LOCATING STARS

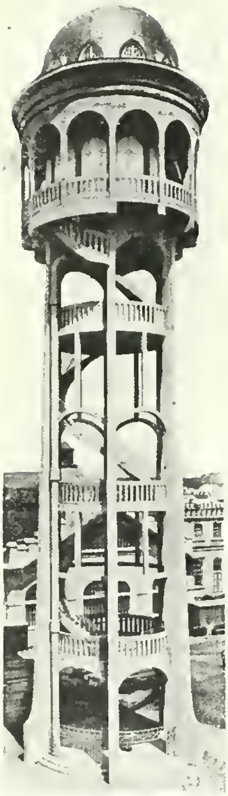
A FEW years ago Claude and Driencourt invented a prismatic altitude and azimuth instrument, to which some improvements have now been added by its constructor, Jobin. This instrument is employed in connection with a chronometer, for observing the instant at which the apparent altitude of a star attains a fixed value, approximately equal to 60 degrees. From such observations it is possible to determine the momentary position of the zenith and the celestial sphere, by reference to the positions of stars whose co-ordinates are known, or conversely, to determine the position of an unknown star from the known position of the zenith. In the former case, the observation gives the sidereal time and the latitude of the place; in the latter, they furnish data from which the right ascension and declination of the star can be computed. The instrument is designed especially for observation of equal altitudes of the same star, east and west of the meridian, from which it is possible to deduce (according to the known data) the time of meridian passage, the error of the clock, the geographical position of the local meridian, etc., and for observations of the equal altitudes of three accurately known stars,



Improved Apparatus for Marking Positions of the Stars.

The New Astronomical Instrument in Use.

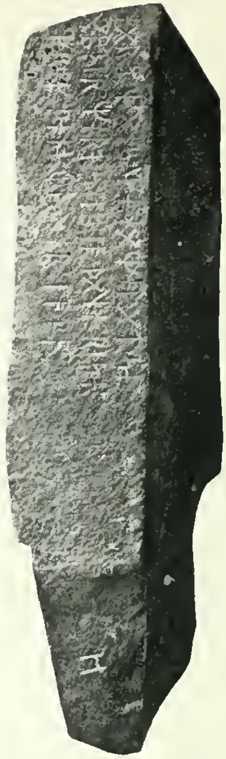
from which the latitude of the place, the time, or the error of the clock, and the precise value of the constant altitude employed can be calculated by methods which cannot be explained here. The construction and operation of the prismatic instrument are greatly facilitated by making this constant altitude equal to sixty degrees.



WATER TOWER OF CONCRETE, SINGEN-HOHENTWEEL, GERMANY.

REINFORCED CONCRETE WATER TOWER

THE illustration at the left shows an unusual form of water tower of reinforced concrete construction as installed at a food products works at Singen-Hohentweel, Germany. This tower is mounted on reinforced concrete rectangular uprights with four landings and a spiral stairway. The total height is about 148 feet. The reservoir has a capacity of about 9,000 cubic feet. It is surmounted by a dome and surrounded by a gallery. While the whole tower is plain it is artistic in design and construction.



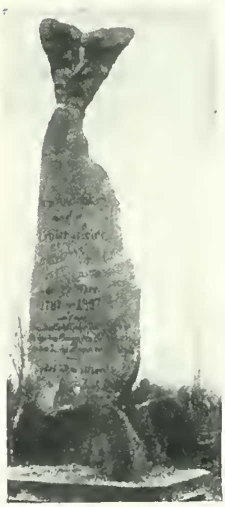
WERE THE NORSEMEN IN MINNESOTA?

Stone with ancient Scandinavian writing discovered by a farmer near Kensington, Minnesota.

FIREMEN'S CLIMBING CONTEST

THE one thing, next to implicit obedience, that a French municipal fireman must learn is to climb—and not only to climb by ladder, but by rope, timber, pipe, or any other thing that will aid him in swarming upward. Indeed, a part of the equipment of most stations is a tower devised for this very purpose, where frequent drills are held. Quite a bit of rivalry is stirred up.

The illustration shows one of these drills in operation. It is an unusual occasion, for no less a personage than the Mayor of Vienna, on a visit to the French capital, is being entertained and instructed, by witnessing a climbing race. Each man must look out for himself. No aid is given to their less fortunate comrades by those who, more active or stronger, are the first to achieve the topmost porch. Such a drill has a double advantage: it keeps the firemen in excellent practice for their work, and it also maintains them in good physical condition, which is just as important.



GIANT FISH THAT BECAME STONE.

Curious monument at Fischbach, Germany.

HOW FRENCH FIREMEN DRILL.

Tower Takes Place of Solar Eclipse.
A new way to photograph sun spots.

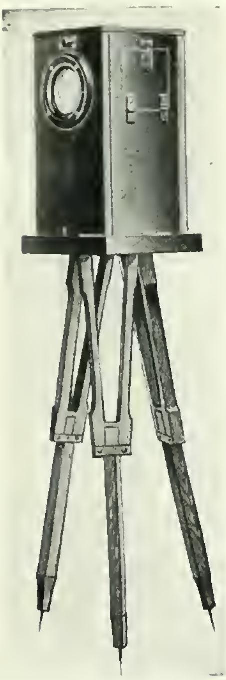
THE SOLAR TOWER

IN connection with the observatory on Mount Wilson, California, a one hundred and fifty foot tower has been erected which is of great interest to astronomers. It is to be used with the spectro-heliograph, to photograph sun spots without waiting for an eclipse. When it is installed at the base of the 150-foot tower on Mount Wilson the sun will be photographed by means of reflections from the top of the tower.

"The elements of light reflected into the spectrograph are diffused through prisms. A spectrum of the sun's spots is taken and the plates are compared to ascertain by scientific means the relative amount of gases or other substances contained in the elements photographed. Each streak or spot on the plate, according to its prominence, furnishes data for scientific deductions according to known formulas."

No Need to Go Home in the Dark.
Germany's small cities are not illuminated, but electric light may be secured from point to point by dropping 5-pfennig pieces in slots provided for the purpose.

AUTOMATIC WATER FINDER



Water Finder on a Scientific Basis.
This supplants the hazel twig.

THE hazel twig as a water finder has been supplanted by a remarkable invention consisting of a simple apparatus. The principle on which the instrument works is the measuring of the strength of the air currents which flow between the earth and the atmosphere. These are always strongest in the vicinity of subterranean water courses, the flowing waters of which are charged with electricity to a certain degree. The apparatus takes the form of a box-shaped instrument fixed on a tripod, with a dial on which a needle is used to indicate the presence of water. If the needle remains stationary it may be taken for granted that no subterranean spring exists; the spot where the greatest movement of the needle is obtained is that where well-boring operations should be made. The water finder is an English invention and is manufactured in Liverpool.

SAFETY BALANCE FOR AEROS

A Large and Small Blade of the Safety Balance.

THE many accidents to aeroplanes have pointed to the fact that the safety problem will have to be attacked from entirely new lines, and at present, the "gyropter," the invention of Mr. Davidson, an Englishman, is nearing completion. This new flying machine has two gyropters which are declared to secure absolute safety in balance, and the complete machine will excel in speed the present system of aviation.

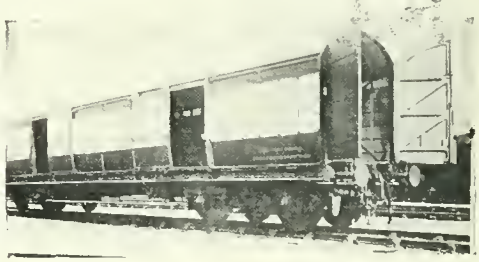
One was tried in America, with a diameter of 27 feet, to lift 3 tons at 55 revolutions per minute. It worked quite successfully.

The gyropter now nearing completion is worked by a Stanley engine. On either side of the engine room is a gyropter—wheel—containing 60 large blades—10 feet long—and 60 small blades—5 feet long—and each gyropter will make 60 revolutions per minute and the ends of the blades are held together by a kind of band—which is braced into position.

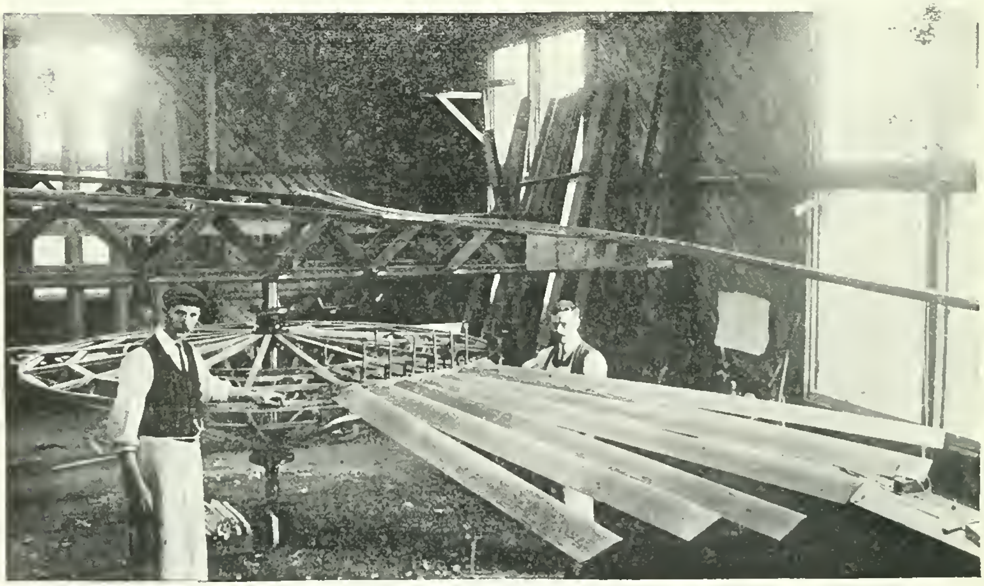
The machine, when completed, will weigh 6 tons with a lifting capacity of 10 tons. The shed in which the new flying machine is building is arranged in halves. When the machine is finished for trial, the two halves of the shed, being on wheels can travel apart and the machine, which is of large dimensions, can then be taken in and out quite easily.

If Mr. Davidson's device should work successfully it would be of the greatest service in the field of aeronautics, obviating the majority, if not all, of fatal accidents of the sort that stirred the world the past year.

Making a "Gyropter," or Safety Balance for Aeroplanes.



Private Car for Aeroplanes.
Flying machines are exclusive; they require special quarters of their own for transport—a car used in Germany.



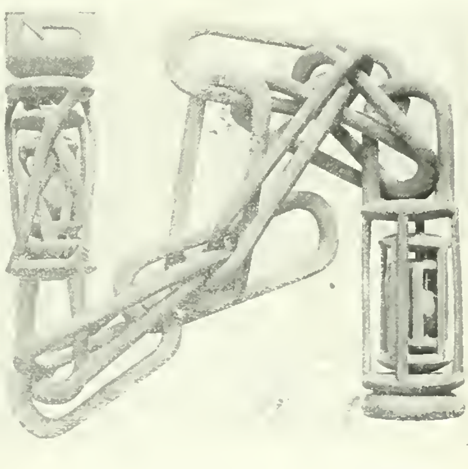
PUTTING IN THE 120 BLADES OF THE "GYROPTER."

ROASTING COPPER ORE ON A GIGANTIC SCALE AT JEROME, ARIZONA.

ROASTING COPPER ORE

THE burning mountain shown in this photograph is the outdoor "roaster" at Jerome, Arizona, where one of the world's largest copper mines is operated. The ores contain a great excess of sulphur and before they can be economically smelted it is necessary to burn out the greater part of the sulphur. This is called heap roasting, the ore being heaped with cord wood and allowed to burn from five to nine weeks. About 500 tons of ore form a heap, so that the enormous quantity shown in the photograph may be estimated. The ore for roasting is trammed through a tunnel 1,300 feet in length, which leads from the 500 foot level of the shaft, and when roasted and ready for the smelter it is sent back into the mine and hoisted to the mouth of the shaft, as the country is so rugged that there is no other way of reaching the smelter.

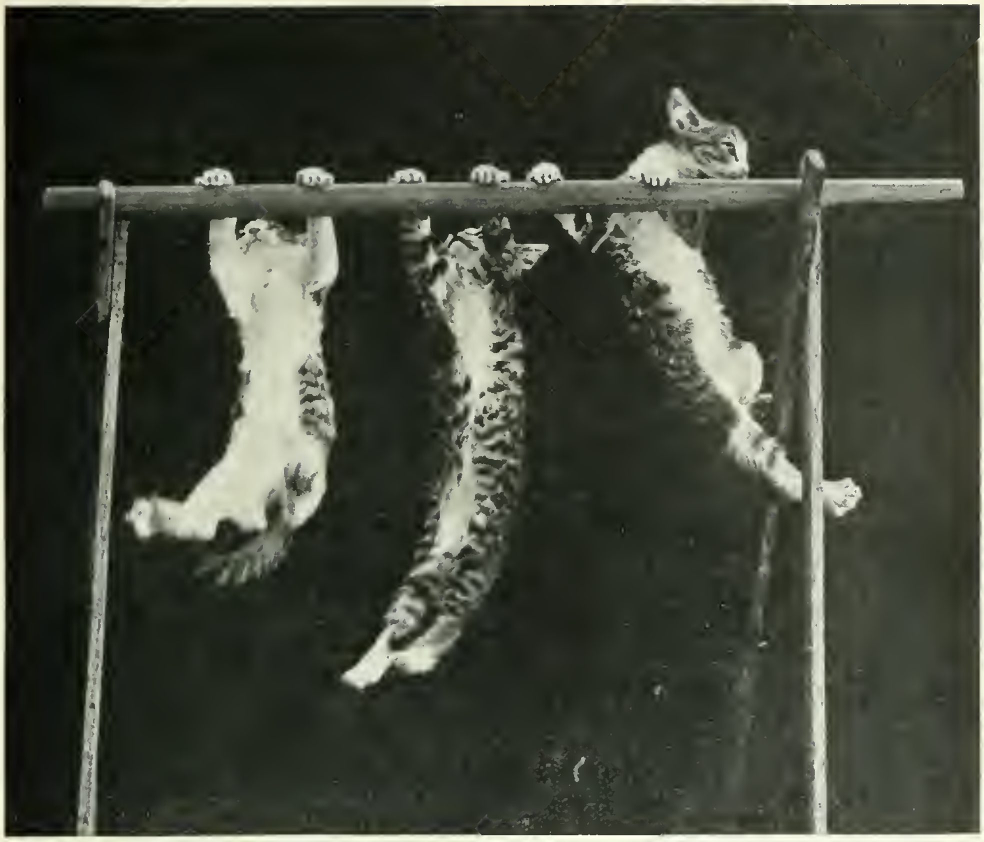
Owing to the exceeding richness of sulphur, 15 to 32 per cent., there is great danger of mine fires from spontaneous combustion. One very serious fire was checked by means of carbonic acid gas which was made on the surface by combining sulphuric acid and crushed limestone, then the gas was conveyed to the mouth of the shaft where its own weight caused it to sink and displace the air in the mine, thus extinguishing the fire.



THIS CLEVER BIT OF CARVING IS FROM A PIECE OF WOOD A LITTLE LARGER THAN A BROOMSTICK IN CIRCUMFERENCE

THIS PHOTO WAS TAKEN BY THE RAYS OF AN INTERURBAN ELECTRIC CAR LIGHT.
The arc lamp is about fifteen inches in diameter and nine inches in depth. It illuminates for five hundred yards.

THE LATEST SURPRISE IN BERLIN—THE FRUIT PEDDLER USING AN AUTO.



CATS AS ACROBATS.

Cats are exceedingly difficult to train, having an unusually developed aversion to doing things they don't like, yet here is a photograph of three of them doing "stunts" on a horizontal bar. These pets are owned and trained by a California photographer who finds much amusement and some profit also in taking their pictures in strange poses.

THE GIANT OF EUROPE

THE giant floating steam crane which is shown is the identical crane which was used a little time ago in the salving operations on the submarine *U 3*, which sank near Keil. The German nation boasts of some of the most remarkable floating cranes in the world, and the one shown here is probably the most powerful in Europe. The gigantic size of the hooks and pulleys—capable of receiving 200 tons—shown in one of the illustrations, may be realized by comparing them with the man at their side. The arm of the crane is pivoted on its base, and the counter-balance weights are controlled by machinery. A monster of such power may well be regarded as one of the modern wonders of the mechanical world.

HUGE PULLEY MAKES MAN A PIGMY.

An odd comparison of tiny man and his creation.

THE CRANE ON THE WATER.

This monster is capable of lifting two hundred tons.

FERRO VANADIUM, TO BE DISSOLVED IN MOLTEN STEEL OR IRON.

VANADIUM IN STEEL

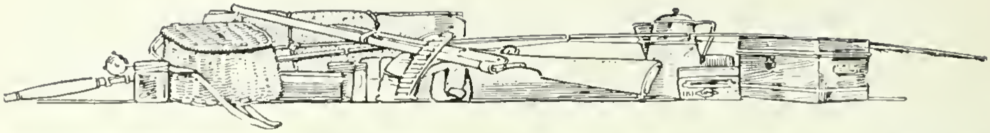
VANADIUM, first discovered in 1801, is a mineral which in late years has been applied with remarkable results in the steel industry. The reason it was not used sooner in the manufacturing arts was because of its scarcity. Large and exceptionally rich deposits of vanadium ores were discovered in the Peruvian Andes several years ago. It is to this source that vanadium steels hold their present commercial status.

Scientists in the employ of the French government first settled the question, "Does vanadium improve the quality of steel?" They proved that the addition of a small percentage of vanadium—never above three-quarters of one per cent—gives to steel a remarkable increase in strength without impairing its ductility—a result that cannot be secured from any other element used in the composition of steel. Carbon, for example, increases the strength up to a certain point but causes brittleness, and even fails to strengthen when employed in large amounts, the result of further additions producing ordinary pig iron.

Pittsburg manufacturers who have used vanadium in their steel products report extraordinary results. It is claimed that a two years' test of vanadium against ordinary steel shows an actual saving of $761.59 on a single item—a flue cutter weighing three ounces. In one year, 1,049 carbon steel cutters were used to cut 145,444 flues. In the next year 60 vanadium steel cutters cut 152,578 flues. The average number of tubes cut with the carbon steel tool was 139; the average for the vanadium steel, 2,244. The cost of the carbon steel cutter per hundred flues was $.54 compared with one and six-tenths cents per hundred, with the vanadium steel tool.

THE GIRLS' BOB-SLED CREW.
Winter sport at Huntington, Long Island.

JULY ··· 1911



FOR naught stirs the blood like the crackle of the blaze
When the smoke of your fire hangs low,
And the moon hides her head in the mid-summer haze
And the yellow flames climb and grow;
For a charm is in the touch of the camp-fire's rays
That sets congenial hearts aglow.

—*Camping Song.*

THE TECHNICAL WORLD MAGAZINE

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AGRICULTURAL HIGHWAYMEN

By

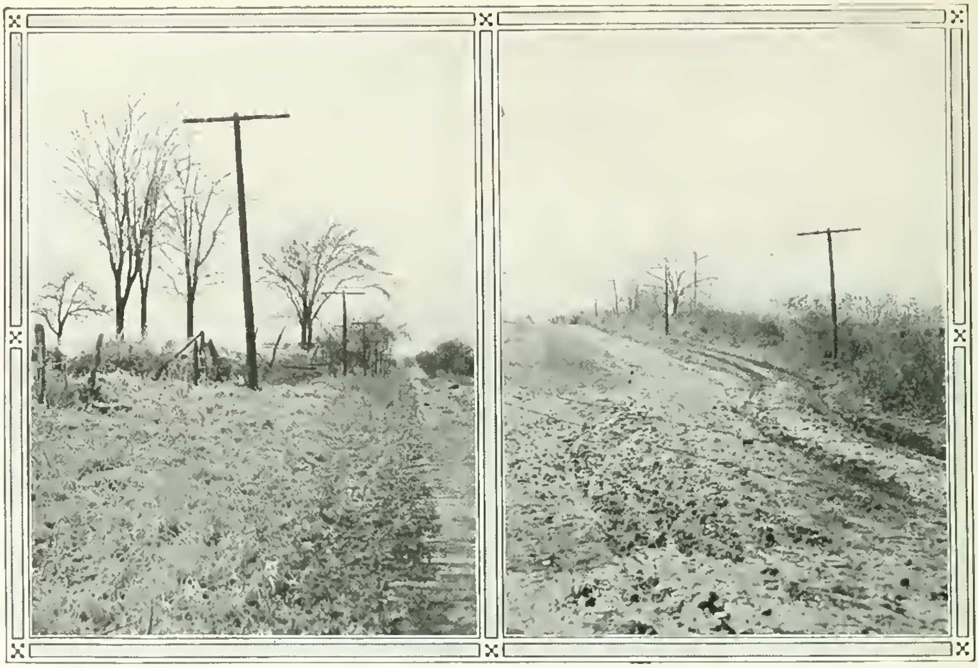
HARRY F. KOHR

AN Iowa farm of something more than eighty acres passed into the hands of a city man on a mortgage. He rented it and, for the first two or three years, the returns were satisfactory. Then he found the dwellings and outbuildings needed repairs which took back some of the profit. He held the land nine years and in that time had six tenants, the last of which harvested a crop of corn that barely was enough to feed his team and pay his own family expenses for the year.

The land was in a community where values ranged around $125 an acre but it cost the owner only about $6,000 under the mortgage. As near as he could estimate his income from the land for the nine years was about $4,000, from which was deducted repairs, taxes, new fencing and other incidentals aggregating about $1,200. This left him a net income of about $2,800. Then he tried to sell the land. Many buyers looked but none bought. They wanted no "corned out" land, they said. Finally along came a young farmer who took it off his hands for $4,000. That left the first man a net income of $800 on his $6,000 investment for nine years.

A northeast Kansas farm was homesteaded forty-six years ago and worked by the original owner for thirty-four years, until he died. His son rented the land to two brothers. They planted wheat for seven years until the yield became too small to be profitable. In the next year another tenant planted corn and he "corned" the land for five years. No record was kept of the wheat yields, but the corn yields averaged only twenty-eight bushels an acre, the first crop being thirty-five bushels and the last crop twenty-three, an average value on the farm of eleven dollars an acre. His ninety acres of corn netted him $445. The owner got the same and his profit was approximately seven per cent. The first year of his tenancy the tenant's return was about $525, while the landlord made about eight per cent. The latter rate has been about the average profit, not deducting for deterioration of farm plant and soil. Increasing land values, however, have compensated for that.

In an eastern Missouri county, the Canadian fever and the Texas fever struck the farmers in one section about the same time. As a result pretty nearly three whole townships were depopulated. The land largely passed into the hands of city investors and then into the hands of tenants. Among the farms in that section was one of 220 acres operated



HIS FENCES FALLING DOWN.
The roads go unrepaired in the tenant farmer's country.

by a father and two sons. The sons took the Canadian fever, and with them went so many of his neighbors that the father became discouraged and decided to rent his farm and move to St. Louis. It was the average type of good Missouri farm with comfortable dwellings, good barns, modern machinery always kept in good repair, the crops being rotated and the soil kept up. Plant and land, estimating by other neighborhood sales, easily were worth $30,000. Of the first tenants, one remained three years, two others remained two years and one is still there. Last fall the two sons tired of Canada, sold their holdings and went back to the old farm. Most of the machinery required extensive repairs, the buildings were in bad repair and the land had been skinned, with the exception of that still held by the tenant. This tenant was a young man, a graduate of the Missouri Agricultural College, and he faithfully carried out his contract. He had taken the 63-acre tract previously held by the tenant who farmed it three years. He planted only corn last year but, by proper seed selection, raised, in spite of the three years of skinning that the land had been subjected to, a larger crop than had ever been raised upon it. By hauling manure from other nearby farms he got enough to cover the field thoroughly with manure last fall. This year he will begin on a crop rotation program, having pleased the owner so well with his results last year that he was given a five-year lease with option of renewal.

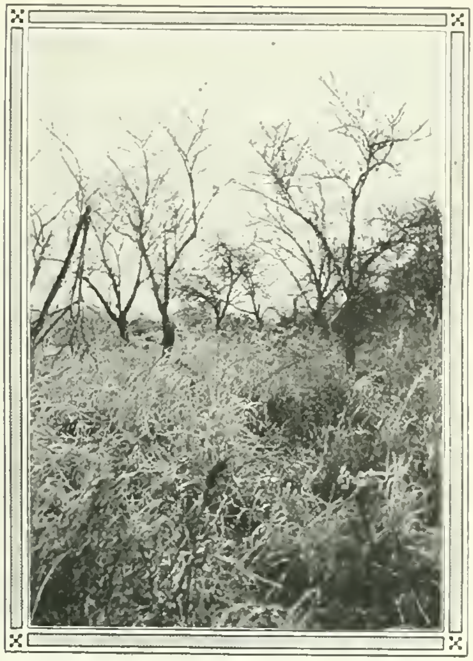
In previous years this farm had paid a net profit of about 6 per cent. on $30,000. Balancing the receipts for four years against interest on the investment and the estimated cost of restoring the land and plant to its original condition the net profit was about 1.4 per cent. on a valuation of $30,000. But that is not all. Peopled largely now by a shifting population of tenant farmers the old community spirit has died out, the roads have deteriorated, the bank deposits in the county seat town have decreased and land values in the whole section are estimated to have decreased ten per cent. in the last four years.

The greatest agricultural evil of the

present day is the tenant farmer. This statement is made by President Henry J. Waters of the Kansas State Agricultural College. The tenant farmer, he declares, is the highwayman of the soil; collectively, a vandal horde that has marched from Maine to the Missouri, laying waste an agricultural empire with the fire of its greed and the sword of its ignorance. His advance guard already is thrown beyond the Big Muddy. Give him time and he will overwhelm the West as he has the East.

The tenant farmer, President Waters says, is the ruination of the country and the menace of the city. He has left in his wake impoverished land, abandoned farms and a train of economic evils that must soon be remedied or grave consequences will follow. The tenant farmer is the man who is chiefly responsible for the increased cost of living, he is the man who has caused American exports to fall off 200 million dollars in three years. He is the man who has reduced our farming area, forced the price of productive land to an abnormal height, and sent droves of sturdy young farmers beyond our borders to the north.

President Waters has been investigating the tenant farmer for a long time and he knows his subject but nothing good of him. He speaks now of the tenant who doesn't farm but merely skins the soil, not the real tenant farmer—the small ten per cent or so of hustling, ambitious young men, long on industry and short on cash, who rent only until they have saved enough to buy a farm of their own. He speaks of the other ninety per cent., the migratory agricultural vagabonds who follow in the wake of the homeseeker and the homemaker, leaving blight and desolation wherever they tarry.



ORCHARDS GO UNTRIMMED AND WEEDS SPRING UP.

The nation's greatest source of wealth is in its land, and its farms should be

JUST AS THE LAST TENANT LEFT IT.

able for many years to supply you and me with all we need and leave enough over to sell to the fellow across the water who produces things that we do not. The extent of land area now under cultivation in the United States is easily capable of producing twice the quantity of foodstuffs that is now gathered. In Germany, where conditions are more nearly similar to that of the United States than any other European country, the yield per acre of wheat is more than twice that of the United States, the yield of rye nearly twice as large, and barley and oats one-third larger. Germany's lands have been farmed for a thousand years, most of ours less than a hundred and millions of acres less than fifty years. There is no reason why our yield per acre should not exceed Germany's, but it is not likely to until we rid the farms of shiftless, land-skinning tenants.

The welfare of the nation requires the scientific and effective usage of the soil, the rotation of crops and fertilization. It is only by such methods that its enduring productivity can be maintained. But the tenant farmer neither fertilizes nor rotates. He is an exploiter. He sows the same crops year after year, taking always but giving nothing in return. He squeezes the fertility from the soil and robs it of its power to produce. For every $25 worth of grain that he grows he takes from the soil a measure of fertility that would cost $12 to replace in the form of commercial fertilizer. Average land will stand such treatment about ten years. Ten years and the tenant farmer has made a portion of the nation's agriculture area a barren waste!

CALLS THE TENANT FARMER "HIGHWAYMAN OF THE SOIL."

One doesn't need to go into the field of higher mathematics or perform any extraordinary feats of mental gymnastics to trace the increased cost of living to such conditions. The farm no longer contributes its share to the nation's supply of beef, pork, mutton, butter, milk, cream and breadstuffs. Every acre of land laid waste adds an artificial value to land that is still productive, lessens the productive area and consequently compels—both by the law of supply and demand and the necessity for an adequate return from the land that still produces — a higher price for food products. The law of supply is as immutable as the law of gravitation. When supply does not meet demand prices rise.

Farming as an occupation is steadily growing more profitable, because the number of consumers of foodstuffs and the rate of consumption per capita are increasing more rapidly than production. Right here let it be understood that this does not mean that

MACHINERY ON A TENANT FARM LEFT IN THE OPEN TO RUST FOR THE WINTER

BUT THERE ARE WELL-MANAGED TENANT FARMS, AND THIS IS ONE OF THEM.

there is a call to the city man to go back to the farm. There are enough farmers already. The call is for better farmers and better farming. For several years past the yield per acre of agricultural products in this country has remained practically stationary, whereas with the revolutionary improvements in farming machinery and farming methods and the wider dissemination of agricultural knowledge, our yield per acre should have increased at least fifteen per cent. That the average yield per acre has not shown an actual decline, is due to the fact that much worn out land has been abandoned while vast areas of virgin land have been opened in the West and Northwest, and great areas and swamp and timber lands in the East have been drained or cleared off and planted.

But we are approaching closely now the limit of our cultivable land. When we reach that limit—and the day is not many years away—either farming methods must undergo a radical change or our yield per acre gradually will decline. If we are to preserve the fertility of the land, the land skinner must be put out of business.

As a nation we are still the greatest meat eaters in the world, but year by year our per capita consumption of meat lessens while the per capita consumption of grain and vegetables grows. The per capita of wheat consumption in the United States in 1885 was four and two-thirds bushels, while in 1909 it had risen to five and one-half bushels. The exports of breadstuffs, meats, live stock and dairy products fell from 413 million dollars in 1907 to 213 million dollars in 1910. The average farm price of wheat from 1896 to 1900 was 66.4 cents a bushel and from 1906 to 1909 it was 86.5 cents. Corn showed a similar advance. When exports fall off and prices rise at home in the face of a total production of farm crops never exceeded in our history, there can be only one conclusion—that the demand is growing at home faster than the supply. The natural result is that the cost of living goes up.

"It was," as Prof. W. J. Spillman of the Department of Agriculture stated in

TENANT FARM IN NEW YORK THAT IS PROPERLY LOOKED AFTER.

ABANDONED FARM BUILDINGS IN NEW YORK.

THE AVERAGE FARM TENANT MAKES NO REPAIRS.

slow adjustment to new conditions, as has been the case in older countries," depends, he says, on how soon we supplant the land-skinning tenant and the ignorant, shiftless owner with efficient farmers.

It is a grave economic problem with which the tenant farmer has brought us face to face through his robbery of the soil, and it was tersely stated in a recent speech of Senator Elihu Root of New York, discussing the ship subsidy bill in the Senate. He said:

"We have reached a point in our development where we can see the time when we cannot maintain our balance of trade by exporting food products. We will soon consume all the food products we produce. Where then shall we turn to pay for our purchases abroad? By exporting our own manufactured articles? But where shall we sell them?"

We may or may not agree with Senator Root's stand on the ship subsidy bill but we cannot ignore the fact that unless the land is made to produce as it should produce and is capable of producing, we must become a manufacturing nation in order to keep our balance of trade. Our manufacturers must compete with the manufacturers of the world, our workmen must compete with the cheap labor of the world. Can we maintain against that cheap labor our present standard of wages and living? Or must we come down to the level of our competitors? If our population goes on increasing, as it undoubtedly will, while our food production remains stationary, it will not be many years until, of necessity, we must begin to import foodstuffs to meet the increasing demand. To pay for our foodstuffs imported we must then export manufactures. Is there any reason to

a bulletin on soil conservation, "the abundance and cheapness of food that made possible the marvelous progress in this country in the last century. The production of abundant crops was accomplished at little expense and with a little knowledge of the principles of the conservation of soil fertility. This period of exploitive farming is past. Whether the era of comparatively cheap and abundant food is past depends upon our ability as a people to develop cheaper and better means of production than now prevail. Future increase in production must come from better methods of farming. Whether we, as a nation shall attain these improved methods after a long period of depression, accompanied by

THIS IS NOT A TENANT FARM.

believe that when we arrive at the necessity for importing food that the cost of living will not further increase while to meet the competition of cheap labor abroad there must be a decrease in manufacturing cost-wages, in other words? Not any. It is up to us to rid our agricultural system of the tenant farming evil, the tenant farmer if we can, and along with him the shiftless, ignorant farm owner.

It has been ascertained by exhaustive inquiry that more than four of every ten farms in the United States are occupied by tenant farmers. As a rule tenant farms are smaller than farms tilled by the owner, but it probably is safe to say that one-third the cultivated area is occupied by tenants. The greater part of this tenant cultivated area is east of the Mississippi River, but the corn belt of the Middle West is feeling him as a growing affliction and he is beginning to obtain a foothold in the wheat country. Oklahoma, the Ozark regions of Missouri and Arkansas, Northern and Western Texas and the more western states are a little too new for him yet, but ultimately he will invade them. West of the Mississippi he is most numerous in Iowa, where he numbers about forty per cent. of the farmers and in Missouri where he numbers thirty per cent. In Illinois he numbers forty-one per cent. In Kansas and Nebraska the tenants make up from ten to forty-six per cent. of the farmers, a general average of thirty-six per cent. in the former state and in both the percentage is growing. In the more eastern states the percentage jumps from thirty per cent. in Missouri and forty-one per cent. in Illinois, to fifty and, in some sections as high as seventy-five per cent. in Indiana, Ohio, and the states south of the Ohio River.

In a recent bulletin of the Department of Agriculture it was stated that the list of tenants in one county in Ohio who were moving in the spring from one farm to another filled a newspaper page in small type. The paper said it was the custom in that county for renters to remain only one year on a farm. Just recently a daily paper, recording the fact that nearly every voter in Adams County, Ohio, had been disfranchised for selling votes in elections said:

"It is a county of tenant farmers * * * * a county of rutty, unkempt roads, ramshackle farm buildings and corrupt people."

In the Eastern and New England states the tenant population drops as low as ten per cent. in some sections, where the tenant has long since skimmed the cream of the soil and moved to greener fields, leaving behind him a worn-out, crop-weary earth which must lie fallow for many years until Nature's laboratory restores again some measure of its fertility. Between 1880 and 1890 the improved farm area of the New England state decreased 38.1 per cent. As he has done in New England, the tenant farmer is doing in Ohio, in Michigan, in Indiana and in Illinois, so will he do in Minnesota, Iowa, Missouri, Kansas, Nebraska, and the Dakotas. He farms for today, tomorrow is the landlord's risk. It is, as in law, *caveat emptor,*—let the owner look out for himself. That's what the tenant farmer is doing.

Every spring the devastating army of tenants prepares to descend upon new fields. The great moving day in the country is March 1, the day on which the tenant farmer invades the farm he is to ravish for the season. Nine times out of ten he finds the land just as it was when the previous tenant harvested his crops—the ground unbroken, not an ounce of fertilizer applied, the dwelling and outhouses in need of repairs, the fences falling to pieces. In a word the whole plant is run down. Sometimes the tenant pays a cash rent, so much per acre. If he works on shares he pays from one-third to one-half the crop, according to what goes with the land. Either system is an evil and between the two there doesn't appear to be much choice. Some owners prefer the cash rent system as the surest in the long run. Other landowners prefer the crop-sharing plan as bringing the largest returns. Either way the landlord usually gets a better return on his investment than the tenant gets for his labor and investment. At least ninety per cent of the tenant leases are for a year, and from that very fact the tenant system has grown to be the evil it is. The tenant has no assurance that he will be permitted to occupy the place the next year and, naturally, he has no interest in the farm other than to get all he can out of it. Why should he spend any time maintaining the fertility of the soil or making repairs for the benefit of the landlord and the next tenant? He does just as his predecessor did. He gets all he can while the getting is good.

Nothing Much to Look at—The Kind of Tenant Home They Show You in Missouri.

Three causes contribute largely to the tenant evil. One is the purchase by city men of farm land as an investment. Another is the death of the farmer and the descent of property to heirs who live in town or to widows who cannot or will not carry on the business. A third cause is the desire of farmers who have made comfortable fortunes at farming and who wish to retire and yet hold their land as an investment. The city offers him ease and amusement or less arduous business cares or duties for his old age! He considers increasing land values so much money earned and he fancies that the value will go on increasing with the years so he doesn't worry if the old place runs down a little and his share of the crops is not as large as it might be.

A large number of the farms in the Middle West that are passing into the hands of tenants have been stock farms or dairy farms or both—farms where practically all of the crops were fed at home and in due course returned to the soil in the form of manure. The tenant farmer is not going to raise stock. First of all he has not the capital and secondly he isn't temperamentally equipped for the work—in other words he is too shiftless. The third reason is that, properly to raise stock he must be assured of a longer lease than one year. Therefore he produces only the crops easiest of cultivation and surest of ready sale—which always happen to be the crops that take most fertility from the soil. He tries no experiments. He adds nothing to the sum of agricultural knowledge except the lesson to beware of him. He burns his straw and his soil—renewing manure rots against the side of his barn. The fruit trees and the hedge go untrimmed, the weeds run riot and the farm implements rust in the spot where the last job was finished. He is too busy skinning the soil to repair the house, the barn or the fences. His live stock is nondescript stuff out of which he gets the maximum of work at the minimum of cost.

He has no community interests. He is here today and there tomorrow. He has nothing in common with his neighbors. Home is where he hangs his hat. The farm is both a factory and a home and it has a value peculiar to each. When, as the temporary abiding place of the tenant farmer it ceases to be a home it has lost part of its value and it lowers the value of its particular neighborhood at the same time. Mississippi, Georgia, Alabama and Louisiana lands, far richer than lands in Kansas, Nebraska, Missouri or Iowa, sell for $25 an acre. From 58 to 62 per cent. of the farmers in these states are tenants, a large proportion negroes. Farmed by white owners these lands would be worth $100 to $200 an acre. That is the value of community interest.

Conditions in the South, are, of course, extreme, but look about you in the northern states and you will find that land in the districts largely farmed by tenants is disproportionately lower in the value than in districts where the owners till their land. The lesser value is not wholly traceable to the difference in the usage of the soil. Part of it is due to the lack of community spirit, the smaller part, of course. The larger percentage of difference in value is due to the fact that the tenant is robbing the soil that he works while the owning farmer is continually doctoring his land to keep it at the highest stage of fertility.

Now the question is: What's to be done about it?

The prices of all farm products are going up, exports are falling off and home consumption is approaching perilously close to our production. It is a situation that will give economists plenty to think about in the next few years. One-third of our agricultural area is being cropped into barrenness by tenants. "In most parts of the country," a Department of Agriculture report says, "the land has been farmed so long without attention to fertility that it will no longer produce crops by the slipshod methods formerly in vogue."

But the tenant alone is not to blame. He shares the responsibility with two other classes—the landlord and the shiftless land-owning farmer. The same department bulletin says:

"Many experienced farmers today are not making a good living for the simple reason that they do not possess the knowledge of the principles involved in their business, and unfortunately only

A COUNTRY ROAD IN THE LAND OF THE RENTERS.

too often the farmer is not aware of his lack of knowledge."

It is doubtful whether tenant farming can be done away with entirely. Practically all of the arable government land is taken up and the tendency now is toward the enlargement of individual holdings rather than toward the division of holdings into smaller bodies, which would be far the most desirable condition from an economic standpoint. Land values continually are rising so that the tenant's chances for becoming a landowner are growing more remote. Take Illinois and Missouri as typical states. The last census gives the average value of farm land in 1910 in Illinois as $94.90 an acre against $46.17 in 1900; in Missouri as $49.56 an acre in 1910 as against $24.82 in 1900, an increase in each state of more than 100 per cent. The average farm area in Illinois is 129 acres as against 124 acres in 1900, and in Missouri it is 125 acres against 119 in 1900. It is an unwritten law in most farming communities in the Middle West that when a farmer desires to sell out he must first offer to his neighbors, the result being to keep out strangers, and enlarge the average farm area, as well as to cut down the rural population. An exhaustive investigation showed that this "unwritten law" was largely responsible for Missouri's loss in population outside of its large cities.

Getting down to the solving of the tenant problem, the ideal solution of course, would be to turn the tenant into an owner. Possession stimulates pride. Make the tenant an owner and, where he is not entirely shiftless he begins to take pride in his ownership and starts off on the road to regeneration. No man with a modicum of sense is going to rob himself if he knows it, or rob the land that he owns.

But the chances for the tenant becoming a landlord are growing more remote. Next to ownership, undoubtedly the best solution of the tenant problem would be the indeterminate lease system, assuring the tenant possession so long as his behavior and usage of the land warrants it. The tenant, under such conditions, has an interest in keeping up the fertility of the soil—in fact, that should be one of the conditions of his lease—and he willingly will learn how he may do better than he has done.

But the real foundation of any remedy for the tenant problem, says President Waters, is education. Governor Eberhardt of Minnesota, who also has been studying the question, says the same thing.

"In Minnesota," Governor Eberhardt said, "many farmers have been mining the soil instead of tilling it. The presence or the prospect of the abandoned farm is a subject of interest in almost every state. We must get the soil back to where it was, for it should yield from fifty to 100 per cent. more than it does. We must educate the farmers and we must begin at the beginning—the children. In Minnesota we are doing this by building up consolidated schools where the vocational and industrial training so freely offered in the cities is brought within the reach of the farm child. We teach in the consolidated schools practical agriculture, manual training and home economics, and we bring to them the elders of the community for their co-operative meetings, lectures on agricultural topics and social purposes. Ultimately we shall accomplish much in stopping the reckless waste of our fertility and in increasing our production."

"Educate both the tenant and the landlord," President Waters says. "The landlord is, unconsciously, the tenant's accomplice. We must educate him to the evils of the short lease system and we must educate him to give closer attention both to his tenant and to his land. So long as the system of short leases prevails and the tenant is allowed to skin the land the faults of tenant farming will not decrease.

"Next we must take the tenant by the neck, if necessary, and force into him a little knowledge of real farming. First we must assure him long tenancy, conditioned, of course, upon good behavior. We must teach him soil conservation to maintain the productivity of his land, we must teach him seed selection to increase his yield, we must teach him diversified farming to lessen the chance of loss, we must teach him the value of good roads and we must pump into him a sense of pride in appearance and achievement and top it off by inculcating a little public spirit. The first thing we know we will have a land owner who will always be referred to as 'So and So, a prosperous farmer of the High Creek neighborhood.'"

"We Must Educate the Farmer and We Must Begin at the Beginning — the Children."

Europe has tackled the tenant farmer problem with success. Denmark not many years ago was tenant ridden to such an extent that the government finally was compelled to act. Agricultural schools were established, public funds were used to expropriate lands and sell them to the tenants on easy terms. Sixty-five per cent. of the population lived on farms and a large majority of them were tenants. Now only one farm in ten is rented and every acre of land under cultivation produces an annual surplus of products worth $9. There are twenty-nine agricultural colleges and 6,000 students. Ireland is undergoing the same transformation through the expropriation of large estate and the sale of the land to the tenants on easy terms. Great Britain and Germany, France and other countries are struggling with the problem.

"Denmark," President Waters said, "is becoming the most prosperous country in Europe, and that is due to the work of its agricultural colleges. The value of the work our own agricultural colleges are doing is incalculable, but we do not yet cover the field. Our seed and soil trains, our dairy trains, our 'pork chop specials,' our farmers' institutes and our extension lectures are bringing fine results but they do not go deep enough. They do not reach the men we most desire to reach—the tenant farmer and the shiftless farmer. The tenant farmer feels himself more or less of an outlander in the community or he is prejudiced against new fangled notions, as are a large proportion of the "shiftless" farmers. We must get into his home, we must educate his wife and children. He must be taught his part of the work, the wife hers. We must teach her domestic economy, sewing, cooking, hygiene and the proper rearing of the children. The children are the hope of the farm and the farmer is the foundation of all our prosperity.

"It must be remembered that the majority of farm children never get as far as the college, many never pass the high school and some never reach beyond the rudiments of education. Especially is this true of the tenant farmer's children, many of whom, under the conditions as they now exist, will become tenant farmers in their turn. We must begin with these children in the primary grades to teach them that there is something more to agriculture than scratching of the soil."

In Kansas, Where the Tenant Has Not Yet Arrived.

A FENDER THAT FENDS

By

M. M. HUNTING

MR. A. D. McWHORTER, the inventor of a street-car fender having a record of saving the lives of fifty-seven people in the four years of its existence, refuses to take out a patent upon his invention, preferring to let humanity reap the benefit.

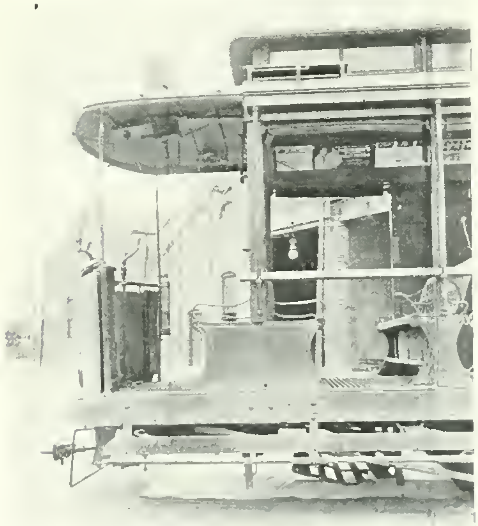
The fender was first adopted by the Memphis Street Railway Company after nearly every other form of fender upon the market had been tried and in most cases found wanting in certain important details. It consists of a cradle-like arrangement underneath the car in front of its wheels. This in turn is connected to a trigger-like attachment located directly underneath the front end of the car.

Any object eight inches or more in height and causing a pressure of five pounds upon the trigger will trip the cradle, allowing it to be dropped upon the rails and to pick up whatever is before it. In one case two persons were picked up at the same time, without injury, except for a few bruises of no importance.

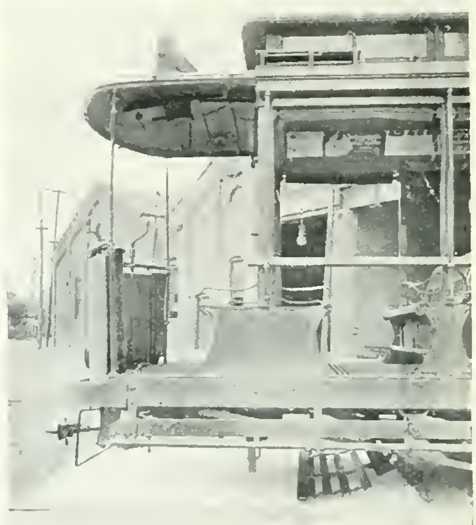
So successful has the fender proved as a life-saver that a number of other Southern cities have adopted it and it is now being tested with a view to adoption by the New York Street Railway systems.

No royalty is asked by the inventor if a city desires to equip its cars with his fender. In order to protect the invention, however, from falling into unscrupulous hands the Memphis Street Railway Company have taken a patent upon the device but will cheerfully furnish plans and specifications to any other roads wishing to adopt it.

The annual death harvest of persons caught beneath the wheels of street cars is too large not to receive the most earnest attention on the part of the authorities.



Fender in Normal Position.



Fender in Position to Pick Up a Person.

SEATTLE'S HARBOR AT SUNDOWN.
In the foreground is a section of the frontage owned by private corporations.

TO GRAB THE TRADE THROUGH PANAMA

By

FRANK C. DOIG

"WE want the trade through Panama!"

It is almost a slogan of the ports on the Pacific Coast. But how much they mean of what they say is shown in the figures on the records of capitalization back of the new engineering enterprises they are pushing to make their port facilities adequate to take care of big slices of the expected business. Los Angeles is planning to spend ten millions of cold, hard dollars on its port—San Pedro. She has already voted a bond issue of three millions, and Uncle Sam has spent three millions more in building a record breaking breakwater for her. Oakland has two and a half millions ready to put into wharves and docks and dredging, and has more than ten times that amount to spend when her plans are ripe. San Francisco has taken the limit off—or hasn't put one on, her appropriations and is spending millions

HOW PUGET SOUND LUMBER IS LOADED ABOARD SAILING VESSELS FOR ALL PARTS OF THE WORLD.

and getting more ready to spend at a rapid rate. Portland and Seattle are making no noise about what they intend to do but they, too, have plans—and big ones.

Every harbor on the Pacific Coast is the largest in the world and has more miles of water frontage than any other, if the assertions of the folks in each seaport are taken at their face value.

Grain Ships Along Tacoma's Water Front.
Tacoma's harbor is so deep that the docks are built parallel with the shore line.

Millions on millions of dollars have been appropriated for commercial shelters and yet these westerners are not satisfied. Now they see the Panama Canal opening and its wealth of commerce ebbing and flowing from one ocean to another and they are planning to accommodate it and incidently grab their share of the benefits. There isn't a seaport on the western coast that is not preparing to handle the shipping of the world within its harbor as soon as the big ditch is completed.

True some of these harbors need little fixing so far as natural advantages are concerned, but vast sums of money must be spent in docking and handling facilities. In all, it is estimated that at least one hundred millions of dollars will be spent on Pacific Coast harbors before the canal is ready for ships. The greater part of this enormous amount is available already, having been voted in bond issues. So great is the western enthusiasm over the future that as soon as the money now ready is spent, other sums likely will be raised for more improvements.

Instead of leaving the important question of water frontage to private concerns, the cities and states have taken a hand in the game and although corporations have made, and are making, extensive improvements, the majority of the undertakings are backed by the public's money and controlled by public officials. The cities have seen the folly of allowing their natural resources to fall into the hands of the corporations, and municipal docks and warehouses are the big issues in almost every political campaign.

Railroads have spent fortunes in attempting to stem this tide of western enthusiasm for municipally owned shipping facilities but without avail. You can't tell the westerner anything about water frontage. He's an expert on this subject and the railroads are not going to have his pet schemes in their grip if he can help it. Besides the railroads are not enthusiastic over the Panama Canal opening, as it means competition and cheaper freight rates. But that's just what the westerner has been fighting for, for years, and now is his chance to get even. And he's going to do it with a vengeance. He's tired of having his cost of living boosted for the benefit of the eastern corporations. He's going to show Wall Street just how well and how thoroughly he can whip it if he tries.

The westerner sees in the Panama Canal a means by which he can throw off the yoke of railroad control and besides become a factor in the commerce of the world. In the words of one of these western enthusiasts:

"With the opening of the Panama Canal the history of man passes to its final phase. The Occidental half of the world meets in the Pacific Ocean the other, and hitherto ignored half—the

SAN FRANCISCO'S HARBOR IS IN CONTROL OF A STATE BOARD.
This body is constructing concrete and steel piers and a sea wall, in preparation for handling the Panama business when the canal is opened.

Orient. That is the supreme meaning of the event."

That's the way they talk about it out on the western coast line. The canal is expected to open new trade routes and steamers will be compelled to call at ports now enjoying little commerce. So the westerners have resolved to get their share of the Oriental trade as well as to hit the railroads a mighty swat and reduce the cost of living. The railroads, however, are not sleeping and at every Pacific Coast seaport they are making preparations to handle greatly increased business when the canal is opened.

If you haven't a harbor of your own, reach out and get one, that's the policy of these progressive westerners. The thriving city of Los Angeles found it had built up a great center of trade in spite of the fact that it was not a seaport. But not satisfied with this it cast longing eyes toward the Pacific, fourteen miles to the westward. So what does it do but annex this strip of land—including several thrifty little towns—to the sea coast. Now Los Angeles has a harbor that it claims is one of the best on the western coast, at what formerly was San Pedro.

At a conservative estimate ten millions of dollars will have been spent on this harbor when the plans now contemplated are carried out. The city itself has just voted a bond issue of $3,000,000 for municipal wharves and fills. The Federal government has spent $3,000,000 more in building one of the longest breakwaters in the country to protect what is known as the outer harbor.

This breakwater has been the making of San Pedro harbor. It is 9,250 feet in length and on the outer end a lighthouse shows the mariner the way to refuge. Between the concrete wall and the shore is a trestle 1,800 feet long and this space will be filled for docking purposes. With this protective wall a harbor of 375 acres has been made. With the channels and the inner harbor 200

OAKLAND HARBOR, RECENTLY WRESTED FROM CORPORATE CONTROL.
The city will spend $25,000,000 in improving this.

acres more of harbor space has been made available with a depth at low water of thirty feet.

With these improvements the Los Angeles harbor will have twenty miles of water front, which can be doubled by the construction of piers without disturbing the present harbor system.

In addition to the public improvements on the Los Angeles harbor the great private corporations are preparing to increase their facilities for handling the Panama Canal trade. About 250 acres of land will be made by filling at a cost of $3,000,000 by private concerns. The Southern Pacific railroad has completed what is claimed to be the longest slip in the United States. It is 2,100 feet long and 250 feet wide.

As for Los Angeles' grip on the Panama business, the southern Californians figure this way: As for an entrance into a harbor what better could be asked than a space 4,000 feet wide with a depth of from thirty-eight to forty-eight feet and no rocks or sandbars? But the most important of all is the fact that Los Angeles is seventy miles from the great circle route between Panama and the Orient. By going a little more than one hundred miles out of their course, the vessels traveling between Atlantic ports and the Far East can deliver and receive freight in the richest section of the south.

The Los Angeles people say there are two benefits their city should derive from these facts. First, the direct all-water connection between the Pacific and Atlantic seaboards, in which all ports on the Pacific Coast should participate, but Los Angeles most of all. Second, Los Angeles should be the port of call of all vessels coming through the canal and crossing the Pacific.

Then as to the swat that these westerners expect to take at the railroads. Los Angeles is taken as an example of how it is figured on the Pacific Coast that the overland transportation lines will be hit. It is expected that goods may be sent from New York to the Pacific Coast for $6 a ton by way of the canal. The present rail rate on oranges for instance from Los Angeles to New York is $23 a ton. Therefore products may be shipped by water at about one-fourth the present tariff. Freight also may be sent to Europe at correspondingly lower rates.

According to the figures of the seaport cities, the inland region should be able to take advantage of the all-water route. Salt Lake, for instance, should be able to transport freight, via Los Angeles and the canal to New York at a saving of $14 a ton on the present schedule. Parts of Arizona could save $19 a ton.

But as said before Los Angeles is not the only Pacific Coast seaport that expects to benefit by the Panama Canal.

After a fight against the Southern Pacific railroad for the control of its water front, which has been waged for more than thirty years, Oakland has won and now is preparing to spend millions of dollars in the establishment of municipal docks and terminals to equip properly this port for handling ocean commerce now existing and the great trade expected to develop with the opening of the canal.

The people of Oakland recently voted $2,500,000 in bonds to begin the work, but the plans of the harbor commission call for an ultimate expenditure of $25,000,000. For years it has been the chief ambition of the Oakland people to own their own wharves and control their shipping facilities. This has been the political issue on which elections have been won and lost. And it was the power of the Southern Pacific against which the people had to battle.

All this muss was caused by the little hamlet of Oakland giving Horace W. Carpentier a fifty-year grant to the water front in exchange for a frame schoolhouse twenty by thirty feet. Carpentier sold this grant to the Central Pacific Railroad and its allied corporations and from that day until the grant expired, recently, the water front of Oakland has been in the control of the Southern Pacific.

But now Oakland is free. It has thrown off the yoke of the corporation and is prepared to hit back with a vengeance. When the Southern Pacific was compelled to accept a franchise, last October, permitting the corporation to use a portion of the water front for wharves, docks and other terminal facilities, the long battle had at last been ended with the city of Oakland the victor.

In the inner harbor of Oakland, for the dredging of which the Federal government recently appropriated an additional million and a half dollars, the first big municipal work is to be done. A concrete quay 2,900 feet long will be built along the north shore and the space between this and beach will be filled. On this fill warehouses will be constructed and a belt line railroad will be operated on the edge of the quay.

Along this quay the city will expend almost the entire $2,500,000. The only other work to be undertaken with this appropriation will be on what is known as the Key Route basin and the southwest front, between the Southern Pacific and Western Pacific railroad moles. A bulkhead will be constructed on the Key Route basin and the land behind this filled, giving 300 acres of land available for warehouses, streets and terminal facilities. The land will be made by the silt taken up by the dredger in front of the bulkhead in order to make the deep water channel in which wharves can be constructed.

When the present plans of the city have been finished, there will be in use along the Oakland water front proper, eight and one-half miles of wharves. And even then Oakland has not exhausted its resources and many more miles of water front can be made available for handling commerce. In all, the Oaklanders declare they will have twenty-six miles of water frontage when the plans are carried out.

Oaklanders, like all good Pacific Coasters, are exceedingly sensitive on all matters pertaining to their harbor. The statement by the commissioner of corporations in his report to the secretary of commerce and labor, "that the three transcontinental railroads will have virtual control of all practical water front except that owned by individuals," stirred up a hornets' nest in the California city. The statement was challenged immediately and figures submitted to show the commissioner did not know what he was talking about. And this is the way the Oaklanders figured out their control of the water front; railroads and privately owned frontage, 9,750 feet; municipally owned, 21,730 feet; disputed, but likely to go to the city, 8,000 feet.

But even with the Oakland city government building municipal wharves and shipping facilities, the railroads also are preparing for the Panama Canal trade. The Western Pacific is under contract to expend five millions of dollars; the Key Route railroad and the big wharf and dock concern of which F. M. Smith, the "borax king" is the head, will spend five millions more, each; and the Southern Pacific will spend $4,000,000 to $5,000,000 on improvements to its already big docking facilities.

With the amounts shipyard concerns and others are spending it is estimated fifty millions of dollars will be expended in Oakland harbor in the next five years. The municipal wharves will be equipped with the latest improvements for handling freight, including electric cranes. And this feature is one of the strong arguments to be advanced by Oaklanders in favor of their harbor. They declare that even though rival ports charge less for docking facilities, the Oakland wharves will be the cheapest in the end for vessels because of the speed and cheapness with which cargoes may be handled.

Across the bay from Oakland, the big city of San Francisco is preparing to retain its hold on the Oriental commerce and also is getting ready to bid for its share of the Panama Canal trade. Already a bond appropriation of two million dollars has been expended. No sooner did the people of the bay city find that this money had gone into docking facilities than another appropriation of nine millions of dollars was voted. This is the fund with which the work will be continued.

The improvements in San Francisco's harbor consist in building a concrete seawall parallel with the shore line and filling in the space between, making a large area of seawall lots. From the seawall, piers have been built and others are being constructed, at right angles to the wall. These piers are the most modern known to engineers. They are constructed of concrete and steel. Not even wooden piling is used, but steel cylinders are sunk and the cement placed in them.

LOS ANGELES CLAIMS TO BE ONE OF THE GREATEST LUMBER RECEIVING PORTS IN THE WORLD.
View looking seaward toward the outer harbor.

A belt line railroad is operated in connection with these other facilities. All these are under the supervision of the state board of harbor commissioners.

The warehouses, piers, belt line railroad, etc., are the property of the state and are operated by the state board so as to return a profit on the investment.

The water front line under jurisdiction of the state board at present is eight miles long and five miles of berth space is available. When the plans now contemplated are carried out with piers 250 feet wide and 800 feet long, the contour will be more than thirty-six miles in length.

At Portland, the metropolis of Oregon, elaborate preparations are under way for the increase of trade expected when the Panama Canal is opened. Portlanders consider their city to be a seaport and practically speaking it is, but theoretically it is a river port. But notwithstanding the fact that it is located far up the Columbia and Willamette rivers, it bids for a big share of the western slope trade. Portland's chief claim on commerce is through its immense grain and lumber trade. At Portland's doors the railroads dump their loads of grain from the interior and Portland has ships waiting to receive the cargoes.

Portlanders expect when the canal opens that they will get a large slice of the trade from the eastern coast for dis-

LOS ANGELES' BREAKWATER, WHICH COST $3,000,000 TO BUILD.
It is over 9,000 feet long, with open trestle 1,800 feet long.

GRAIN VESSELS WAITING, OFF PORTLAND, FOR CARGOES OF WHEAT.

tribution. That's the reason they voted to expend two and one-half millions of dollars in harbor improvements immediately. They also have passed an ordinance that places all wharves and docking facilities within the city limits under supervision of the city government. Private corporations also plan to expend something more than two millions in reclaiming land along the river front at Portland.

Farther north on the shores of Puget Sound, the young commercial giant of the Northwest, Seattle, is struggling to free itself from the galling yoke of the corporations. To strike the railroads a mighty blow and also to reach out for its share of the Panama Canal trade is the ambition of Seattle. And when this ambition is realized Seattle will have the most unique harbor in the world.

Seattleites have found that the narrow strip of level land along their water front, facing the Sound, has been gobbled up by the railroads and other corporations. So what do these Seattleites do but decide to make a great fresh water harbor in the very heart of the city and leave the salt water to the private concerns, at least for a while.

The Lake Washington Canal project is the weapon with which Seattle will hit the railroads and bid for the commerce of the world. The Federal government has been coaxed into appropriating a couple of million dollars to construct the locks necessary and the local government has enough money available to do its share of the digging. The plan is to dig a waterway from Salmon Bay—which is a long arm reaching landward from Puget Sound—to Lake Union and then to connect Lake Union with Lake Washington. These two lakes are separated by a narrow strip of land, or were until recently when the last mud barrier was blasted away and the two bodies of water united.

At a recent election Seattle voted a bond issue of $1,750,000 for the improvements to its harbor, including the Lake Washington Canal project. When the canal is completed, which will be in less than three years, Seattle's present water frontage of ten miles will be increased to more than one hundred miles of available space fronting on deep, navigable water.

Another project that will be undertaken with the bonds is that of filling in more tide flats and dredging the Duwamish waterway, which empties into the southern end of the salt water harbor. This will add another twenty-four miles to Seattle's water frontage.

But this isn't all that Seattle proposes to do to the corporations. It is proposed to bring the entire harbor under the control of a harbor commission, consisting of perhaps three members. This board will be a government within itself and will have absolute charge of the water frontage, docks, warehouses and everything that is connected with the commerce of the port. Ultimately it is proposed to establish a belt line railroad under control of this harbor board. At this time Seattle has no municipal or state piers or docking facilities.

No true Seattleite admits that his harbor will not be the largest and best in the world when completed. If you ask a Seattle man how he figures his port will capture the lion's share of the Oriental commerce, he immediately will lead you to a globe. He cannot figure out his arguments on a flat map of the world's surface. After carefully leading you up to the globe he will prove to you that as the earth is smaller around as you go north, the path across the northern Pacific Ocean from Puget Sound to the Japanese ports is at least 1,000 miles shorter than it is from California. He also will tell you that boats sailing to the Orient from the southern part of the coast go almost directly north until about opposite Puget Sound and then take a westerly course out past the end of the Aleutian Islands. A thousand miles is some trip for a big vessel, he will tell you and therefore, the future trade of the Orient will be handled through the port of Seattle.

As to the Panama Canal trade he will point out arguments similar to those of other cities, with the additional point in Seattle's favor of a fresh water harbor and closeness to the markets of the Pacific northwest.

To the landlubber the real value of a fresh water harbor is not apparent. One advantage is that salt water animal life cannot live in fresh water. An example of what this means to shipping is shown by the fact that six hundred tons of barnacles were scraped from the bottom of the armored cruiser *South Dakota* before it made a recent voyage to the Orient. It is necessary to dock and scrape ocean going vessels at frequent periods in order that the sea growth and foulness may be removed. By entering fresh water this growth is removed without the aid of man. With a fresh water harbor thousands of dollars would be saved annually by the shipping interests of the Pacific.

Tacoma, on Puget Sound, has voted a bond issue of half a million for a municipal pier and harbor improvements and is preparing to take the first step in throwing off the yoke of the railroads. This port with its closeness to the grain growing regions is one of the big wheat handling ports of the coast and expects to participate in the benefits of the Panama Canal. Tacoma harbor has

SEATTLE'S SALT WATERFRONT, NOW IN THE HANDS OF PRIVATE CORPORATIONS.

HOW SEATTLE IS STRIKING AT THE RAILROADS FOR OCEAN TRADE.
The corporations having gobbled up the salt water frontage, Seattle is putting through a fresh water canal. Lakes Washington and Union are links in this canal.

plenty of deep water, but its citizens feel they must be up and doing in order to handle the increased shipping expected.

To the ordinary individual the gigantic proportions of the Panama trade are not apparent. But when it is known that eighty-two million dollars' worth of merchandise, originating in the United States crossed the Isthmuses of Panama and Tehuantepec last year, some idea of the enormous trade that will be opened by the canal may be gained. Most of this merchandise was moved across the isthmuses for the mere purpose of transferring it from one section of the United States to another; from the eastern to the western coast or from the western coast and Pacific islands to the Atlantic seaboard. Fifty million dollars' worth of this total originated on the eastern coast and moved westwardly across the isthmuses, four-fifths of it then passing northward to the Pacific Coast of the United States, the other fifth being distributed along the coast of Mexico, Central and South America.

Thirty-two million dollars' worth of goods went eastwardly, two-thirds of it originating in Hawaii and the remainder along the western coast of the United States. The Hawaiian sugar which formerly went around the Horn, now passes over the isthmus by railroad and is transferred to boats and taken to the refineries of Philadelphia and New York. The returning steamships carry merchandise for the western coast.

Figuring even on the present commercial conditions of the section of country surrounding Los Angeles only, $20,000,000 in freight rates on non-perishable goods alone will be saved in a year when the canal is completed. It is estimated conservatively that a million tons of non-perishable freight moves between the eastern states and the Los Angeles territory. The present rate is $26 a ton, while the all-water route will make the rate less than $6, thus effecting the enormous saving. A saving of $6,000,000 to the orange growers of southern California will be made.

When the canal is finished Pacific ports will be within twelve to fourteen days of New York in eighteen-knot vessels. This is figuring that it takes twelve hours to get through the canal. Between the Pacific Coast and European ports the trip should be made in three weeks in eighteen-knot ships. This is a comparatively short trip for the modern vessel. So the Pacific Coast folks do not feel that they will be extravagant in spending one hundred millions of dollars in improving their harbors. They figure that with the canal trade in full swing the hundred million could be saved in a year or so, in the reduction of freight rates. Besides, it's worth it to get this hearty swipe at the railroads.

LIKE PARENT LIKE CHILD

By

RALPH BERGENGREN

IN the basement of a large stone building at Forest Hills, Massachusetts, there are several thousand mice and rats. Fortunately for the other occupants of the building they are all in wire cages. Unlike ordinary rats and mice in ordinary basements, they are cheerfully fed and nicely taken care of. And to complete this extraordinary situation the same basement contains several hundred rabbits and guinea pigs.

The stone building is the Bussey Institution, the headquarters of the agricultural department of Harvard University, and the basement is occupied by the animals used by Dr. William Ernest Castle, of the Harvard Zoological Department, as material for a continuous series of important scientific experiments. Without going so far as to consider this host of guinea pigs, rabbits, rats, and mice literal representatives of the human race they nevertheless pass their lives in affording material for the study of phenomena upon which the continuance of the human race, at its progressively highest level, is obviously dependent. The problems in which they are the living factors in the equation are those of heredity—the transmission of traits from parents to offspring and the possibility of determining in advance the characteristics that will appear from the mating of individuals with whose own characteristics the investigator is already familiar. Despite the occasional startling announcements of sensational journalism, however, men of science generally admit that human beings are more complicated than guinea pigs; and students of heredity in the lower animals turn their practical attention rather to improving live stock than to improving its owners.

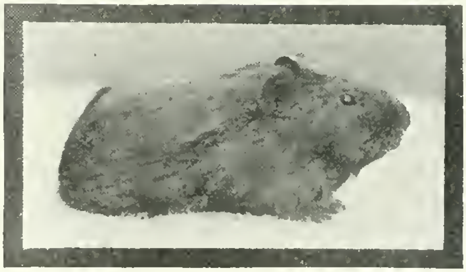
Granting all this, and at the same time remembering Mr. Gilbert Chesterton's remark that the first thing the perfect race of men produced by scientific marriage would do would be to smash the system of scientific marriage, it is fair to argue that the fundamental principles of heredity revealed in the color of a flower or of a guinea pig exist also in the more complicated cases of human inheritance. If study of guinea pigs can throw light on human inheritance, knowledge of the mysterious world we live in is advanced in proportion. The "reversion to type," for example, that every now and then produces a human being surprisingly unlike either of his parents has its analogy when a yellow rabbit is mated with a black rabbit and the result is just such a little gray rabbit as runs wild in the woods. Black rabbit or yellow, each parent contained a different element of the ancestral gray condition from which they had descended. And the combination of these two elements reproduced the gray color of the little rabbit, just as oxygen and hydrogen when brought together produce water. And this, moreover, happened in accordance with a well-established law of heredity. The law was discovered fifty years ago by an Austrian monk studying the flowers in his cloister garden; and it has been proved just as true of animals as of plants by such experiments as those of Dr. Castle with his scientific menagerie in the Bussey Institute basement.

Mendel's Law of Heredity, as this principle is known to scientists, was the result of a series of experiments in the cultivation of garden flowers. The good monk, Gregor Mendel, having leisure, curiosity, and a scientific mind, crossed different varieties of ordinary garden peas and carefully noted what happened. Long continued experiment showed that under certain conditions certain results would follow with sufficient uniformity to establish a law. If a pea with yellow

Albino Female Guinea Pig Whose Descendants Would Normally Be White.

The ovaries of the black guinea pig were transplanted into the body of the albino.

Albino Male Guinea Pig with Whom the Albino Guinea Pig Was Mated.

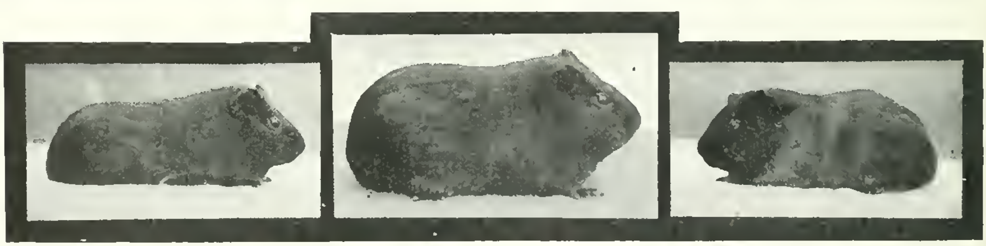


Black Female Guinea Pig Three Weeks Old.
Her descendants would normally be black.

cotyledons—as botanists call the seed leaves of young peas—was crossed with one having green cotyledons all the peas that grew from this crossing would have yellow cotyledons. Apparently what had happened was the extinction of the green characteristic, and if these peas were crossed with other peas that had yellow seed leaves, yellow was still the characteristic seed leaf color in the immediate descendants. But if the peas descended from the first crossing were self-pollinated, or crossed with each other, the result was an average of one green seeded pea for every three yellow ones; and if these green seeded peas were separated and self-pollinated the resulting peas were all green seeded.

In other words, each of these little peas had inherited a characteristic—the green color of the seed leaf—from the first crossing, but this color characteristic did not become visible until two of the peas in which it was latent were brought together; and in every four descendants from this second crossing only one individual showed the inherited green seed leaf color. Yellow, in short, was *dominant*, in that it was most likely to perpetuate itself and green was *recessive* because it could be expected to appear visibly only in a minority of the peas that inherited it. But when it did appear visibly, the result of a union between two of these peas was a continuation of the characteristic green color in the whole family of descendants.

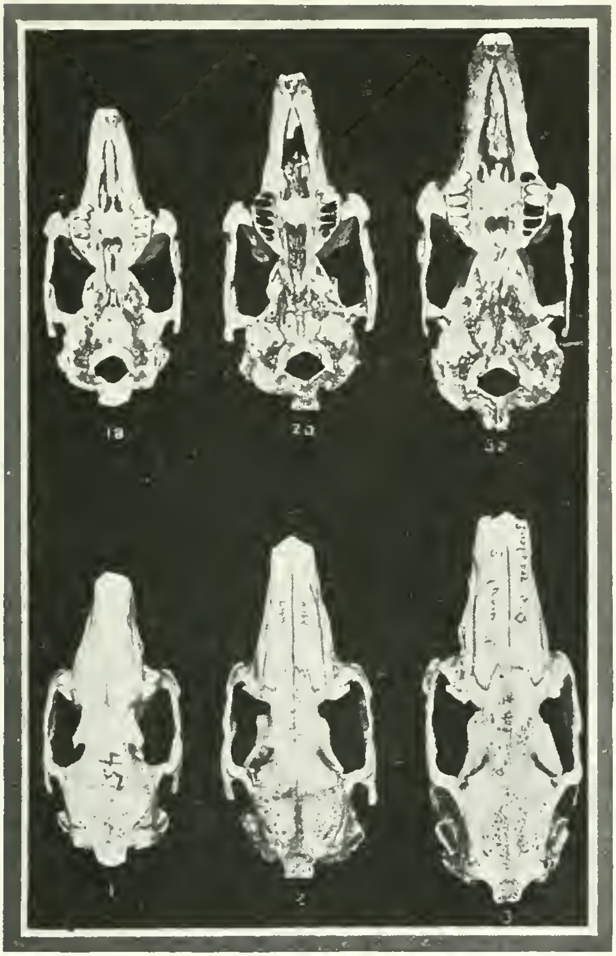
Mendel's Law of Heredity divides transmissible characteristics into these two kinds—dominant and recessive. A recessive characteristic will be invisible in all descendants of the first generation, but will reappear, usually in the propor-



THE DESCENDANTS OF THE TWO ALBINO GUINEA PIGS.

The black color of these little pigs shows that black was the dominant color characteristic and was contributed by the transplanted ovaries of the black guinea pig. In other words, although born of albino guinea pig No. 2, these little guinea pigs are apparently the descendants of black pig No. 1 and albino pig No. 3.

tion of one to three, whenever the offspring of this first generation are mated together; and the recessive characteristic will then breed true or perpetuate only itself. The definite proportion of one to three is said by those scientists who devote themselves to heredity to be "as fundamental to a right understanding of heredity as the law of definite proportions in chemistry." It applies to guinea pigs, mice, rats, and rabbits as uniformly as it applies to the garden flowers. And one of the results of scientific observation of the development of hereditary traits in these little animals points to an explanation which would undoubtedly have deeply interested the Austrian pioneer in his flower garden. The characteristic of color, green or yellow, in the peas with which he was experimenting was resident not in the flowers themselves but in the germinal material which formed the seed leaves of these flowers; and the germinal material of a yellow seed leaf, could it have been transplanted into the body of a flower whose seed leaves were normally green, might have gone on producing yellow seed leaves in its descendants just as if it had never been transplanted. In the case of the animals at the Bussey Institute it has been shown that a surgical operation can make a white guinea pig capable of bearing black offspring.



SKULLS OF THREE RABBITS.

Size usually expresses itself as a blending of maternal and paternal characteristics. The maternal skulls are on the right; the paternal on the left. The skulls of the descendants are the intermediate ones, in the middle.

To say that science watches and records the development of hereditary peculiarities in these lower animals has perhaps already set the reader wondering how these characteristics can be detected. To most of us one guinea pig or rabbit looks very much like another, and one mouse or rat very much like another mouse or rat. Fortunately for science, there are a considerable number of useful differences. There are albino guinea pigs; black guinea pigs; guinea pigs that are only part albino; guinea pigs with long hair like an angora kitten; and yet other guinea pigs that are "rosetted"—a word that describes them when their hair grows in such fashion that they look as if they were always out in windy weather and the wind blowing from every point of the compass. Rabbits have been so long bred as pets that the fanciers have developed many characteristics that are immediately useful in tracing heredity. Rats and mice in bewildering variety have also been produced by the hit-or-

Black Female Guinea Pig and Her Young.

miss methods of fancy breeding, and England has "mice clubs" whose members, just for the fun of it, have long been interested in obtaining fancy house mice with pink eyes and variously colored overcoats instead of the uniform gray costume of the usual victim of the domestic mouse trap.

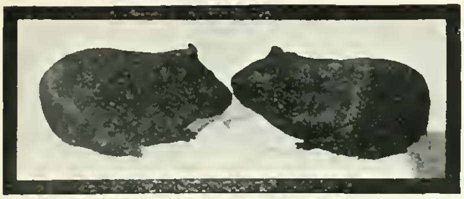
All these differences, secured apparently by chance but really, it now appears, in obedience to a law of heredity, are of direct value in still further testing the uniformity of the law and in getting new lines on the problems of inheritance. In this scientific menagerie the guinea pigs, rabbits, rats, and mice include specimens of practically all the varieties yet produced by experimental breeding. Each has a pedigree, so far back as it can be traced, neatly recorded in a card catalogue, and, as the experiments inspire no fear or distrust of their keepers, they are most of them tame and easy to handle. The rabbits in particular behave very much like those that inhabit little Johnny's coop in a suburban back yard.

A typical working out of the Mendelian law of heredity may be seen in the mating of an albino and a black guinea pig. If a pure bred black guinea pig is mated with a white one all the young guinea pigs in the first litter are black. These baby pigs are apparently the offspring of black parents, although, as a matter of fact, the white parent has contributed something of her own color characteristic and the contribution is unseen because the black color characteristic is dominant and conceals it. According to the Mendelian law the white color characteristic, being recessive, can appear visibly only from the union of two germ cells in both of which this characteristic predominates—and that is exactly what happens when the black children of this black guinea pig with an albino partner are in turn mated. Two black guinea pigs are presumably as surprised as a hen that has hatched ducklings by the appearance of one white guinea pig for about every three black ones in the family circle. The original cross had brought together two characteristics, B (black) and W (white), to make a single individual, B W, which showed only the dominant black characteristic. When these individual B Ws formed germ cells for the continuation of their species there was a return to original conditions; B became the sole characteristic of some of these germ cells and W the sole characteristic of others. When these germ cells united to create a new individual there were necessarily three possible combinations—B B, B W, and W W, the combination B W evidently occurring twice as often as either of the

Albino Father of Black Guinea Pigs.
The youngsters are black because this is the dominant color characteristic, contributed by the mother. In the first generation all the little pigs show this color.

others. And, as any individual containing the dominant characteristic B would be black in color it follows that the combination W W would alone produce a white individual and would be likely to occur on an average of about once in four offspring. Evidently, too, in the case of individuals represented by B B and W W one characteristic had been doubled and the other eliminated.

By applying the Mendelian law in scientific breeding new combinations of individuals or races can be obtained in the course of a few generations. Thus when a guinea pig with a dark and smooth coat is mated with one whose coat is smooth and white, the young will exhibit a wholly new combination, dark and



Two of the Grown Up Descendants of the Black Mother Guinea Pig and the Albino Father.

rough; and if these dark and rough guinea pigs are bred together a fourth combination will appear in the grandchildren of the original couple. Some of these grandchildren will be white and smooth while others will represent the combinations seen respectively in the parents and grandparents. By proper selection of parents any one of these combinations may be established as a pure race of guinea pigs in which the children will invariably resemble their father and mother. Often also a new combination of characteristics obtained through experimental crosses will coincide with some long lost racial combination. The yellow rabbit mated with a black one may produce a certain proportion of little rabbits with the characteristic gray color of the wild progenitors of both father and mother. In the same way occur presumably those occasional surprising cases in human families when a son or daughter developes racial peculiarities not visible in either parent. If their genealogies could be carried back far enough each parent would probably be found to possess an ancestor of the race to which the child had reverted—so, at any rate, we may deduce from the guinea pig.

A case of such reversion, for example, has resulted in Dr. Castle's laboratory in the evolution of a race of four-toed guinea pigs. The laboratory some years ago came into possession of a male guinea pig whose four-toed feet made him unique among all the guinea pigs in the collection. There was no other like him. And yet the four-toed guinea pig one day surprised observers by becoming the father of a four-toed descendant. The mother was apparently normal. The only explanation, therefore, was that she had inherited what might be called the four-toed tendency from some distant ancestor; that this tendency was recessive; and that it could only be perpetuated by union with another recessive tendency of the same kind, supplied in this case by the visibly four-toed father. Selective breeding among the descendants has since "fixed" the type so that it breeds true and adds yet another striking characteristic for the study of inheritance.

There are some characteristics, however, in which so far the Mendelian law does not altogether coincide with the observed results of scientific breeding, although it is now believed that further investigation will discover another application of the same principle. Size is the most important of these exceptions. Whereas color characteristics have been proved to vary with predicable uniformity, size is apparently a permanent blend

Produced by Mating Descendants of Black and Albino Pigs.

In their second generation the white color characteristic contributed by grandfather pig appears in the estimated proportion.

of inheritances. In a typical rabbit family the size of the offspring is intermediate between that of the parents and none of the descendants revert to the extreme proportions of either grandparent. The practical result of this condition is that scientific breeding may produce at will a race of rabbits of any desired size between the known limits of size in rabbits, and with any conceivable combination of color characteristics. The variation in size is apparently continuous and depends upon blending or striking a compromise between the sizes of the parent rabbits. The variation in color depends upon the scientific selection of parent rabbits in which the desired color characteristic is not counteracted by any other.

These transmitted characteristics, it

will be seen, are invariably associated with the parent at birth and are never "acquired" by the necessities of individual existence and then transmitted to offspring. Dr. Castle's experiments, like those of many modern students of biology, tend to disprove the theory that acquired characteristics can be transmitted. Rather they confirm the conclusions of Weissmann, which for twenty years have been the battle ground of biological opinion, that the germ plasm, or reproductive cells on which the continuity of all organic life depends, is independent of the body containing it, and that it is not influenced by the characteristics acquired by that body during the space of a single lifetime. This theory of inheritance casts an interesting and hopeful light on the statistics that are every now and then published to show that the physical condition of the average city-bred individual of today is inferior to that of his immediate ancestors. It would seem to indicate that such retrogression is not the result of inheritance but of environment, and that healthier living conditions in the large cities, together with a wider distribution of population back to the country, would counteract the tendency and produce a corresponding physical improvement. But it is also true, judging by these lower animals, that the statistics indicate breeding from inferior family and racial stocks as a serious factor in the retrogression of a startling number of individuals.

It is still a far journey from guinea pig, mouse, rat or rabbit to a human being, and the thoughtful observer naturally wonders about subtler inheritances than those of size and color. There is the question of inherited intelligence and disposition—and this, in fact, is the next step in the study of the lower animals. Work is now in progress in Dr. Castle's laboratory to investigate the effects of a union between wild and tame animals; the wild rat, for example, mated with a rat that has been domesticated by several generations of captivity. These experiments are recent, but, so far as they have gone, they seem to indicate that the strength and ferocity of the wild creature is the dominant characteristic according to the Mendelian law. The offspring of the wild and the tame rat are in the first generation all apparently as wild as if they had been born of two wild parents, but when the offspring are mated the characteristics of the wild rat appear in modified form in some of the descendants while others seem to lack it entirely. These qualities are readily recognizable and the work of the psychologists with the various kinds of apparatus they have invented for the study of intelligence in the lower animals fortunately offers a means of examination for mental characteristics that are more difficult to determine. The psychological study of individual animals and the psychological examination of their offspring and descendants for inherited traits of intelligence is the next step to be taken by these trained searchers in the investigation of heredity by scientific breeding.

AN APRICOT AS SMOOTH AS A NECTARINE FROM GEOK-TEPE, TURKESTAN.
While smooth apricots are not entirely unknown, this, the "slew-abrikose," is believed to have superior qualities.

PLANT HUNTER IN THE WILDS

By

EDWARD B. CLARK

CAPTAIN MAYNE REID, whose books have made naturalists of more than one American boy, once wrote a story called, "The Plant Hunters." Its title was not particularly alluring to the lads of the generation who looked to their favorite for tales of pure adventure, but before they had read long they knew that they were to get excitement with their botany.

The heroes, there were three of them in the Captain's book, if memory's long shadow does not obscure the facts, were on a plant hunting expedition in a valley of the Himalaya Mountains. The scene of action was laid largely in wild places virtually geographically identical with those which are being searched today for species of plant life by Frank N. Meyer, an American field explorer working under commission of the Bureau of Plant Industry of the Department of Agriculture. Some of Mr. Meyer's experiences are akin to those of the three hunter naturalists whom Captain Reid represented as having been sent out on like errand by the authorities of the Kew Gardens of London.

The adventurous botanists of the old tale were seeking specimens to be dried and preserved for museum purposes. The adventurous botanist of the present tale cares nothing for the cut and dried. His is what David Fairchild of Washington, the Agricultural Explorer in Charge of Foreign Seed and Plant Introduction, calls "a living work."

It is the duty of the man now in a great desert of the Himalayan region to secure seeds or cuttings of plants, shrubs and trees which he considers worthy of introduction into the United States, and to get them quickly to Washington where the work of propagation almost instantly is started.

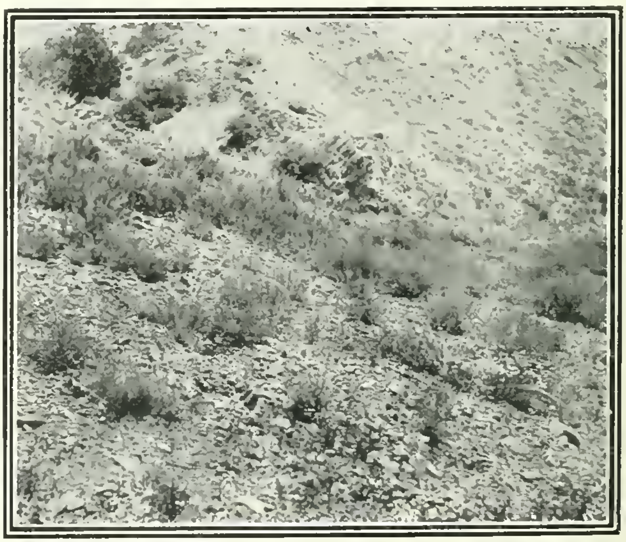
Highly Recommended as a Shade Tree in the Arid Regions of Our Western States.

A drought-resistant species of poplar in Krasnawodsk, Turkestan.

Explorer Meyer is today in a lonely land and before his mission is ended he will pass through still lonelier lands. His collecting journey began at St. Petersburg and it will end at some sea coast port of Eastern China. His trip already has been successful enough to make it worth much more than the money it has cost. He has frozen and melted alternately as the altitudes have changed; he has encountered wild beasts and men nearly as wild; he has scaled glaciers and crossed chasms of dizzying depths; he has been the subject of the always alert suspicions of government officials and of strange peoples jealous of intrusions into their land—but he has found what he was sent for.

A plant hunter! Official and peasant are accustomed to the coming of hunters of wild beasts. They understand the lust of killing and the desire for danger which make men take long journeys into strange places. But a plant hunter!—It seems to them the thinnest pretense to hide some design on the peace of the government or the community. The specimen bag must hold some strange instrument of destruction, the more deadly because it is unknown. The experiences of botanists in the Eastern mountains, though with an added element of real danger, are like those of the peaceful opera glass ornithologist whose sanity is doubted and whose arrest is threatened by the country folk because he prefers to study the living bird rather than to kill it, fill it with cotton and arsenic, and to pierce it with wires for mounting in painful and grotesque attitude.

Admittedly the expression falls within the limits of what the objectors call the bromides, but it is the desire of David Fairchild, the Agricultural Explorer in Charge, and of his fellow laborers in field and Capital, to make such deserts as the United States has to blossom like the rose or, if not the rose, the pear, the apple, the orange, the pomegranate or the olive. The nature



A Wild Grass, Apparently a Species of Rye, in the Mountains Near Bacharden, Turkestan.

of much of the land which is under search today for plant treasures is stony and forbidding, places apparently for the thistle and the thorn, and it would appear that he who looks for fruitage there must be one who thinks "yea" the answer to the question of Scripture, and that grapes may be gathered of thorns and figs of thistles.

The explorer now in the Himalaya Mountains carries in his head a botanical chart of the United States. He finds a species of plant useful or ornamental, or a variety of a species, and by reference to the mental map he knows instantly in what part of the United States it has a chance to flourish and to prove a blessing. He gathers with full knowledge of the locality in which one day Americans may sit under the shade of a Himalaya tree or gather fruit from a Himalayan vine.

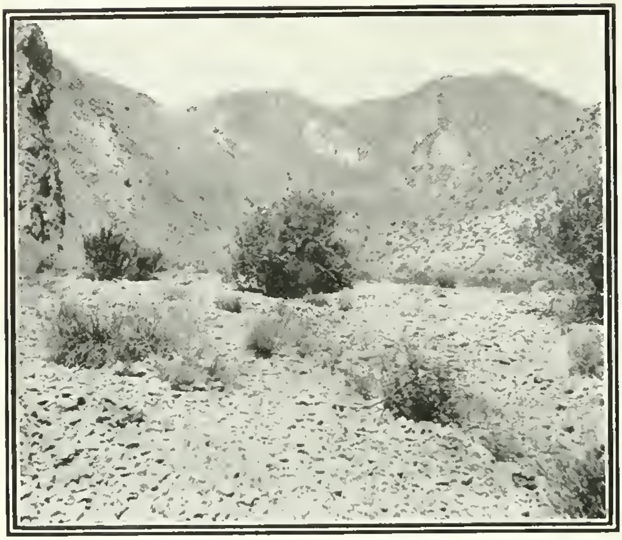
In the plant hunter's head there is also a weather map. He knows the sections of the United States where long periods of drought would wither quickly any form of introduced vegetation whose life is moisture. He knows the places where the rainfall is apt to be excessive and he knows where there are shadow and sunshine in about equal parts. His is a work of selection, and it can be said that in large part the judgment of the plant finder has been justified by results.

Frank M. Meyer, the Explorer, in the Himalaya Mountains.

Americans in the dry country of the Southwest before long may pick from the dooryard trees cherries whose flavor and juiciness will make them forget the yearnings which they have had in the June time for the fruit of the tree which shadowed the New England home. Explorer Meyer found a wild species of cherry (Prunus microcorpa) growing and thriving on the dry mountain sides of Southern Chinese Turkestan. Perhaps in truth it must be called a bush rather than a tree for it is bush shaped and its height is not over ten feet. This cherry soon will be introduced into America.

In passing through the villages along the line of his journey it is Mr. Meyer's habit to visit the fruit and vegetable stalls of the market places. While

An Avenue of the Karakatch Tree, a Specifs of Elm. Eminently fitted as a shade tree for the hot and arid, but irrigated sections of the United States.



A Species of Wild Cherry—*Prunus microcarpa*—Capable of Resisting Great Drought.

in Geok-Tepe, Turkestan, he found a smooth skinned apricot on sale. It is as smooth as the nectarine and its color is a pale yellow. It is a juicy, delicious fruit known locally as the Slew-abrikose. Smooth apricots from the American grower's point of view, are things much to be desired, and this particular fruit the explorer found to possess superior qualities of flavor. He found out where it grew and today under care of the experts in Washington the apricot is under "process of propagation" and ultimately it will be sent to the American apricot lands where the hope is it will flourish and yield abundantly.

The history of the introduction of new kinds of alfalfa into the United States with a view to proper selection and distribution, so that the proverbial benefaction of making two blades of grass grow where one grew before may be outdone, has been written again and again in agricultural history, but the search is never over. Explorer Meyer is looking for new kinds of alfalfa, kinds which may prove to be better adapted to the soil of some parts of the United States than those which already have been tried.

No grass and no grain is too humble to escape the plant hunter's attention. To Washington from the mountains near Bacharden, Turkestan, has been sent a wild grass, apparently a species of wild rye, and when under the gentle ministrations—plant lovers are always gentle handed and gentle hearted — of the Capital botanists the promise of the rye reaches fulfillment the work of distribution will be begun, and it may be that through it some of the country's waste places will come to a green redemption.

Travelers agree, Mr. Fairchild says, that the most beautiful tree in Turkestan and perhaps one of the most beautiful in the world is the Karakatch. It is a species of elm, the Ulmus campestris umbraculifera, the shade bearer. Word has come from Mr. Meyer that this tree eminently is fitted for planting in large numbers in the hot, irrigated sections of the United States. This introduction will be pushed in regions where trees of adequate shade are desired, but where experiment has shown in the past that many species have failed to respond to irrigation.

From the foothills of the Himalayas has come a drought resisting species of poplar. In the arid and semi-arid regions of the western states where irrigation is not possible, or as yet has not been accomplished, there is a demand for shade trees for home yards and parks. Attempts have been made frequently to find a promising subject. Explorer Meyer thinks that in this poplar, the Populus pruinosa, he has found something which will grow and give grateful shade to the families living in dry regions where the cold of winter is not too severe.

Seeds and cuttings of scores of species of plant life have come out of the country already traversed by the American plant explorer. Perhaps if one in twenty of the discoveries upon introduction into this country proves to be of lasting value the results will be worth the labor, the disregard of danger, the personal devotion to duty of the hunter, and the money spent by the government which commissioned him to the search.

The explorer of the deserts must be a botanist, but he must do much more than is done by the ordinary botanist of the field. He must know what many men who are botanists only do not know, how to get his material with the germ of life still active across deserts, countries, continents and oceans. He cannot be sure always that his collections will stand the long journey to Washington from the point of gathering. In this case frequently he must send them ahead of him to the coast town from which ultimately he intends to take his departure, there to be planted and to grow until he can regather them from the soil to make them his jealously watched companions on the last stage of his journey.

David Fairchild, the Agricultural Explorer in Charge of Foreign Seed and Plant Introduction, Bureau of Plant Industry.

As soon as consignments of cuttings or seeds are received in Washington by David Fairchild they are turned over to the entomologist who examines them carefully for insect pests. Then quickly they are given to a pathologist who examines them for diseases and then if all is well with the importations they are put into alien but kindly soil "and started to growing."

The Bureau of Plant Industry for several years has been at work introducing new and promising species of vegetation into the United States. What has it done? Improved alfalfa, thick growing, and enriching fields to which the plant was a stranger, are one answer to the question. Alfalfas have been brought to this country from the Andes, the Himalayas, the Gobi Desert and from Australia, in all perhaps seventy-five kinds. Experiments in interbreeding have been successful and the American alfalfa range rapidly is being extended.

From Southern California and from Arizona recently there have been sent to market five tons of dates, the fruit of palms introduced and grown successfully by the exploring scientists. In Florida the mango industry is today upon a commercial footing. Explorer Meyer now in the Himalaya Mountains, some years ago found in China a puckerless and seedless persimmon. He sent cuttings to Washington where they were grown successfully. Then they were shipped to places in the Southern United States where it was believed they could be cultivated. Today ten acres of puckerless, seedless persimmons are under cultivation in Georgia by one of the largest fruit growers in America, a man who has faith in the word of the plant finders.

Out of China recently the government's explorers brought a new cherry, which was sent to Southern California where it took kindly to soil and climate and gave return for the work expended by a crop of fine, marketable fruit which was ready for the picking two weeks in advance of any species of cherry known to the state. A red currant, the Ribes petraeum, brought from the Altai Mountains has proved in St. Petersburg to be a thrifty grower, and a producer holding promise of a successful American future.

Cuttings of ten forms of olives of the hardiest kind known, have been sent from the far east to the gardens of the American Capital. It has been proved that these olive trees will stand a temperature of —2° Fahrenheit which kills American olives down to the ground. Apples, pomegranates, wild peas and hardy oranges are other introductions, some of them already acclimated, bearing juicy fruit, fine flavored and grateful to the eyes of the market man and the buyer.

Disappointment comes frequently and always painfully to the men of the Explorer's Division of the Bureau of Plant Industry. Time after time attempts to bring to this country living seeds and living shoots from places far distant have failed, but the death of the plant does not bring death of hope. Five times attempts were made to secure from Chili the seeds of a plant relative of the Alligator pear with the germ of life still in them, and five times failure came. Finally the explorer has planned to swing a cradle of moss underneath the fruit of the tree to catch it as it falls ripened from the stem, knowing that in this way he can be certain of an absolutely fresh seed supply.

The work of David Fairchild and his fellow scientists is one of propagation and distribution. The aim is to put new forms of plant life into the hands of the agriculturists of the country. It is the development of a new type of field work. It is experimental of course, but no experiment is tried without previous study to make certain that kindred conditions of soil and climate exist between the place of the species' origin and the place where it is to start life anew in an environment which, the anxious plant lover's constant prayer is, it will not find uncongenial.

LIGHT-PRODUCING ALLOYS

LONG before the modern process of using chemical preparations, fire was kindled by the use of flint stones which by concussion emit sparks.

This method of lighting inflammable materials has been restored by the use of other metals producing, under the action of a shock, sparks hotter than those obtained with the ordinary steel and flint. Metallic uranium will ignite a mixture of air and fire-damp; scientists have discovered that this mixture must remain a certain length of time in contact with the uranium before igniting. The phenomenon is its delay to take fire; this delay of 10 seconds at the temperature of 650 degrees, diminishes in proportion as the temperature increases, for a delay of only one second the temperature must be increased to 1,000 degrees.

The temperature of the sparks from uranium is then above 1,000 degrees.

Sparks forced from iron whether by an ordinary steel and flint or by the stroke of a miner's tool will not ignite the mixture of air and fire-damp.

Sparks from uranium readily ignite cotton wicks saturated with alcohol or benzine. It was decided that this metal could be utilized for making very simple lighters, by placing a piece of uranium in a movable support pressed by a spring against a steel surface covered with points arranged in such a way that the sparks produced would be projected into the gas jet or on the wick to be lighted.

This very ingenious idea which was not applied because of the high price of uranium is now going to be realized because of the recent utilizing of the substance cerium.

In 1906 Dr. Auer of France attracted attention to cerium by a patent concerning an alloy of cerique metals with iron; by this alloy small pyrophoric sticks under slight shocks will emit very hot sparks.

A new alloy, the Kunheim alloy, is composed of cerique metals with the addition of iron and magnesia. It ignites more readily than the preceding alloy, and may be utilized for lighting gas jets, while the Auer metal is especially adapted to pocket lighters.

SUBSTITUTE FOR SHORTHAND

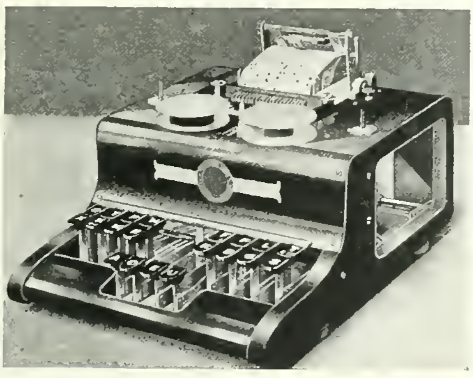
By

ROBERT H. MOULTON

A FEW years ago an important law-suit was being tried in a court of one of our large cities. A dozen witnesses, representing each side of the case, had been heard and their testimony duly recorded. The most important witness, however, and the one upon whom the defense chiefly relied to support its contentions, was reserved until the last. When he finally took the stand, judge, lawyers and the other court attaches leaned eagerly forward in order not to miss a word of what might be said, and the official court stenographer prepared to take down his testimony. The examination began, and the witness proved to be such a rapid talker that the stenographer, one of the most expert in his line, was forced to exert himself to the utmost to keep pace with the questions and answers that were plied back and forth.

When the examination finally was concluded, the stenographer leaned back with a sigh and congratulated himself that he had made a record for speed and —accuracy? Well, he had passed successfully through similar experiences before and there was no reason why he should feel that he had made any errors in this instance, or doubt his ability to correctly transcribe the queer assortment of hieroglyphics that covered page after page of his note book. Besides, if there was any doubt in his mind, he could easily communicate his perplexity to the judge, who would re-examine the witness and —but just then a dramatic incident occurred. The witness was seen to sway in the chair and then topple forward, dead—a victim of heart failure.

This incident so unnerved the stenographer that when he set to work a few hours later to transcribe his notes he found more than the usual difficulty in deciphering them. Still he finished his work with the consciousness that he had performed his task well. The half dozen or so of words about which he had been in doubt could not affect the result of the trial materially anyway—at least that is what the stenographer thought. But when a few weeks later the case was decided by the judge, it went, very much to the surprise of all concerned, against the defense. In reading his decision the judge dwelt with some emphasis upon certain words in the testimony of the chief witness and which, he declared, had led him to arrive at his conclusions. The stenographer recognized in these particular words the very ones about which he was in doubt when transcribing his notes, and he was troubled. If he had been absolutely sure of himself, might not the whole case have been decided differently? But now it was too late to do anything in the matter.



The Machine Which Does Away with the Stenographer's Pad and Pencil.

This is only one of many instances wherein the inability of stenographers to read their shorthand notes correctly has re-

T H EU S EU S A S P E S P H E PB O F T H E W O R B G W R EU T E PB	 (specimen) (written)	This is a spes i men of the work writ en
T O R E T S W E L S T O W R EU T EU T U H A P T O T P B O A T P U K O T S EU PB S	 (read) (you) (have) (know) (few) (code) (signs)	To red as well as to write it u haf to no a fu kod sins
T O E T T R E S W R O R TS EU PB S H O R T H A PB T U H A P T O T P R O T H E R O L T H EU PB G	 (read) (these) (you) (have) (know) (whole)	To red thes words in short hand u haf to no the hol thing
EUP W R EU T S H O R T H A PB T U T P R O R O U H A R T EU T EU S T O R E T EU T	 (you) (write) (you) (know) (how) (read)	If u writ short hand u no hou hard it is to red it
P H A R T P * S * T S * S *	(March) (1911)	Mar 23 19 1 1

THE NEW STENOGRAPHIC CODE AND ITS KEY.

EU equals I; PH equals M (initial); PB equals N (final); BG equals K (final); final T equals T or D (context invariably distinguishes); S equals Is or As—in phrases initial or final); TPH equals N (initial); TP equals F (initial). The following letters, when appearing on the same line with asterisk, become figures instead, as: S with the asterisk equals 1; T with the asterisk equals 2; P with the asterisk equals 3; H with the asterisk equals 4, E with the asterisk equals 5; F with the asterisk equals 6; P with the asterisk equals 7; L with the asterisk equals 8; T with the asterisk equals 9; O with the asterisk equals 0.

sulted in much trouble and confusion. This defect in a marvelous system of taking down the words of a speaker verbatim is one which numerous inventors have labored to correct. Mechanical aid of some sort seemed the only solution of the problem, because there are limits beyond which even the swiftest hand and the keenest and most accurate mind cannot go. So these inventors set to work to perfect a device that would replace shorthand. But none of the many machines on which patents were claimed seemed capable of fulfilling all the requirements that would be exacted of them.

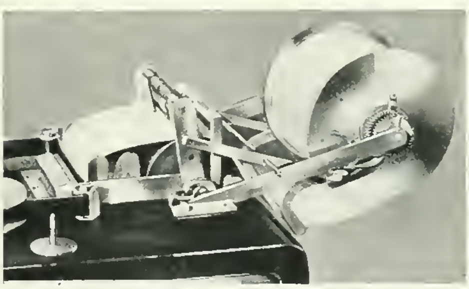
There has recently been put upon the market, however, a dictating machine, called the Stenotype, which its inventor claims will do for shorthand what the typewriter has done for longhand. It is not intended to replace the typewriter, but to be a companion machine to it. It is said to eliminate the greater part of brain work in taking dictation, and to make this work a matter of practice rather than mental strain. This claim certainly makes it look rosy for those who have heretofore found the stenographic pace too fast. Instead of learning stenography the student will only need to learn to operate the dictating machine.

Shorthand is difficult to master and many students of it never become proficient, while those who may be termed experts are comparatively few. This is proved by the number of those who fail in taking the Civil Service examinations for Uncle Sam. The speed required to pass is only eighty words per minute, which probably defines the speed limit of the average experienced stenographer. The trouble is that in shorthand there are too many mental operations to be performed—six for every word, in fact. It is claimed that the dictating machine will cut this in two.

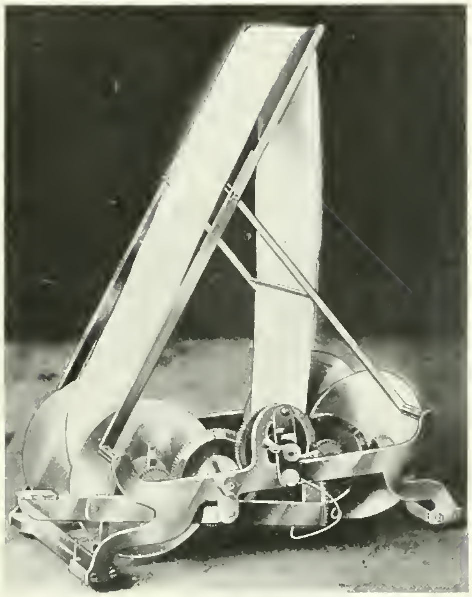
The training and practice necessary to be able to make all the characters in any system of shorthand—the dots and dashes, big and little circles, long and short characters, the curved and straight lines, and the light and shaded lines—accurately and while going at any speed requires months and often years. And then there is the serious question, already referred to, of legibility in transcribing these characters after they are once made; for often the same character will mean different things when above, below or on a line, different things when shaded, and still other things when lengthened or shortened.

The dictating machine is said to do away with this question of legibility entirely, since it writes in plain type-letters, so that no matter how fast one writes the letters are always properly executed. For this reason one person can read what another has written just as easily as he can his own work, a thing which is practically impossible in shorthand. It also leaves a permanent record, which can be transcribed at any time; and this is another advantage over shorthand, for every stenographer knows that the longer the time that elapses between the taking of shorthand dictation and its transcription, the more difficult the task becomes.

It is possible for an expert user of the typewriter to take slow dictation directly on the machine, the average speed in this connection being about sixty words per minute, which means that the typewriter is given about four hundred strokes, including spacing, in this length of time. As the new dictating machine is designed to write over a word a stroke, the spacing being done automatically, it will be seen that even if it is struck only half the number of times that is required in ordinary use on the typewriter, it will



THE RIBBON REWINDER.



THE COPY HOLDER, FROM WHICH THE TYPIST READS HER MACHINE-MADE NOTES.

still be writing almost four times as many words as the latter, and more than twice as many as the average stenographer can take down in shorthand in the same length of time.

The most remarkable feature of this machine is the keyboard, which contains only twenty keys. All of the missing letters on the keyboard are secured by combining certain other letters. These combinations form what is called a code, and it comprises the entire brain work in connection with the machine. The code is so small—there are only eight combinations for letters and ten for figures—that it can be memorized in a couple of hours. It has been figured, however, that the average boy or girl, just out of school, can memorize it and read fluently in a week or two any matter that may be written on the machine.

The keys are built to fit the fingers, and as each finger has but two keys to operate, the keyboard is always under immediate control. At the top of the machine is a bar, which may be struck in conjunction with the top row of letters and with any finger. This is called the figure bar and prints an asterisk in the centre of the piece of paper on which the writing is done. The code tells that whenever any of the top row of letters are printed on the same line with the asterisk, they become figures instead of letters.

Another interesting feature of the machine is the rewinder, which automatically rewinds the paper as fast as it leaves the keys. The power generated by striking the keys, or any set of keys, is also the power that operates the rewinder. The paper is wound upon a spool, which is removable for the purpose of placing on the copy holder. The copy holder is a separate contrivance designed to facilitate the transcription of notes. By pressing a key on one side of the copy holder the paper is fed forward page by page, so to speak, as fast as may be desired.

In business offices where speed is an essential factor the dictating machine should result in a great saving of time. One person can transcribe while another is taking dictation, thus having mail ready for the dictator to sign almost as fast as the dictation is finished. It has been figured that four operators on the dictating machine can do the work of five in shorthand—a clear saving of twenty per cent. And time is money. Consider what this would mean in offices where from twenty to a hundred, and sometimes even as many as three hundred stenographers are employed.

The dictating machine should also be the means of reducing the cost of tuition to students of shorthand very materially. Probably a quarter of a million of new students are turned out by the shorthand schools of this country each year. As the time required to learn to use the dictating machine should not exceed two weeks, while a course in shorthand may run anywhere from as many months to a year—well, figure it out for yourself.

MOVING-PICTURE PEOPLE TO TALK

HEREAFTER the phonographic discs of popular songs will be accompanied by picture-discs to illustrate them, when the device of a California inventor is placed on the market. The song illustrator is a very ingenious device which can be attached to an ordinary talking machine and its principles may be briefly explained as follows: a disc about the size of a song record contains sixteen lantern slides which are set in small circular openings near the circumference. This picture-disc is adjusted so that the motor of the phonograph causes it to revolve, a couple of inches or so at a time, stopping for a brief interval as each picture is brought before the lens. The lens and light which are designed on the principle of the stereopticon, can be adjusted to the ordinary type of horn, and electricity, gas or kerosene may be used to project the picture upon the screen. The latter is a hoop of about 16-inch diameter over which a piece of thin, white cloth is drawn taut. It is attached to the flare of the horn by an adjustable bracket so that the screen hangs in front of the large opening.

Talking Machine Which Will Accompany Moving Pictures.

The machine shown in the accompanying illustration is equipped with a 16 candle-power electric light and is designed for parlor entertainment, but by using a more powerful light the pictures can be projected on a much larger screen at a distance, thus serving for use in a hall or auditorium. By using a larger song-disc, fifty or more slides can be set at the circumference, and it would serve for advertising purposes. This ingenious device is the invention of a clerk in a Los Angeles music store, Mr. Harry Clubb, who has spent two years in perfecting his invention.

AUTO COMPETES WITH RAILROAD

By

LEONARD McKEE

THE West is supposed to look to the East for new ideas, but occasionally the coldly practical minds of Westerners evolve an idea far ahead of what is considered within the range of possibilities to the Eastern minds. For instance, five years ago, the East did not consider the automobile a practical utility, yet away down in the Southwest a little, grey-eyed man sank all of his available funds in machines and established an auto route to compete with one of the greatest railroad systems on earth. His line was a success and now he not only carries passengers but holds the mail contract as well.

It was in the summer of 1905 when a doctor brought the first auto into the Pecos Valley. At Roswell, a hotel man, J. W. Stockard, became interested in the possibilities of the machines and bought one. After running it around some, he conceived the idea of an auto line between Roswell and Torrance, New Mexico. At that time, in order to get from Albuquerque to Roswell, you had to go north to Trinidad, Colorado, then to Amarilla, Texas, and there you could get a train into Roswell. But by driving overland to Torrance, a hundred and five miles, you could make far better connections. Stockard figured he could make money with a regular auto between the two points, Roswell and Torrance. Instead of taking the regular wagon road he set out one day with a compass and a camping outfit and staked a new path across the rolling prairie. Along this path he scraped two bare streaks, and that completed his road.

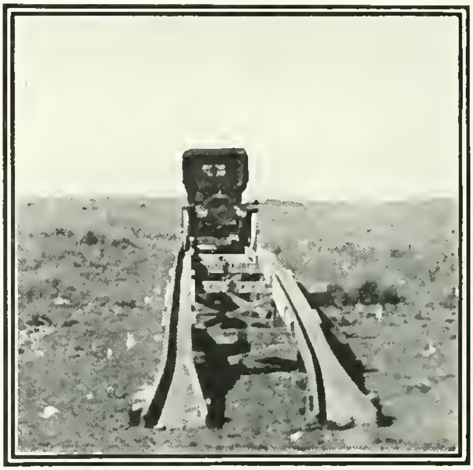
From the beginning the line was a success. Traveling people saved both money and time as well as having one of the oddest trips to be had in this country. Nine hours were consumed in making the hundred mile run and the machines never broke down. Finally an agitation was started for the route to carry the mail. It took as long for a letter to go to Kansas City as for one to go to Albuquerque, and the daily papers were two days coming through. The railroad naturally opposed the move, but in the fall of 1905 the mail contract was taken from the Santa Fe and given to the Roswell Auto Company. As the line connected at Torrance with the Rock Island and the Santa Fe Central this brought the mail from the East as well as from the West.

In July, 1910, the Santa Fe finished

AT THE HALFWAY HOUSE, WHERE NEW DRIVER AND CAR ENTER FOR THE RACE AGAINST STEAM.

their great Belen Cutoff between Belen and Clovis, and to facilitate handling mail the route was changed to Vaughn where the Santa Fe crosses the Rock Island. The distance was about the same but Stockard had to build an entirely new road. This was easy, for by this time his inventive mind had evolved a patent road drag which broke, smoothed and rolled a new road all in one operation.

The cars which were bought when the line started were two-cylinder chain-drive cars of about twenty horse power, and were used continuously on the line till this fall when three new cars of the same make but far more powerful, four cylinder, and carrying seven passengers were bought and put into operation. The old cars had each run a little over 130,000 miles on the line, and are still in use around Roswell, one being the "ambulance" car at the garage.

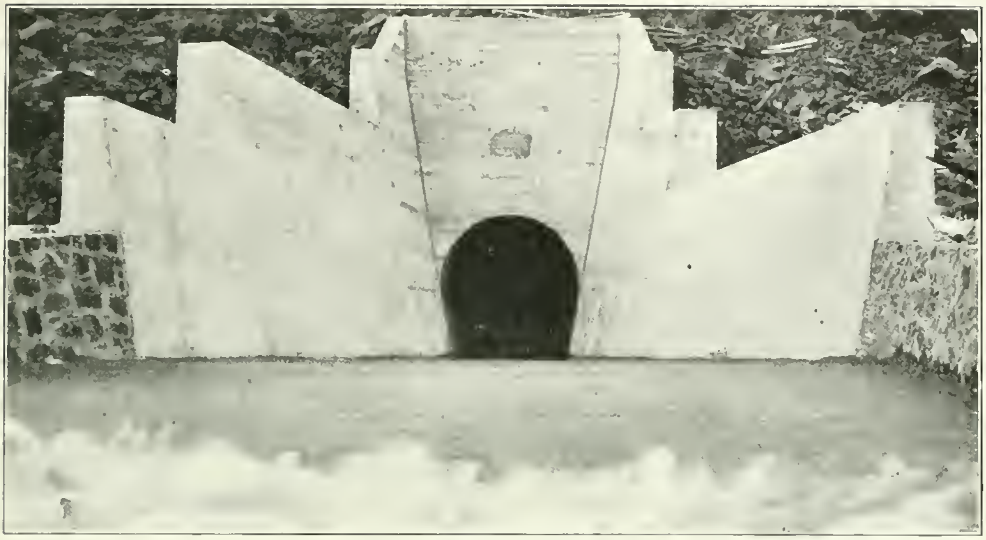


One of the Special Auto Bridges in the Desert.

With the change to Vaughn came an increase in the amount of mail, in fact so great a quantity had to be carried as to necessitate the use of an extra car on many occasions. When no extra was run there was no room for passengers. So Stockard retired to think and in due course the "dingle" wagon was built. This is a little rubber-tired canvas covered wagon which is hitched to the back of the motor car with a patent connection (to make it track) and in which the mail and baggage is carried. The big machines have no trouble hauling this car when it carries up to a thousand pounds of mail, and can easily make the whole trip on the high gear.

As there is something like $9,000.00 a year paid for the hauling of the mail, the railroad again tried to get the contract which expired a short while back. They can make the trip between Vaughn and Roswell in nine hours if necessary, and said so. Stockard said he could beat nine hours so the Government did a little figuring and called on him to make the trip in five hours flat, if he wanted the new contract. He ran one of the cars through and set four and a half hours as the new schedule time. This means an average of between twenty-five and thirty miles an hour, counting out the time necessarily consumed in the slow driving in town and on bad places. However, the cars have no trouble making it though it is hard on the drivers as the strain is so constant. The auto-mail driver cannot loll back occasionally as can his brother in the engine-cab, for one second's relaxation might mean a bad "smash." So the drivers and cars are changed at a lonely ranch in the middle of the desert, thus each driver makes the round trip every three days. This plan too, prevents any possibility of a passenger having to "lay out" all night in case of accident for if a car becomes overdue at any point on the line the reserve car goes out to get it. No passenger has ever had to lay out, but there have been occasions when the mail could not get through on account of the deep snow. A storm which ties up the auto line also blocks the railroad and often a storm which blocks the railroad does not bother the autos much for cars are running back and forth all the time and the road is kept fairly clear.

In the narrow washes or "arroyos" the snow will occasionally pile up and then a big home made car called the "Yellow Kid" is used to buck the drifts till a way is broken through. Last winter one of the drivers rammed the Kid into a drift and it took two weeks to pull it out.



HOW THE CONCRETE IS SET.
The south entrance to the diversion tunnel of the great irrigation project in southern Idaho.

IDAHO'S HUGE "MAGIC DAM"

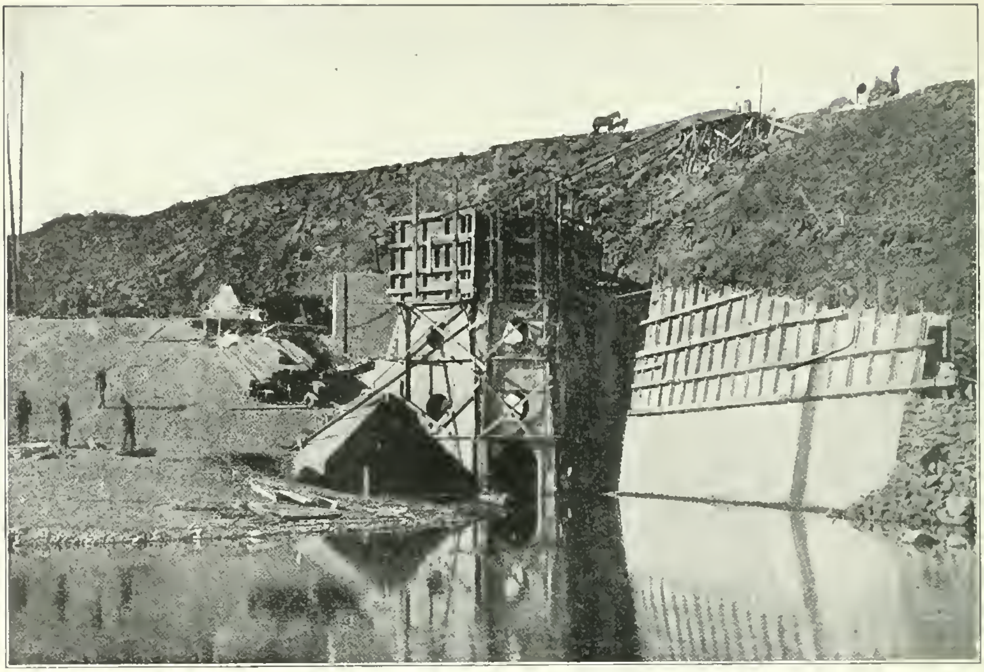
By

DAY ALLEN WILLEY

PAST volcanic eruptions have resulted in a very large area of southern Idaho being covered with a deposit of what is known as volcanic ash. This material is known for its richness when properly irrigated, as is shown in the Hood River valley in Oregon, lying between the extinct volcanoes of Mount Baker and Mount Hood. Here orchards produce some of the finest fruit grown in America, especially apples.

The portion of Idaho covered with volcanic ash caused plans to be considered with a view to irrigating a part of it from what are known as the Bigwood River and Littlewood River which rise in the ranges of the Smoke and Sawtooth Mountains. The water shed serving these rivers is estimated as sufficient to irrigate fully 150,000 acres which are located in four sections of the state, the largest tract aggregating 55,000 acres.

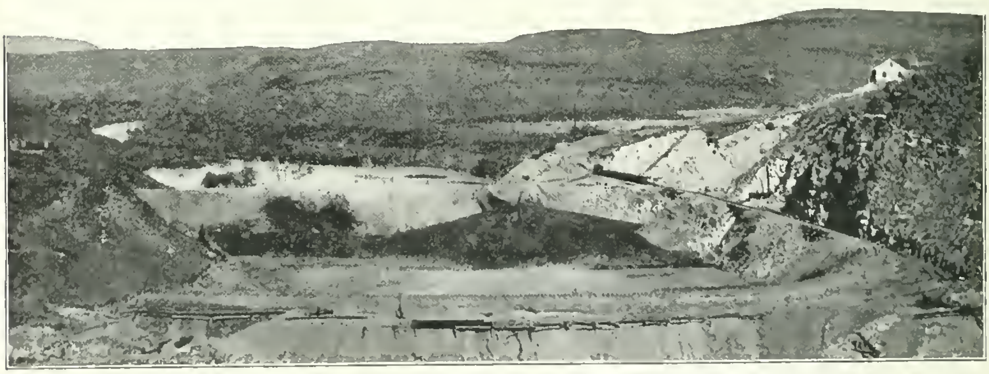
To conserve the water necessary to insure permanent and adequate irrigation it was necessary to form a barrier across a gorge through which the main river flows. The formation at this point is of such a character that it would be impossible to erect a masonry dam. The distance from the nearest railway transportation, twenty-five miles, also entered into the problem. The natural course of the river is over a bottom which is composed of sand, some clay and strewn with bolders and rock fragments which have fallen from the canyon sides, and have been washed down by flood currents. The depth of this material has been found to be as great as sixty feet lying above the foundation of hard rock. On each side of the canyon the forma-



A PORTION OF THE EMBANKMENT.
The fill and the intake tower serving the diversion canal are here shown.

tions are largely granite, but on the west side this deposit is covered with a mass of loose material, such as volcanic ash, to varying depths. By damming the gorge, this would be under water.

An examination of the proposed site and surroundings convinced the engineers that the only practical method of creating a reservoir was to make an earth fill embankment protected at each end with a reinforcement of rock, also auxiliary work to prevent leakage or undermining at the bottom or where the ends of the embankment were set into the canyon sides. The varying volume of water in the river and the great difference in the current at flood height were factors in the problem. One of the mountain water courses having a channel of rapid descent, and as stated carrying down yearly much debris in the flood season, the flow of the Bigwood as meas-

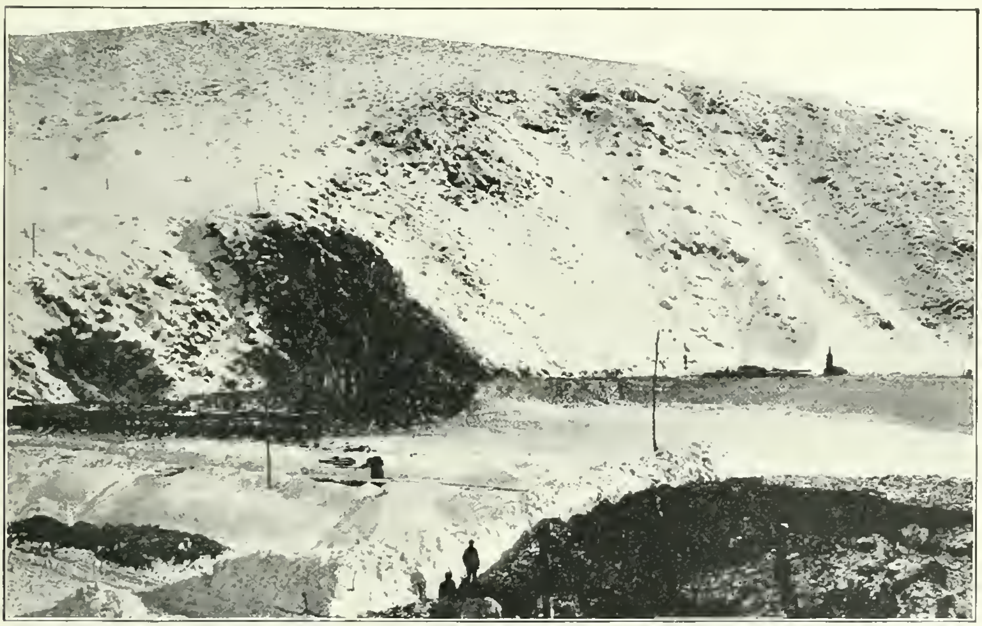


GENERAL VIEW OF THE BIGWOOD EMBANKMENT, LOOKING UPSTREAM.
The south and the north enclosures, the earth and rock formation, the rock-filled toes, and the enormous area filled with earth are shown. At the left can be seen the rock deposits used in making a part of the fill.

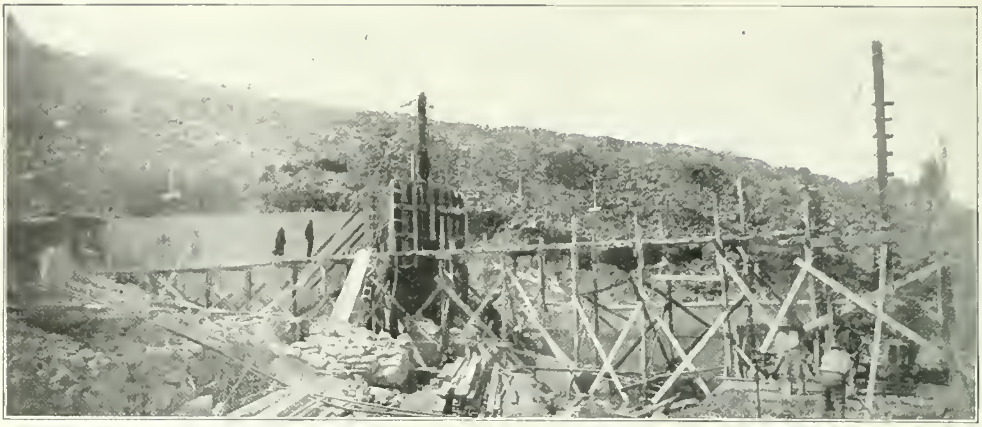
ured for a series of years at the site of the dam ranges from two hundred cubic feet per second in the dry season to 6,000 cubic feet in May and June, when it is filled with the waters from the melting snow of the mountains. The work must be strong enough to resist the enormous force of the flood currents also planned to divert the surplus water in an emergency and thus aid in relieving the pressure.

This is why the embankment forming the reservoir, when completed will be by far the largest yet planned in this country and the greatest in the world for restraining and conserving a river. The figures give an idea of its dimensions. At the center it is no less than 789 feet in thickness, rising to a maximum height of 140 feet above the natural bottom of the river, while the length of the main dam is 623 feet. To this, however, is added an earth dike 2119 feet long extending from the west side, forming a barrier to hold back the overflow of the flood where it has but little current. Simply speaking, the work is an enormous fill. Compared with the great Roosevelt dam its base is nearly five times as great in width. It has what might be called a "back bone" of steel but this is the only material in it that is not rock, sand, gravel and ordinary earth.

In creating the "Magic Dam," as it has been called, some very interesting preliminary work had to be performed. The engineers found they could economize time, labor and material by first preparing the sides of the gorge where they joined the barrier. Chambers were dug into each side to a distance of forty feet, all of the loose material such as sand, loose stone and fissured rock being cleared away, so that the ends of the dam would rest against the solid rock. A curious feature of this work was that the material removed was used for building up the "toes" of the two barriers which inclose the embankment—known as the up stream and down stream dams. Much of the composition of these dams was taken from the excavation in the canyon sides and the balance needed from quarries. The type of the dams is the rock fill and they were constructed from each side by dumping the rock and finer "spoil" from cars on tram roads reaching to the excavations. Portable derricks placed in position the larger rocks. By the plan an opening was left



THE EXCAVATION WORK IN THE HILLSIDE, WHERE, LATER, ROCK WAS SET INTO ROCK.
View of the gorge at the dam site.



THE CONCRETE APPROACHES TO THE NORTH PORTAL OF THE DIVERSION TUNNEL, UNDER CONSTRUCTION.

for the river channel and the work was but slightly interfered with during high water. In July, 1909, the dams were so far advanced that advantage was taken of the low stage of the river to close them.

The first work done on the project, however, was the building of the diversion tunnel, cut through the west wall of the gorge, a distance of 591 feet, and lined with concrete. This tunnel is large enough to convey half of the river flow at flood and was built first in order to divert the river current at high water and minimize the pressure on the uncompleted works. It will be utilized permanently to serve the irrigating system. The method of receiving and distributing the water is by means of an intake tower. This is composed of concrete, is one hundred and thirty-seven feet above the foundation of the dam, and is designed in octagon form, to offer the least resistance to water pressure. The water from the reservoir enters the tower through several openings to minimize the pressure within, and is thus carried into the tunnel. The water reaches the tunnel through two water gates, five feet in diameter, which are operated by hand. This unique water distribution is connected with the embankment by a steel bridge of two spans each one hundred and fifty-three feet in length. When the engineers were ready to close the dams, this tunnel carried away most of the river flow and the Bigwood was barred in July, 1909, as stated.

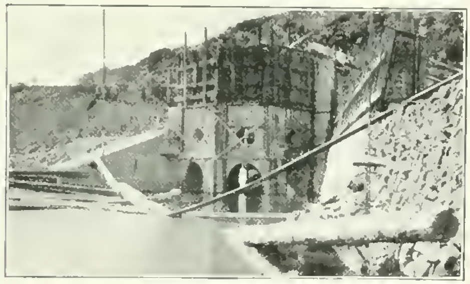
With the ends of the embankment completed the river channel between them became a pond which drained under the down stream barrier as an aperture had been made for letting it escape. Operations were now begun in building the "back bone" already referred to. A trench thirty feet wide and ten feet deep was dug along the axis of the embankment connecting with the excavations made in the side walls of the gorge. Into the trench for its entire length, was driven a row of steel sheet piling, down to solid rock, the top of the piling extending to a height of several feet above the top of the trench and ten feet upstream from the axis. This work was done to prevent any possible seepage of water through the embankments and is also intended as a reinforcement to the earth work.

The system employed is notable for its economy, and capacity, contrasted with what it accomplishes. The material is readily taken out by steam shovels moving on tracks. Such is their capacity that the shovels excavate 90,000 cubic yards a month with their automatic filling and emptying buckets. The spoil is dumped by the buckets into tram cars on railway tracks running to the material pits, then hauled to the edge of the fill where it is to be deposited or at some point up stream from the place it is to fill.

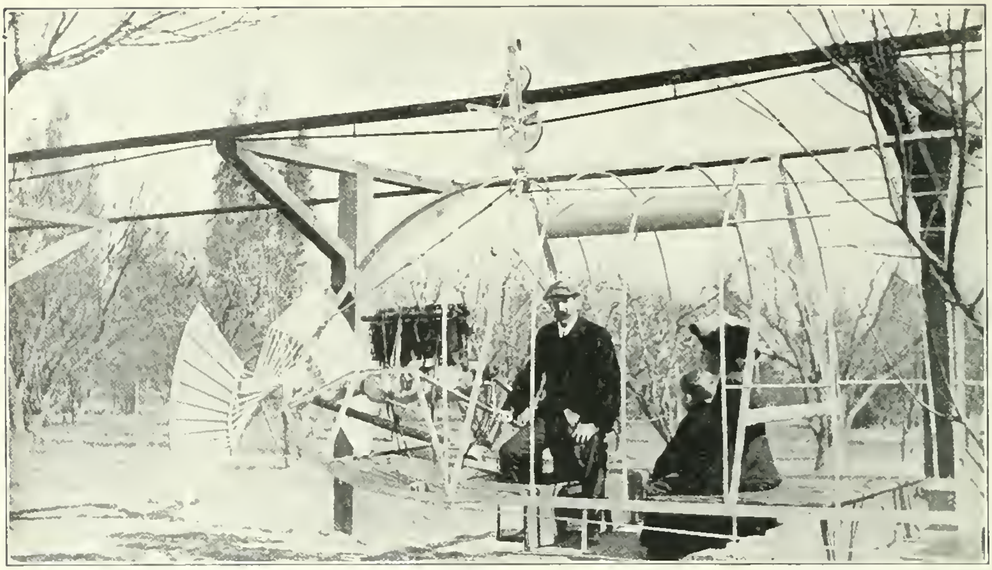
Then it is forced into the embankment by hydraulic jets—literally washed into position as the gold of the placer mines is extracted by the stream of water. One advantage of this method is that the filling is done more compactly and firmly than it could be formed by throwing in the material and grading it with the shovel or otherwise. As fast as the dump cars are emptied through their hopper bottoms, a stream of water is turned on the pile from the nearest pipe connection thus forcing it into the fill without the necessity of any human labor in grading or distribution. The drainage is such that the water leaves the newly made formation in a few hours.

As to the formation of the dams or borders of the work, the down stream structure was composed of large rock on the face, its inner slope being of smaller material worked into the crevices between the rock. In making the upstream face the finer filling material forms the exterior, the rock work thus being protected from the eddies and currents, and not directly exposed to the river. Thus in flood season the currents and eddies cannot work into the filling between the rocks beneath. In addition to the diversion mentioned, further protection against flood currents is an emergency spillway on the embankment. This is to be four hundred feet long and extend to a depth of four feet below the crest. A concrete weir has also been constructed, 1,600 feet in length to carry away surplus water. These works were only built after studying the river stages for a period of years and getting the depth of the river at the highest point recorded by instruments. In all about six hundred miles of distributing canal reaching the part of Idaho described, will be served by this reservoir which will cover an area of 3,300 acres.

In Flood Time.
Looking northward, toward the dam, showing the rock-filled toes.



Beginning of Work Upon the Tower for Receiving and Distributing the Contents of the Reservoir.



INVENTOR FAWKES WITH HIS FAMILY IN THE "AERIAL TROLLEY."

AN AERIAL TROLLEY

By

CHARLES ELDERS

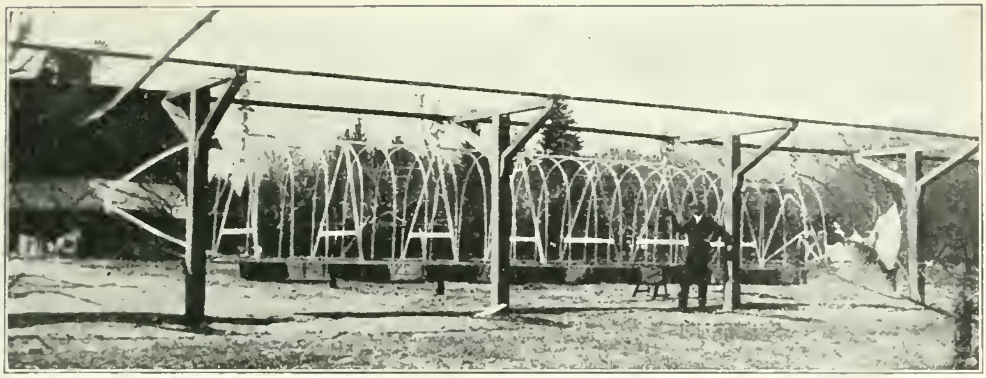
AN aerial trolley car, driven by a propeller and with a carrying capacity of fifty-six passengers, is in actual operation on a short stretch of track in one of the suburbs of Los Angeles, California. It is the invention of J. W. Fawkes, who has made a fortune from various patents.

The car has a length of fifty feet, is six feet wide and seven-and-a-half feet high. It is of a torpedo or cigar shape, with a propeller at one end, and is built of angle steel and aluminum.

It is suspended on an overhead rail of iron, three-and-a-half inches broad, and this is scientifically trussed with iron rods which are kept taut by a system of turn buckles. Trolleys above and below hold the car firmly to the rail. The track is suspended from twelve-inch wooden posts with iron bars, and these posts rest on a firm foundation in the earth and are securely braced.

It is proposed to construct a double track system, one on each side of the central poles, so as to equalize the pull in both directions.

Probably the most remarkable feature of this aerial trolley is the propeller which drives it along the track. It is a radical departure from the type of propeller in use on aeroplanes, having two huge fan-shaped blades, which, the inventor claims, add greatly to the force of the thrust. The construction of the fan-shaped blades is unique. They are of sheet iron, supported by frame work of seamless steel tubing. Each of these tubes is welded into a disk of aluminum, an inch in thickness and six inches in diameter, and the driving shaft runs through this series of fifteen aluminum disks like a core.



A FULL-LENGTH VIEW OF THE CAR.

The propeller has a diameter of six feet and is driven by a twenty-six horse-power automobile engine. It is estimated that the engine can drive the propeller at the rate of 1,500 revolutions per minute and by actual test it has produced one thousand revolutions a minute. Although the one-hundred-and-fifty-foot track has made it impossible to test the car for speed, it is believed it will be capable of one hundred miles an hour and as work is progressing on a large circular track the speed capacity of the new invention will soon be known.

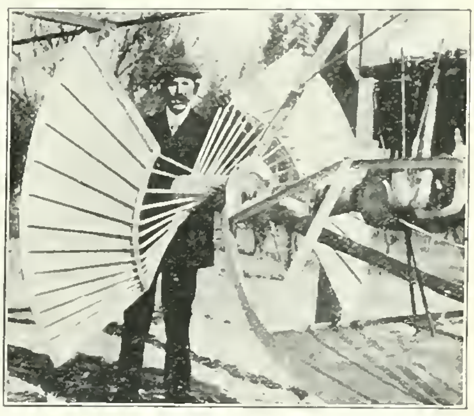
By an ingenious device for raising and lowering the car, the inventor expects to take on passengers or freight from any level, thus doing away with the necessity of elevated stations. He claims that there are many advantages in this system of transportation. It would do away with grade crossings, as the cars could run through the country fifteen or twenty feet above the ground. If used in the cities, it would not disfigure the streets as does an ordinary elevated road; in fact, its appearance would not differ greatly from the ordinary trolley poles and wires and would not shut out sunlight nor drop oil or clinkers on the street, as do elevated steam roads.

The danger from collisions would be minimized, and yet it would be possible to attain greater speed than on an ordinary surface road. As the inventor's theory is, that the great momentum would lessen the weight of the car as it flew through space, a system of tilting planes under the car is arranged for. These planes would be adjusted by the engineer so as to get the benefit of the lifting power of the atmosphere, like the planes of an air craft.

It is estimated that this system can be operated very economically and that its construction cost would be low, about $2,000 per mile to build while the cars could be built for about $1,500 each.

When completed, the car will have a propeller at each end and will be furnished with a removable cover or sheaf of aluminum, with celluloid windows. In experimental runs, about forty people have been carried at one time without any accident. The carrying capacity is estimated at ten tons.

It has been suggested that the aerial trolley be thoroughly tried out at some pleasure resort, and with the practical knowledge thus gained, it could be perfected for transportation purposes on an extensive scale.



A VIEW OF THE PROPELLER IN DETAIL.

THE GREAT OLIVE ORCHARD AT SYLMAR, CALIFORNIA.
Over 150,000 trees grow on 2,000 acres.

WORLD'S LARGEST OLIVE ORCHARD

By

J. MAYNE BALTIMORE

CALIFORNIA boasts of possessing the largest olive groves in all the world, and this immense property belongs to the Los Angeles Olive Growers' Association whose headquarters are located in Los Angeles.

One so associates the growth of the olive with the south of Europe and Oriental lands, that it comes as a curious surprise to find the greatest olive grove in the world is located at Sylmar in the Golden State.

Out in the San Fernando Valley, twenty-three miles north from Los Angeles, stretching over a broad expanse at the base of the towering Sierra Madre Mountains, is the famous Sylmar Olive Ranch, comprising 2,000 acres, planted to over 150,000 trees. This beautiful little valley is sheltered by the lofty range—serving as a climate barrier, and also as a picturesque background.

The Sicily olive trees obtain the height that elms usually do in England, and there are many quite one hundred feet high, and measuring twenty feet in circumference at the base. However, the trees at the Sylmar grove do not present such formidable dimensions and the vast groves of the Los Angeles Olive Growers' Association, through scientific pruning and careful cultivation, are of the convenient and uniform height of about twenty feet. Thus science makes convenient the harvesting of the olives.

The olives are plucked at the Sylmar groves late in the summer and early in the fall months—weeks being required to complete the work of harvesting. The gathering is done in a very systematic manner—the many gangs of pickers being under the personal supervision of bosses—and so the work progresses rapidly.

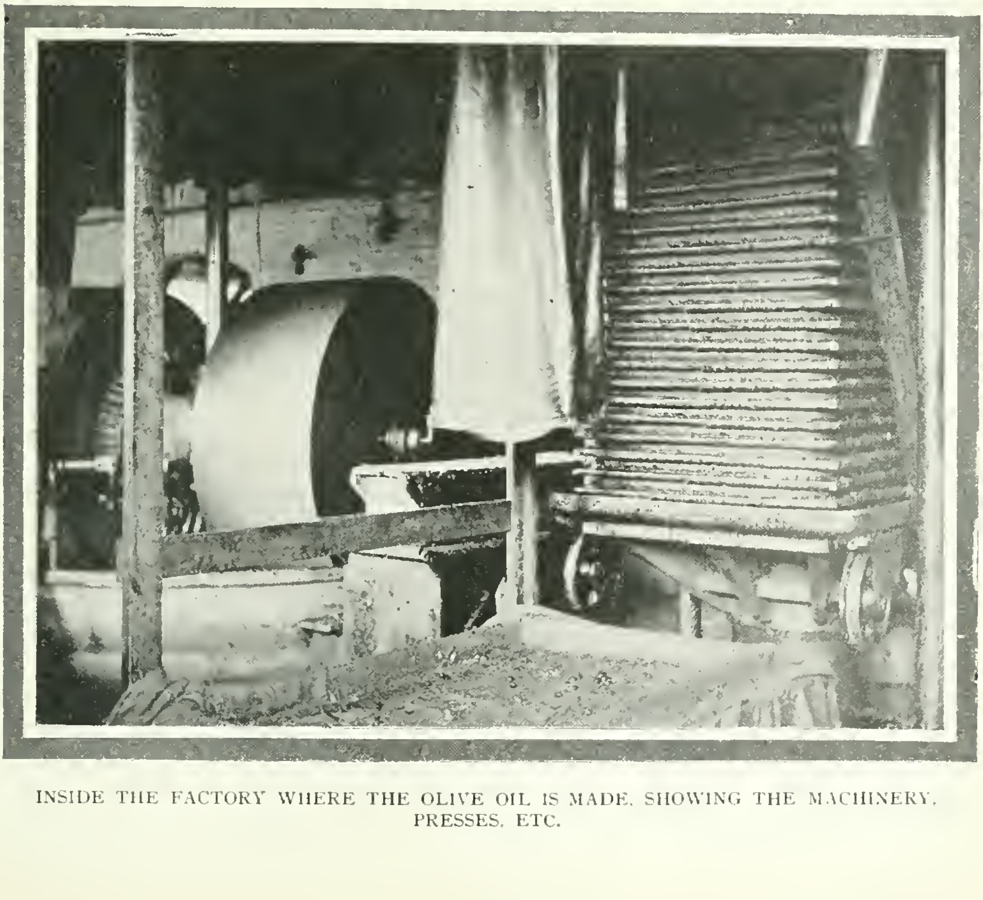
Much care is observed in gathering the fruit from which the oil is to be extracted. A canvas is placed beneath a tree and with two pickers to a tree, one mounted on a ladder, and one standing on the ground, the fruit is stripped from the branches, being allowed to drop from the hands of the pickers to the canvas.

In boxes the olives are carried to the factory, and, after being weighed and run through a fanning machine, to free them from leaves and dust that are always necessarily present, they are dumped into crushers where huge wheels quickly reduce the fruit to a purple mass.

The pulp thus obtained is next subjected to the power of hydraulic presses. Passing through the canvas-covered layers of pulp, the oil, mixed with the water of the olives, runs down from the press in dark-colored, sluggish streams; the water and sediment settle, leaving the turbid oil to be drawn off and filtered through cotton and gravel, after which it is turned into glass-lined cement tanks, where it is left to settle and mature.

A final filtering leaves the oil clear and brilliant for bottling. Within two months from the time the olives are gathered, the oil extracted therefrom is fit for table use; however, the oil improves, like wine, with age, and may be kept for almost any reasonable length of time, if hermetically sealed and stored in a very cool place.

From three hundred to five hundred gallons of pure olive oil, per day, are extracted at the great Sylmar Ranch factory during the active harvest season.



INSIDE THE FACTORY WHERE THE OLIVE OIL IS MADE, SHOWING THE MACHINERY, PRESSES, ETC.

ANOTHER VIEW OF THE LARGEST OLIVE ORCHARD IN THE WORLD.
The oil and preserving factory may be seen in the distance.

As to irrigation, these immense San Fernando Valley groves receive no other irrigation than the winter rains since they were planted some years ago. The soil of the ranch is composed of the wash of the Sierra Madres, and is of exhaustless richness and fertility. Evidently the olive trees are not thirsty souls, as, during some seasons, rains do not fall once in three months. Yet the thrifty condition of the trees and the yield of fruit are not noticeably affected by dry weather. The climatic and soil conditions of San Fernando Valley are peculiarly favorable to success of the olive industry.

Olive Tree Laden with Fruit, Showing a Picker at Work.

San Fernando is the center of the great olive industry of California, though there are many large olive orchards in other sections of the state. There are the oldest olive trees in California, having been planted by the Spanish padres more than a century ago.

The olive industry has been, and is constantly increasing in California since its first introduction by the early Spanish mission fathers; and the olive culture can never be overdone in that state since the olive can be produced only in central and southern California, New Mexico and Arizona, with profitable success.

The olive wood is also very highly prized by cabinet workers as the grain is exceedingly fine and hard and susceptible of receiving an elegant finish.

Italian olive orchardists look upon an olive ranch as a perpetual source of wealth, as the older the trees grow, the greater bearers they become. The trees are supposed to attain a great age—as high as 4,000 years. In the sacred groves of the Mount of Olives in the Holy Land, near Jerusalem, there are olive trees still flourishing that scientists declare are not less than 3,000 years old.

The Los Angeles Olive Growers' Association have found their investment a decidedly profitable one—constantly increasing. The quality of the output of the Sylmar groves are equal to any in the Old World, and have won the grand prizes at more than one world's exposition.

HOUSE MOVED IN TWO PIECES

ONE of the most singular ideas ever involved in the moving of houses was recently put into practice in West Somerville, Massachusetts, where a large three-story dwelling was cut in two and moved from an eminence ten feet above the street level and set up a mile distant from its former resting place. It was found impossible to move the house in its entirety. The cut was made squarely through the center and as the house was built in a very symmetrical manner each part was an exact counterpart of the other.

After bracing the house, first one section and then another was moved to the new location with jackscrews and rollers. On bringing the two reunited divorced portions together they dovetailed into such a perfect fit that the separating cut was impossible to discern. As each of the sections was 35 by 20 feet at the base and almost forty feet in height, they were liable to topple over. This was prevented by tearing down the chimneys and foundations and loading the first floor of each section to a considerable depth with brick.

Making Ready to Move the Last Section to the New Location.

First Half of the "Sectional" House After Being Moved.

CHICKEN FARMING IN A NUTSHELL

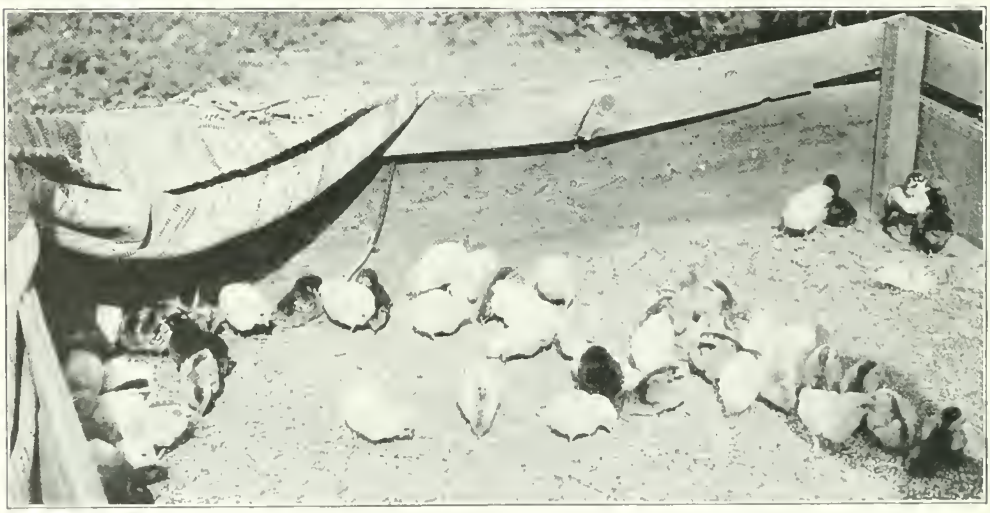
By

CHARLES DILLON

THIS is the story of a girl who made money from hens. It is not an advertising plot, although the girl's father is in the poultry business, but just the facts showing what she did, how she did it, and the figures to prove the result. Not every girl can do so well but the example is worth trying to emulate and ought to encourage some who have not been so successful.

In September last Miss Grace Kellerstrasse of Kansas City chose thirty prize-winning hens from her father's flocks and put them in a wire netted yard forty by twenty-four feet, in the rear of the house. The yard was subdivided into three pens of ten hens and one cock each, the space allowed each family being forty by eight feet. At the north end of these yards, facing south, were the coops built with every regard to economy. Any man handy with tools could duplicate them with a few boards, nails, tar paper and muslin. The whole cost was less than thirty dollars, and they were far better at that than was required.

June twentieth was then fixed as the limit of the test. The chickens were fed three times a day on table scraps only, with occasionally a little hot meal mash in winter. In cold weather they had warm water morning and night and precautions were taken to see that this water never froze over. This was regarded as an important point. The bottoms of the coops were kept filled with clean straw or hay, a pretext for much exercise on cold or stormy days.



A FINE BROOD THAT KEEP CLEAN AND HEALTHY WITH SUNSHINE AND GRAVEL.

Miss Kellerstrass's principal idea was to promote the laying of fertile eggs in cold weather and this was accomplished by means of the table scraps which contained bits of meat, and the warmth of the coops. In the summer chickens get bugs and other insects which are a stimulus to egg production, but in the winter when this supply is cut off the meat, raw or cooked, is the best possible substitute.

Now for the figures: In the test term Miss Kellerstrass's hens—thirty in number—laid 4,033 eggs, or about 140 eggs to the bird. Of these 1,024 were sold in settings. In addition, 418 chickens were hatched from some remaining eggs and sold. There were others but they were used on the farm and were not included in the record. Miss Kellerstrass received a fancy price for her settings—thirty dollars, or about two dollars an egg, with a total income from this source of $2,048. The 418 chickens hatched under the hens and sold brought an average of five dollars apiece as pullets and cockerels. They were, of course, sold to fanciers. This netted Miss Kellerstrass another $2,090. The total income was, therefore, $4,138. From this sum the girl had to deduct roughly $518 for coops, yards, grain feed, advertising, shipping charges, etc., leaving a profit of $3,600 from thirty hens in ten months.

But, says the amateur—and Miss Kellerstrass is an amateur, too—few could do so well. Very good. Consider the eggs in another way. If produced by ordinary chickens in the fall, winter and spring the 4,033 eggs would have brought an average market price of thirty cents a dozen. At that figure the 325¼ dozens would have brought $100.57½. Suppose the producer had sold only one-half his eggs, or fifty dollars' worth, and had raised 500 chickens from the remaining two thousand eggs. Even the greenest chicken man ought to rear that many to marketable age. If sold at only thirty cents each—and you can't get them that cheaply—these chickens would have netted $150, making a total profit of $200 from chickens and eggs. And he would still have his original thirty hens and the surplus stock reserved from the hatchings of late eggs. Also he would have his coops and other fixings. Counting $50 off from the total receipts for feed and deterioration the earning capacity of a hen would still remain at about $5 for ten months.

COUNTING CHICKENS AFTER THEY'RE HATCHED.

Almost everyone who owns a home with a back yard has the chicken fever at one time or another, or his wife or children have it. Many and many a family has tried it only to fail, but in every instance the failure has been proved to have been the inevitable result of no system or of carelessness, and either will kill pretty nearly any business adventure. To these two drawbacks should be added ignorance. Two kinds of persons fail in the chicken business: The man who buys a few chickens at the corner grocery or gets a setting of ordinary eggs from some nondescript brood in the neighborhood; and the city man with a little money and a suburban place. This last named man usually goes into the chicken business on a grand scale the first year, builds an expensive plant from designs taken from someone's manual, buys many expensive birds and high-priced eggs and at the end of the season has nothing except experience. He failed because he knew nothing about chickens. He would fail as quickly in Wall Street if he knew as little about stocks or bonds.

Another thing: The average amateur doesn't know that fresh store eggs are

A Common Sense, Sanitary, and Cheap Chicken House.

seldom good for hatching purposes. People in the business of egg producing for market do not keep roosters; the chanticler isn't needed in that hennery; just as many eggs are laid without his presence and they are better eggs—for market purposes.

It will pay, too, to remember that people do not send hens to market nowadays that are any good as layers; so don't buy such poultry expecting to start a chicken ranch. If you feel that life will be a blank unless you have hens and raise chicks and good eggs and get into the game generally put down these fundamental rules:

Clean out the old shed or barn and make it vermin-proof with tin, stone or cement.

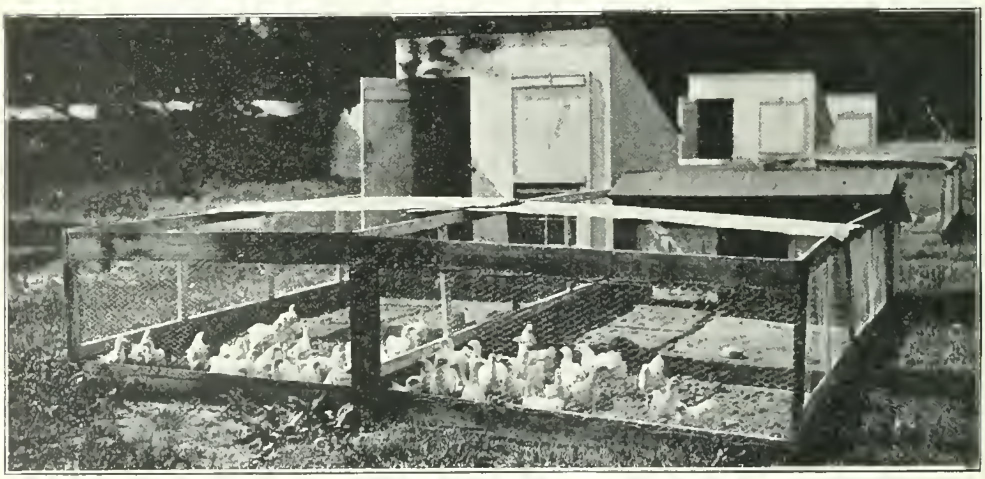
Fence the yard with chicken netting. It won't cost much to make the yard tight and it will save scenes with the neighbors.

Be certain you know the source of the eggs you buy. Don't buy cheap eggs; you'll regret it. Any good setting will cost from five dollars up to twenty or thirty dollars—usually the five dollar kind are good enough; buy a good brood hen or a pen of the best chickens you can afford.

Feed your chickens three times a day, a well-ordered ration and change it from time to time. Keep clean, fresh water always at hand. Be sure the food is clean. Keep the yard dry and drained. Dampness causes ninety-nine per cent of all chicken maladies.

Give your chickens a chance to dust for mites and lice. Mix in a box about one-half its capacity of road dust and six ounces of powdered sulphur and six ounces of naphthaline. If your chickens are white substitute flour for road dust. Keep this box where it will be dry and where the chickens can always use it.

Give the chickens plenty of air and exercise. Never shut them up in a tight barn. Cut windows and cover them with netting. Keep the chicks warm and away from dampness. Make all chickens scratch for their food.



YOU CAN MOVE THIS YARD FROM PLACE TO PLACE.

ELECTRIC AUTO AS WIRELESS STATION

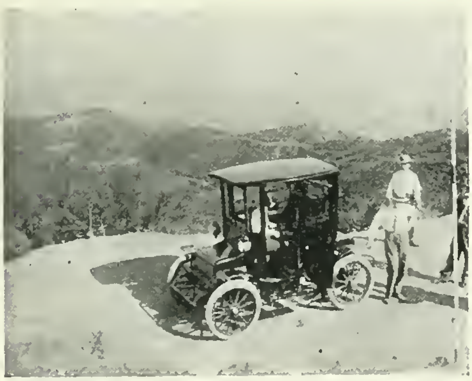
By CHARLES GLEASON

AN interesting experiment in wireless telegraphy was tried recently in Los Angeles when an electric automobile was used to supply power for flashing messages from a portable wireless station. The little car was run up the steep grade of Lookout Mountain in the outskirts of the city, and a thirty-foot steel mast was speedily erected and rigged with the necessary guys and wires. Then the operator took his place at the keyboard and sent out a call which brought responses from amateur stations in various parts of the city and from Point Loma station more than one hundred miles away. These answers were disregarded, however, as operator Ryan was trying for the United Wireless station in the center of the city, which answered within a short time. Then the following message directed to Mayor Alexander of Los Angeles was flashed: "Have pleasure of sending you the first message ever transmitted by portable wireless station using electric automobile via United Wireless from Lookout Mountain."

This feat is of more than passing interest as it demonstrated the possibility of rapid communication by wireless from an electric motor equipped with portable mast, etc.

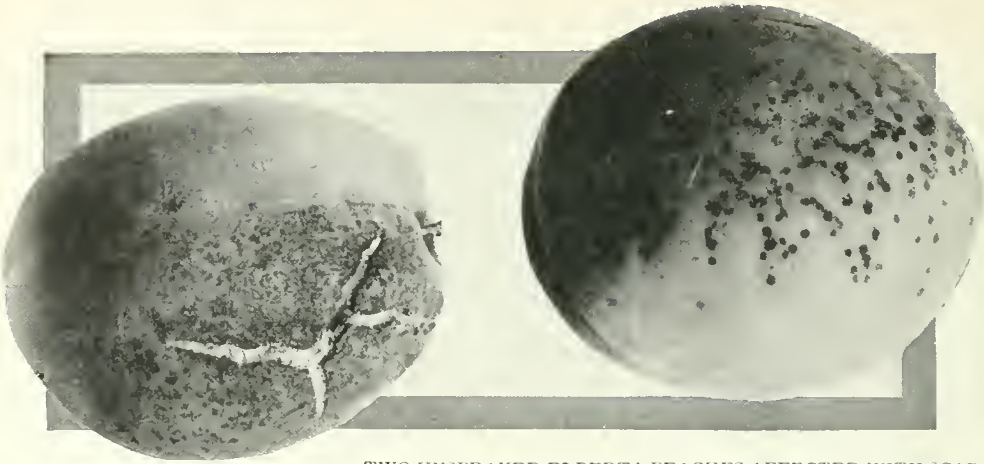
The experiment was planned and carried out by Mr. W. B. Kerrick, an electric engineer, who wished to clinch his argument that you could run most anywhere in an electric car and still keep in touch with home by wireless.

SENDING THE MESSAGE.



GETTING THE APPARATUS READY.

THE ANSWER RECEIVED.



TWO UNSPRAYED ELBERTA PEACHES AFFECTED WITH SCAB.
The black spots and cracks have been produced by the disease.

CURBING THE DREADED PEACH ROT

By

R. A. SANBORN

MR. J. H. HALE of Georgia and Connecticut, the greatest grower of peaches in the world, commanding over 1,000 acres of orchard, paid his respects to the brown-rot in the following terms: "The brown-rot is so great a factor for evil in the raising of peaches for the market that in a few years more it would have accomplished the complete failure of my orchard plant in the state of Georgia. We can master or control every other enemy of the peach by up-to-date methods and precautions but until now we have had no weapon that would touch the brown-rot fungus." And then he continued to say that, "The use of the self-boiled lime-sulphur spray, as a foliage treatment for the peach-tree, recently discovered by Mr. W. M. Scott of the U. S. Department of Agriculture, alone would swing the future status of my fortune from failure to success."

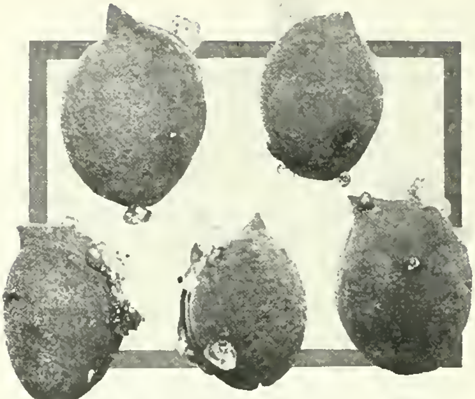
In the spring of 1909 Mr. Hale offered the orchard of the Hale Georgia Orchard Co. at Fort Valley, Ga., as a demonstration and proving ground of this spray mixture of the usefulness of which Mr. Scott was then pretty well convinced. Experiments on small plats had been made in 1907 and 1908. While the great plant of the Hale company had had the best of care and was otherwise in good condition, it had in recent years become so infected with brown-rot that in 1908 the crop was largely lost.

Two other enemies of the peach were allied with the rot to encompass the ruin of the orchard, namely, the scab and the plum curculio. The former is also a fungus but of not so malignant a type as the brown-rot. It serves as an accomplice to the latter by cracking and spotting the fruit thus giving the deadlier fungus an easy entrance. The curculio beetle damages the peach by puncturing the fruit for the purpose of laying its eggs within the skin. It is a troublesome creature but its rate of speed as a worker of destruction is to that of the brown-rot as a slow-match to a prairie fire. Its worst crime is in making the punctures that give the rot free entree.

Mr. Scott and his chief assistant, Mr. Willard Ayres, conducted the spraying in large blocks of different varieties comprising over 5,000 trees, while Mr. Hale's force sprayed about 7,000 trees in their orchard under the supervision of the two scientists. Plats of trees were selected, trees counted and sprayed while next a sprayed plat another was left unsprayed. Two applications of spray were made, one about a month after the petals dropped and again three weeks before the fruit ripened. At picking time the entire crop including dropped fruit was counted on five average trees in each plat. On the sprayed plat it was found that 17% was affected with brown-rot, and that in 93% of the rotting fruit infection had been admitted by curculio punctures. The scab was, from the commercial point of view completely controlled. On the unsprayed plat 49.5% of the fruit was affected with rot, and 91.5 with scab. 81% of the rot infection had happened through curculio punctures. The figures themselves were very satisfactory to Mr. Hale but there was another cause for gratification in the increased size and color and generally better merchantable condition of the sprayed fruit. The commercial results of the spraying were determined by counting the marketable fruit on 500 trees from each plat. The sprayed plat yielded 170 crates, the unsprayed but 80. Thus was nearly a quietus given to the brown-rot. The curculio was the factor that held the door open.

To offset curculio injury some experiments were made in cooperation with Mr. A. L. Quaintance of the Bureau of Entomology of first spraying with

DIFFERENCE IN BROWN-ROT DEVELOPED IN SPRAYED AND UNSPRAYED PEACHES.
Two crates of Elberta peaches after six days in refrigerator car and a day in express car. The fruit on the left had been sprayed; that on the right had not.



GUM EXUDATIONS ON YOUNG PEACHES FROM CURCULIO PUNCTURES.
It is these wounds that give entrance to the brown-rot.

arsenate of lead just as the calyces were shedding, and again in about three weeks with self-boiled lime-sulphur plus lead arsenate. The success was brilliant. Only 4.5% of the fruit showed brown-rot, 6.5% had slight traces of scab, and about 27.5% were curculio punctured. On the unsprayed plat 63% was rotted, 99% scabby, and 97% was wormy from curculio. The sprayed block yielded 327 crates of first class fruit while the unsprayed block yielded but 33 crates, all of which were poor in quality. In the New York market the sprayed fruit brought fifty cents more per crate than the unsprayed, and all of it was sold before the other, showing the impression made upon the buyers by the difference in the appearance of the two classes.

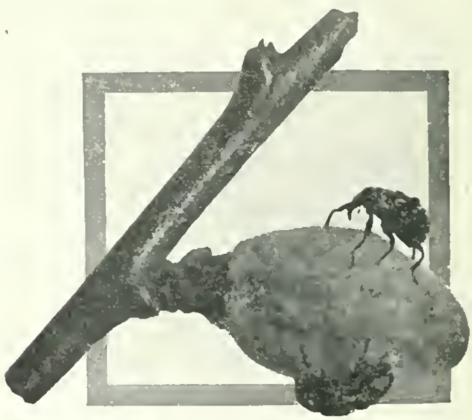
The principal reason why, until Mr. Scott's discovery, the disease had enjoyed immunity was that, so far as was known, there existed no spray that could be safely applied to the peach tree while in full leaf. All the peach-grower could do toward controlling the fungus was to gather the dropped infected fruit and burn them. As it was quite impossible to do this cleanly and as a few of these "mummies" overlooked was enough to infect an orchard, the laugh was generally with the "mummy."

The self-boiled lime sulphur spray in which the mixture was boiled by the slaking of the lime was a discredited spray for San Jose scale treatment. Mr. Scott after trying about all the combinations of lime and sulphur finally reached the conclusion that the excess of the caustic sulphids in the boiled mixture caused the scalding of the peach leaf and he turned as a last resort to the expedient of self-boiling as bringing into solution a minimum percentage of sulphur.

The theory about the action of this new spray is that the free lime serves as a matrix to hold all the other elements together, that there are enough of the sticky sulphides to bind the solid materials to the fruit, branches and leaves, and that the finely divided sulphur deals personally and correctively with the bad fungus.

While brown-rot does its worst in humid regions such as the early peach belt of Georgia, it is to be feared in every peach section of the country, with the exception of the arid irrigated localities of the west. As a general thing the disease does not fall to work until the fruit is nearly mature.

A typical and singularly complete case of rot destruction occurred near Dublin, Georgia, a few years ago. It was the year of the first full crop the orchard had borne and all went fairly until harvest time. Figuring on his masses of large handsome fruit the owner ordered crates for 40 carloads. Then came days of muggy air and drizzling rain, and with them a spontaneous combustion of brown-rot. Out sprang the brown spots wearing their beards of white spore-bearing threads. The pickers were hurried to cull the best of what was left but it was too late. The disease continued to develop in transit and an entire crop



ADULT CURCULIO BEETLES ON A YOUNG PEACH.

that was easily worth $20,000 was a total failure and the owner was in debt. The career of this disease had practically doomed the early peach belt of Georgia to extinction when Mr. Scott intervened.

The annual loss to the peach crop due to the ravages of brown-rot is estimated at $5,000,000. The normal output of the state of Georgia is not less than 5,000 carloads, worth about $2,500,000. In 1900 the brown-rot burned up between $500,000 and $700,000 of the peach profits of that state. A conservative estimate of the annual damage in Georgia in recent years is $1,000,000. It is good to know that the peach grower now has the whip-hand of so expensive a disease.

YOUNG PLUMS ATTACKED BY CURCULIO.
Showing crescent shaped egg-laying punctures

CHEMICAL WATCHMAN

TO a bank cashier with a taste for chemistry is due the credit of a simple yet highly efficient cash protector and cracksman tamer. Several years ago Cashier George Clark of the Corona State Bank, South Dakota, hit upon the idea that if he could place a bottle of some strong chemical between the outer and inner doors of the vault its fumes might retard the work of safe breakers or perhaps frighten them away. A quart bottle of formaldehyde was immediately given a position as a silent night watchman between the doors of the vault.

SAFE THAT BLOWERS FLED FROM IN TERROR.

For about five years the "yegg doctor" kept unobtrusive guard. Finally early in November, 1910, the test came. A couple of professional cracksmen entered the town. Two charges of nitro-glycerine were used on Cashier Clark's safe that night. The first one did little damage but the second wrecked both the outer and inner doors, tore the latter from their hinges and threw them out into the vault and against the small safe and safety deposit boxes. The "yegg-men" did not wait to wreck the inner safe, however, for at the same moment the "yegg doctor" responded to a hurry call and the fumes of a full quart of formaldehyde filled the room. Choking and gasping, with tears streaming from their eyes, the criminals scrambled out the way they had come in and left tracks down the peaceful country highway that fairly sizzled. For days after the explosion the fumes of formaldehyde were so strong that a person could not breathe in the vault.

A MASTERPIECE OF ARTIFICIAL FOLIAGE.
Every leaf and twig and bit of rotting wood is studied from nature and reproduced by art.

ARTIFICIAL SPRAY OF THE TULIP TREE.

PUTTING LANDSCAPES UNDER GLASS

By

WARREN H. MILLER

HOW do they reproduce the plants, the tree leaves and wild-flowers with such marvelous exactitude?

We look at them in the museum cases in wonder. Here are the familiar fields brought to your eye just as you recall them in life—myriads of grasses, dozens of daisies; every leaf, every petal and stamen as perfect as if living. One usually dismisses conjecture with the thought that, no doubt, they picked these things in the field, and preserved or petrified them just as they were by some mysterious process.

Here is the case of the duck hawk or peregrine falcon for instance. You may recall it—a section of rock cliff nearly fills the case and sets off, as it were, the habitat of the falcon. In a cleft of the rock there is a tuft of grasses, and in the midst of it grows a fairy-like columbine in full blossom. How did they get it there?

If they picked that delicate plant and dipped it in a preservative that petrified it just as it grew that would be wonderful indeed. But the way they actually do it is still more wonderful. Every one of those flowers; every leaf; the stalk, and its branches—is the work of man's hand!

Think of the skill, the close observation of Nature, required to do this and yet not make an obvious imitation!

And yet, the basis of the process is simple enough. It is all done from life casts of the component parts. In the laboratory you will find large tables covered with boxes of various green shades of the finest thin sheet wax, rolls of fine oiled *muslin de soie*, and short lengths of cotton-wrapped steel wire. The simplest thing that the laboratory turns out is a leaf. Suppose that the group to be mounted requires for one of the "accessories" a branch of white oak. The first thing done is to secure representative specimens of white oak leaves of various ages, including buds. These are picked from the tree and brought into the laboratory.

The Curator's assistant takes modeling clay from a stand and makes an oblong dish of it slightly larger than the oak leaf. This he fills with wet plaster of Paris and lays the leaf face downward, stem and all, on the wet plaster. It soon hardens and the leaf is stripped off, leaving a perfect impression on the plaster.

Now, a sheet of wax is selected, matching perfectly the color of the leaf, and is pressed down into the form. One, two, or more strands of the covered wire are then laid down the midrib and veins of the leaf, and a piece of the oiled muslin placed over it and kneaded down onto the wax sheet in the form. A gentle heat is next applied, which fuses the whole together and makes the wax so plastic that it takes the impressions of every least vein and membrane of the leaf. The edges are trimmed with scissors and the axil of the stem moulded in wax to fit the form. In the case of leaves with serrate edges the mould itself is trimmed away sharp from the edges with a small gouge, so as to give a sharp, clear outline to the wax leaf. The face side only is cast, as the oiled silk imitates the reverse of all leaves except a few requiring treatment on the under side.

The leaf is now complete, and any quantity of them can be turned out from a single mould with great rapidity. If the underside is downy or fuzzy, fine chopped camel's hair is strewed on while it is hot and sticky. If the face of the leaf is glossy, a few drops of poppy oil produce the desired effect. If dull, talcum powder, of the proper shade of color, is sprayed on.

The colored leaves of autumn require a still further process. It would of course be hopeless to reproduce the endless shadings and coloring of Nature with anything so gross and coarse as a brush, so a process was invented to match Nature's.

A GROUP OF BEAUTIFULLY MADE ORCHIDS.

Branch of Safal. Used in Roosevelt Elk Group.

Assuming that a silver maple leaf, of which the prevailing autumn color is yellow, is to be made, the leaf is first cast in the proper shade of yellow wax. Then it goes to the painting room, where the delicate mottlings and colorings of the real leaf are copied with marvelous fidelity by what is known as the air brush. This instrument is essentially an atomizer, connected by hose to a reservoir into which air is pumped by a small, hand air pump.

The cup of the atomizer is filled with the color to be used, and it is blown on in a fine spray. This spray can be modified from the veriest breath of color to heavy coarse stipplings, and the wonderful colorings of Nature are reproduced by it with absolute accuracy and great speed.

The colors used are the usual artists' tubes, diluted so as to make them atomize freely. All the artist's old friends are there excepting that great mainstay, the fat tube of cremnitz white.

This cannot be used as a dilutent and general modifier because the leaf colors must be transparent or clear. The addition of white immediately turns the mixture into what is technically known as "mud." All the lakes are barred for the reason that they are not permanent enough. Before a year passes, anything colored with a lake is several shades off the original hue. The madders are much used. Also cobalt blue, emerald green and many of the anilines.

Before leaving the subject of leaves, another question comes up. How about specimens picked on the Pacific Coast or elsewhere, when several weeks are required for shipment to the Museum? Of course, succulent plants must be cast fresh on the spot, but the majority of trees and shrub branches may be expressed east and put to soak in large tanks in the laboratory immediately on arrival. In a few hours the warm water restores the leaves and twigs to their original freshness and casts can be taken.

The making of flowers requires more skill, but the method is the same. The flower is dissected and casts taken of the petals of both calyx and corolla. The stamens are made from fine hairs dipped in wax and the knobs formed on the end by hand. The parts are assembled, after coloring the petals, which are moulded in white wax. Such a flower as the wild rose is one of the easiest to assemble in spite of its numerous stamens. A practiced hand can finish one in about twenty minutes.

The columbine, mentioned before in connection with the duck hawk group, is one of the difficult flowers. The reader will doubtless recall it as a dark-red, five-lobed flower like a miniature king's crown, hung inverted by the center from

Marshmallow Made by Clever Hands.

a slender curved brown stalk. It looks hopeless to attempt to reproduce this delicate fairy thing with its five, incurving, red tines, each capped with a yellow knob. If cast entire in a waxen bullet it would be horrible, leaden. To make it, each lobe, which is virtually a petal tightly curled, is opened out flat, and a cast taken of it. A thin white wax sheet is now worked into the mould and cut a sixteenth of an inch larger than size along one edge. A steel rod is prepared by pointing it to exactly fit inside one of the tines and the wax petal is then curved around it as a form. The extra sixteenth-inch laps over and is burnished down with a smooth, warmed rod. The little knob at the end is worked up with the fingers. The five lobes are colored with the air brush, the stamens put in and the flower assembled complete around the stem. In most of the flowers there are so many colors that white wax is usually selected as the color to form the parts with.

All the grasses, including the canes, are simple and easy to mount. Most of them are simply dried and then re-colored with the air brush. If the leaf is broad, like the cat-tail, it is cast and made up from wax sheets. In large stemmed fleshy plants like the sagittaria water lilies—the ones with the flowers in a close blue spike and spear-head leaves—the stems are cast from life and molten wax poured around a stout steel wire. The leaf is made separately as described before and secured to the stem.

The preparation of tree and plant fruits presents a range of problems, varying in difficulty from the easily reproduced fruit of the pawpaw, to the well-nigh impossible catkin of the white willow. The laboratory is still wrestling with this latter, after many flat failures.

Beginning with the large, smooth fruit of the pawpaw—with which may also be classed the persimmon and wild plum—the first step is to beat out a flat ribbon of clay about an inch wide and mould it edgewise around the fruit, resembling the rings of Saturn. Thick plaster of Paris is poured over the fruit, the ring acting as a stop, and followed up with a paste of the plaster, moulding it with the hand as it sets. The clay is then peeled off, and any fins of plaster that may have crept up under it are trimmed with a sharp knife.

This same process is repeated by dividing the remaining half of the fruit into two sections and plaster-moulding them one at a time, the final result being a three-piece mould around the fruit. It is then drilled at one end and poured full of wax, giving a cast of the pawpaw, which is forthwith colored to life with the air brush.

Any fruit treated this way must be first coated with beeswax thinned out in kerosene. While not thick enough to fill any detail, it still is greasy enough to part the plaster from the fruit.

A second method of preparing tree fruits is to actually preserve them by saturating with glycerine on the osmotic principle. Acorns, winged ash and maple seeds, and the tiny green flowerets that

Leaf and Petal Casts for Marshmallow.

are the blossoms of so many trees, are all treated in this way. Glycerine has a very strong affinity for water, though it must be first diluted with it to enter any vegetable tissue. Besides this, the solution must be an insecticide and germproof, so formaldehyde and arsenate are added. The acorn or maple seed is soaked in a bath of this solution. Gradually the fluid enters the pulpy interior, forcing the water from the cells, entirely replacing it with non-shrinkable, deliquescent glycerine. The seed will not hold its color, turning brown in a few months, so the air brush is used to color it to match a green fruit.

Still another method, applicable to hard dry seeds like the chestnut and sweet-gum burrs, is to dry them out and recolor with the air brush. Many of the berries, such as the red sumach drupes, are also treated this way.

Hardest of all are the catkins. Being full of interstices, it is impossible to cast them in wax, they are too perishable for the glycerine process, and, unless accommodating enough to dry in shape like the catkins of the birch family, the last resort is usually to make them laboriously by hand. And if, in addition to countless tiny berries, the catkin further adorns itself with fine downy fuzz, colored both black and white, the ingenuity of the curator is well-nigh overtaxed to reproduce Nature's handiwork.

To prevent branches and twigs from shriveling, there are large vats of glycerine and formaldehyde solution in the laboratory, in which they are put to soak. Heavy branches, and tree trunks with smooth sappy bark, are simply painted with the same solution, as it is only necessary to impregnate through the sap wood.

Osage Orange Cast in Mould Shown in Another Photograph.

Orchid in Parts and Assembled.
Six separate casts were required for this flower.

The preparation of such a panorama as that of the bird life of the Arizona deserts, for instance, involves an immense deal of close Nature observation, study by life photographs, and skill in mounting the birds and plants. The expedition sent out for this group consisted of two curators, a museum artist, and some helpers hired on the spot. Camp was pitched near the Carnegie Laboratory, a short distance from Tucson, and the work begun of collecting specimens and photographing the birds in all conceivable postures of life action. The cameras were concealed in blinds near nests, and thus characteristic postures were photographed from which the birds would later be mounted. The scientists then selected the most typical scene for the proposed group, and decided what must be included and what left out. A strip of ground on which might be several desirable bushes holding nests, was marked off and photographed from different positions. Then every stick and stone in the strip was gathered up and color-sketches of all objects made on the spot. If a characteristic bush or cactus grew just outside the strip, but no good specimen on it, it was taken in place of non-essential plants. When the group was finally complete, every last foot of it was packed up in sections and expressed in boxes to the Museum—

ground, stones, sticks, plants, shrubs, and trees.

The nests were tied in place and packed tight with excelsior, and the trees sawed up and marked branch by branch. It made no difference which tree the nest happened to be on; that was the one the bird chose; that one must come up, root and branch, and be shipped to the Museum. Finally, the artist sat him down and painted the large canvas panorama that forms the present background of the group in the Museum.

Arrived at home the collection was unpacked and made up according to the photographs. The cacti all had to be cast from plaster life moulds, first cutting off the clusters of thorns. That big prickly pear on the right of the group, for example, has all the old wax drippings of a generation of laboratory work in its interior. The casts were then colored with the air brush and the clusters of thorns replaced. Some of the hard thorny bushes gave worlds of trouble as it was exceedingly difficult to drive out their sap with glycerine. The bush in the center of the group—the one with a nest on it—is still alive today and grows a few leaves every spring! This, though the branches have been sawn in sections fastened with iron dowels. Its present roots are also iron dowels, driven into a block of wood in the bottom framing, but the bush does not seem to mind the loss of the real ones.

To secure a smooth curved surface for the canvas background, a light stud frame is first built, and on it wire mesh is fastened for a furring. It is then plastered with hair-felt plaster bond, upon which is applied a smooth finish coat, much as in lath-and-plaster work in house building. On this surface is sized canvas, giving a horizon around the scene, except at the window, through which the observer looks.

MOULD OF AN OSAGE ORANGE.
A very difficult one to make.

It is astonishing how much the canvas has to be retouched to match the actuality of the foreground. The effects of lights and shades on objects, as the artist sees them, are often glaringly at variance with the appearance of the real foreground, especially at the junction of canvas with reality. Of course the painting has to be worked over until the most fastidious eye can scarcely point out where they shade into each other.

A still further matter must be looked to, to secure the wonderful reproduction of the actual scene that these panoramas give. It is the effect of shadows on the groups. The real objects in the foreground must have either no shadows at all, or else they must agree with those on the canvas. The former method has proved the best. The light is thrown directly down on the group by concealed reflectors which receive their light from the adjoining windows. In some cases this is further reinforced by outside reflectors which throw in the light of the zenith.

The Museum has at present twelve of these panoramas on exhibition in the Bird Hall. It is worthy of appreciative consideration to reflect that each one cost an expensive expedition by scientists and artists of the Museum Staff, months of laboratory work in mounting the birds from photographs and preparing the accessions, so as to reproduce the actual plants and trees precisely as found. The expense of this work is all borne by a coterie of public-spirited private citizens of New York. The result of it all, is to take the observer into the heart of typical American wild scenery which he could never otherwise see, and to fill the study of wild birds with interest and instruction that never by any possible circumstance could be gotten from the old-fashioned stuffed bird on a varnished wooden pedestal.

LOGGED-OFF LAND IN THE STATE OF WASHINGTON.

WHAT SHALL WE DO WITH STUMP LANDS?

By

FRED C. DAYTON

THE greatest problem that confronts the people of the Pacific Coast states, is what to do with the vast areas of land left barren by the woodsman's ax and saw. Millions of acres of giant timber have been cut-over and the great stumps and tangles of underbrush left to menace standing timber through fire and to bar the way of the agriculturist.

In eighteen counties in the state of Washington, west of the Cascade Mountains there are 8,700,000 acres of assessed land. Of this, 5,034,000 acres are covered with merchantable timber; 429,000 acres are under cultivation; and 2,352,000 acres have had the timber cut off and consist of what is called "logged-off" land. In Oregon the logged-off area is about equal to that in Washington. In British Columbia, on the Canadian side of the line, another million acres of logged-off land lie idle, of no use whatever to mankind.

The big lumber companies of the West have hewed and slashed ruthlessly into the virgin timber of the Northwest. The standing trees are of such huge size, that the average tree is cut ten or twelve feet above the ground, leaving an enormous stump from ten to sixteen feet in diameter. Only the long straight knotless trunk of the tree is used and the tangle of branches is left where it falls. No attempt is made by the timber hewers to remove anything from the land except the choicest timber. In fact so little do the lumber barons care for the land after they get the timber off, that in most cases they allow it to revert to the county for taxes.

The survey made last summer by Professor Landes, Dr. Benson, and Dr. Fry of the Washington State University and

TANGLE OF BRUSH AND STUMPS LEFT BY THE LOGGERS.
It certainly is a puzzle to know what to do with this.

Prof. W. J. McGee, of the federal Department of Agriculture was to determine how best to utilize these vast logged-off areas. One of the most important lessons growing out of this investigation was that the cut-over lands should be protected from fire. It is more important, according to these men, to keep the fire out of these areas than out of the standing timber.

On the logged-off lands the great accumulation of waste becomes dry and highly inflammable. In addition, this land is heavily covered with moss, which by the exposure to the sun becomes like tinder. This waste, including the pitch-loaded stumps, burns freely and with great heat. The thick moss quickly carries the flames to the nearby timber, as well as ignites the heavy rich mulch, with which the soil is covered, beneath the moss. This reduces the soil to a barren wilderness. Thus all the constructive work of nature for ages reverts to the desert.

One big lumber company in Washington has seen the folly of this enormous waste and is now experimenting with a view to converting it into dollars. The spectacle of this concern taking up the dairy business and the production of prime beef is now engaging the attention of Western economists. The members of this company, on whom the final success or failure of the conservation idea is conceded to rest, announce that never since the conservation policies were first urged, has there been a departure of such vital bearing on the immediate future of the Pacific slope.

Two hundred and fifty acres of this concern's logged-off land have been set aside for the experiment. This land has been seeded to orchid grass and clover. Several carloads of young stock were turned loose to graze as soon as the crop was well rooted. In a few weeks additional stock will be added. The experiment so far is declared to be successful and of far more value than the timber wealth, will be the agriculture worth after the woods have disappeared.

The finest dairying country in the world eventually will be found where the

CUTTING THE VIRGIN TIMBER.
Incalculable damage to the future for profit in the present.

timber now stands. Anything that will grow in the western climate will grow on logged-off lands.

But the success of the conservation movement depends largely on the owners of the vast timber tracts. In the last few years small land holders have demonstrated the value of these lands for agricultural purposes, but these few pioneers are scarcely a drop in the bucket when the enormous area of land is considered.

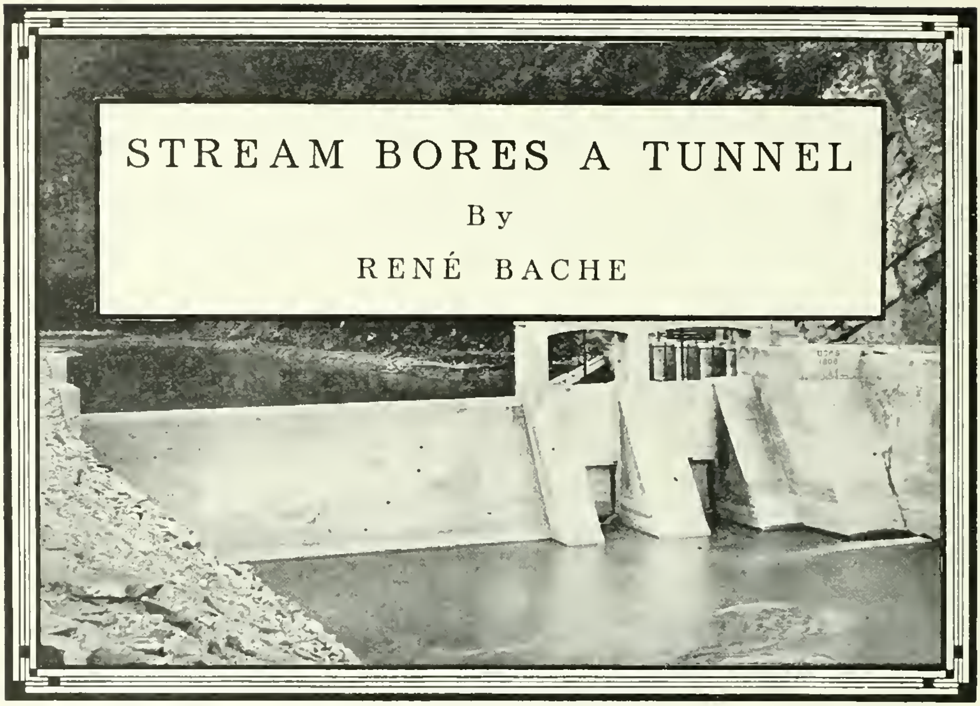
Dr. Rudolph S. Hoague is preparing to demonstrate the value of these lands by establishing a colony in Washington. Already the county in which this colony will be formed, has shipped 350 carloads of choice prunes this season. While not all this land is suitable for general cultivation, it is often ideal for fruit and poultry. The stumps often are left in the ground and only the underbrush cleared away. In other cases the land is cleared away and luxuriant growths of clover and grasses provide forage for cows to transform into milk. One man on twenty acres last year sold $3,000 worth of products. He had six Jersey cows, ten young cattle, forty chickens and sold beef, veal, potatoes, apples, garden truck, cherries, plums, butter, cream, milk, eggs and poultry.

Thus it will be seen that the real conservation problem, in regard to the timber, does not rest entirely on leaving the trees standing, but on the ultimate utilization of the land. In the place of vast areas of blackened stumps, there should be seen waving fields of grasses, blossoming orchards, lowing herds, and flocks of well-kept poultry to delight the eye.

STREAM BORES A TUNNEL

By

RENÉ BACHE



PHOTOS COURTESY RECLAMATION SERVICE.

THE government reclamation service is putting through a very picturesque job by rather novel means on the Strawberry Valley Project, in Utah. It is an engineering problem, the most important feature of which is the boring of a tunnel four miles in length through a range of mountains, the boring being done with the help of electricity generated for the purpose by a stream.

In the Utah Valley, sixty miles south of Salt Lake City, are sixty thousand acres of land which need water to make them fruitful. This valley is separated from the Strawberry Valley by the lofty Wasatch Mountain range. On the other side of that range, in the Strawberry Valley, is the Strawberry River, which, to furnish the requisite water, is to be brought through the great rocky barrier by the tunnel aforementioned.

The Strawberry River now flows into the Colorado River, its waters thus finding their way eventually into the Gulf of California. But, in obedience to the mighty power of engineering, it will be obliged in future to turn its current through the four-mile tunnel into the adjoining Utah Valley, where it will be diverted into canals for irrigating purposes. By means of a dam forty-five feet high, its waters will be impounded, so as to form an immense lake for storage.

Thus a very striking change will be made in the physical geography of the region. But the unique part of the business, from an engineering standpoint, is the taking of a small stream in the Utah Valley, diverting it by a dam into a cement-lined canal, passing it several miles along the side of a hill, and dropping its water through a pressure pipe upon turbines in a power house, generating electric power which is transmitted to the tunnel camp far up in the mountains, where it is used in boring the great hole.

This small stream is called Spanish Fork. Its water, after being utilized for the production of electric power in the manner described, is turned into the canals for irrigation, thus serving a double purpose. Incidentally, the surplus electricity has been leased to the town of Spanish Fork—which claims four thousand inhabitants—for illumination and other purposes.

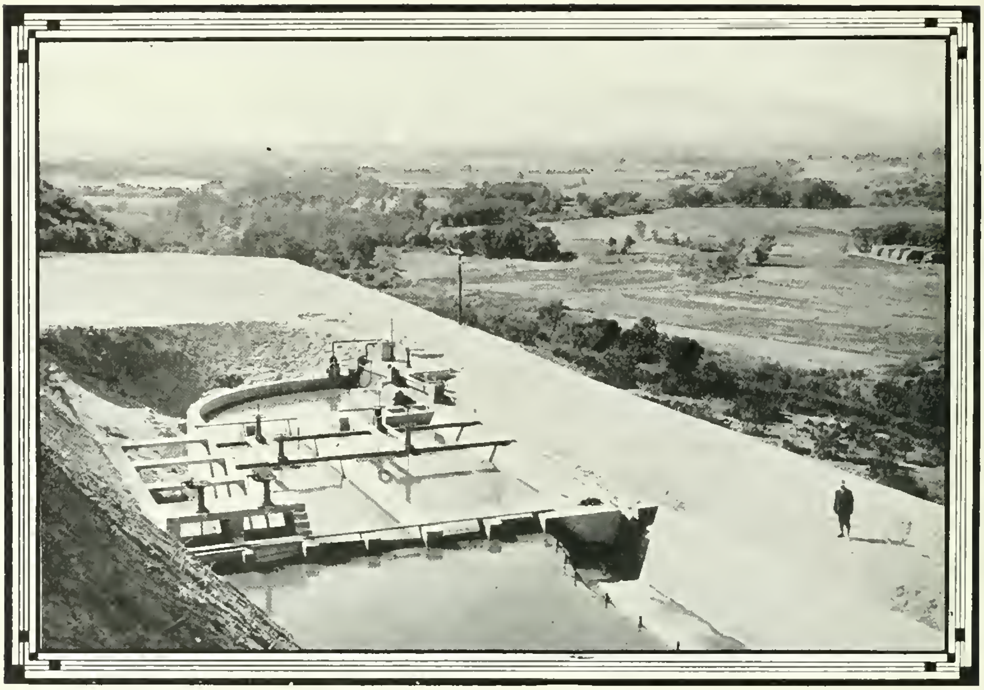
The construction of the Strawberry Tunnel, a mile and a half above sea level, is perhaps the most beautiful piece of engineering work the Reclamation Service has ever undertaken. In magnitude it is second only to the huge bore now completed, in Colorado, to carry the Gunnison River through a mountain range. In summer time the work of digging the tunnel is carried on without much difficulty, but in winter at that altitude the storms are frightful, and snow accumulates to almost unbelievable depth. During the winter of 1908 the snow-fall on the watershed, as shown by the weather bureau's snow-boxes, was nearly twenty-three feet.

The tunnel is concrete-lined and about sixty square feet in area of section—that is to say, six and a half feet high and seven and a half feet wide, with arched roof. It will carry five hundred cubic feet a second. But it will not be finished for about three years. The Utah Valley has no outlet to the sea, and the water fetched through the mountains from the Strawberry Valley, after all of it is used that can be used for irrigation, will find its way into the Great Salt Lake.

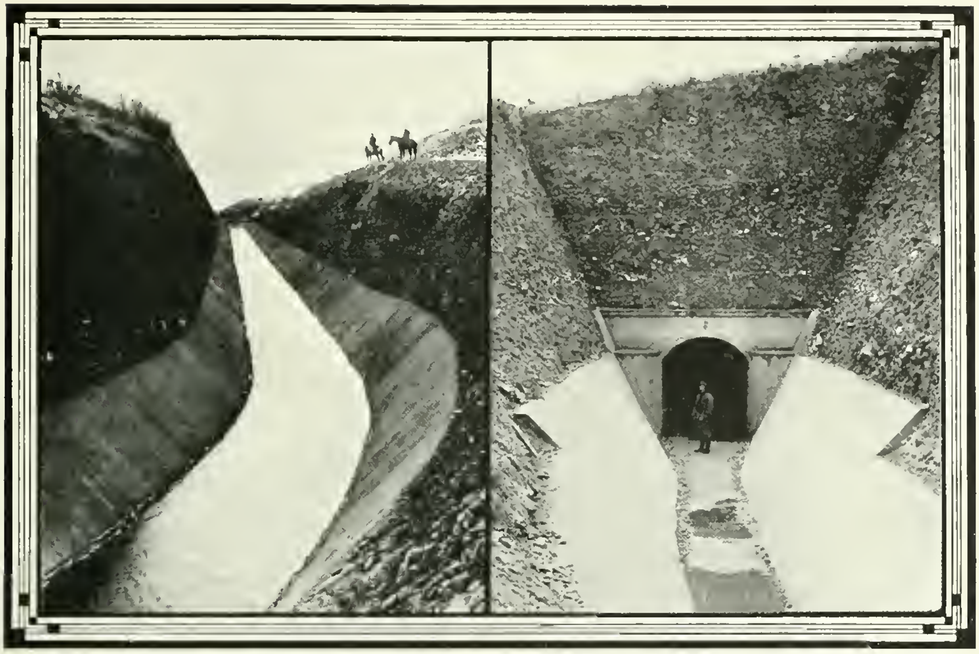
The Utah Valley is one of the oldest settled parts of the West. Pioneer farmers established themselves there as early as 1850. Peaches, apples, cherries, plums, alfalfa, all kinds of vegetables, and likewise the cereals, grow there most luxuriantly and profitably. There has been irrigation from the first. But the water supply is insufficient, and this is why the government is going to bring more water, and plenty of it, through the heart of the mountains.

The Reclamation Service says that the

WATERMELONS AND CANTALOUPES GROWN IN THE STRAWBERRY VALLEY, UTAH



THE UPPER PHOTO SHOWS WHERE THE WATERS OF SPANISH FORK FLOW DOWN THROUGH A PIPE, TO FURNISH POWER. THE LOWER PHOTO SHOWS THIS POWER HOUSE.



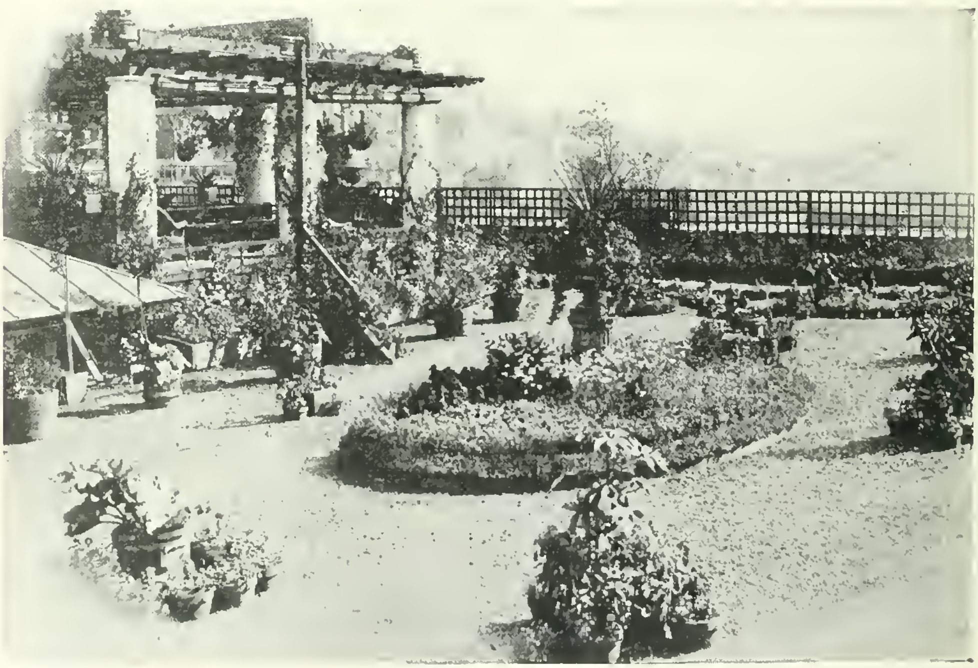
THE UPPER PHOTOS SHOW THE POWER CANAL AND TUNNEL WHICH CARRY THE WATERS OF SPANISH FORK; THE LOWER, THE MOUNTAIN THROUGH WHICH THIS TUNNEL IS BORED.

opportunities now offered to secure valuable farms in the Utah Valley, at merely nominal prices, are the most attractive to be found anywhere in the United States. Land at present obtainable there for a few dollars an acre is quite as desirable in all respects as areas in the Grand Valley, of Colorado, which have been sold for nearly $5,000 an acre—the highest price ever paid for agricultural land. All it needs is water, which will soon be supplied.

It is a beautiful country. The Utah Valley is like a level floor, walled on either side by ranges of gigantic mountains. Nothing more picturesque can be imagined. A veritable paradise in the midst of the desert.

WOMAN HAS FINEST ROOF-GARDEN

WHAT is declared to be the finest roof-garden in the world is that owned and managed by a lady, Mrs. Blackwell, of Seattle, Washington. It occupies a space of twelve thousand square feet, and, in addition to well-laid-out grass lawns, flower-beds with beautiful blooms, shrubs, trees, and climbing vines, there is a charming tea-house and a pagoda. The whole of the work in this aerial garden is done by Mrs. Blackwell and her two daughters. In addition to fruit trees, there are a number of ash and birch trees, six holly bushes, four hawthorns, a few evergreens, two laburnums, and several Arabia trees, together with one small apple tree, which bears enormously large fruit. Besides this there are large shrubs, like the lilac, and quantities of roses, there being three hundred or more bushes. The climbers, which add softness and grace and give the flowing lines needed to complete the picture, are jasmine, Virginia creeper grape, three varieties of clematis, wistaria, ivy and climbing roses. The photograph herewith shown gives a good idea of the beauty of this unique garden.



REMARKABLE ROOF-GARDEN OF MRS. BLACKWELL, OF SEATTLE, WASHINGTON.
It occupies a space of 12,000 square feet.

DATES FROM OUR OWN DESERT

By

CHARLTON LAWRENCE EDHOLM

OUR Southwestern desert is developing a new industry which will add a delicious fruit to our native food supply, the fresh date of high quality, which will replace the low grade imported product, the sticky dried dates from the Persian Gulf. The Deglet Noor date grown in southern California and Arizona is as much more appetizing than the messy lump of dried, crushed and unclean dates that the grocer pries off the ordinary cube, as a sound, sweet, rosy-cheeked apple is superior to the leathery slice of the same fruit which the clerk scoops out of the dried apple barrel.

Within a few years we may see the Eastern market supplied with the fancy fresh dates from our own desert, for already this delicious fruit is sold in Los Angeles, though the output is quite limited.

For some years the U. S. Government has conducted experiments in date growing with shoots brought from famous orchards in Persia, Tunis and Egypt. These tests and the results of planting by ranchers in southern California and Arizona have demonstrated that the date can be profitably cultivated within our own borders, and various companies are now being formed to go into the business on a large scale. Just what this industry may mean in the Southwest can only be guessed at but its possibilities seem very great for there is not only the food value of the fruit to be considered but also the various by-products of a date orchard which make the palm in its native land a sort of universal provider.

Three Year Old Tree in the Coachella Valley.

Ten-Year-Old Date Palm Ready for the Harvest.

Off-shoots Banked so as to Form Independent Roots.

A PLANTATION OF YOUNG DATE TREES AND OFF-SHOOTS.

The leaves furnish a long fibre which is excellent for cordage, mats, baskets and so forth. The pulpy part of the leaf and stem can be made into paper which is said to be of a superior quality; while sugar, alcohol, wax, starch and dyeing material form other by-products of the date palm, to say nothing of the wine made from sap of the old trees. In its African home the palm is also used for building and furniture making and in fact enough beautiful pieces of furniture have been made by amateurs in this country from the palm stems to suggest another by-product. Thus in the cultivation of a desert plant we may find a partial solution to the problem of reclaiming our own arid wastes.

The conditions for successful date growing are stated in the Arab proverb that "the palm should have its feet in the water and its head in the fire." An abundance of water at the roots, but the least possible humidity in the atmosphere are the chief requisites, and these are found in various parts of Arizona and southern California, notably the Salton Basin. Here the water is brought up from wells at a depth of about one hundred feet, while artesian water is found at about five hundred feet. The desert heat is intensified in this basin by the bare slopes of the mountains near by, which throw back the rays of the sun into the centre of the valley, producing an exceedingly dry and hot atmosphere.

CLUSTERS OF GOLDEN SWEETNESS.

A large acreage has been set out in date palms near Indio on the Salton Basin and until these young trees are producing there will be good profits from raising alfalfa which is planted between the trees, this doubling up of the crops being advantageous to both. Even more valuable than the alfalfa as a secondary crop is the cotton which is now being produced in the Coachella and Imperial valleys and which flourishes under like conditions with the date. This can be planted between the thirty-foot rows of trees without damage to either crop. Experiments have shown that the area adapted to date growing in California is also suitable for the raising of the long-fibred Egyptian cotton, an expensive variety which we import to the extent of sixteen million dollars every year. One of the companies which is going into the date business extensively has built a cotton gin and warehouse preparatory to raising these two crops on the same ground.

The date palms produce fruit in their third year and bear generously from the fifth year on and unlike most fruit trees do not deteriorate with age. Some of the historic palms in the Orient are said to be a couple of thousand years old and bear from 400 to 600 pounds per tree every year.

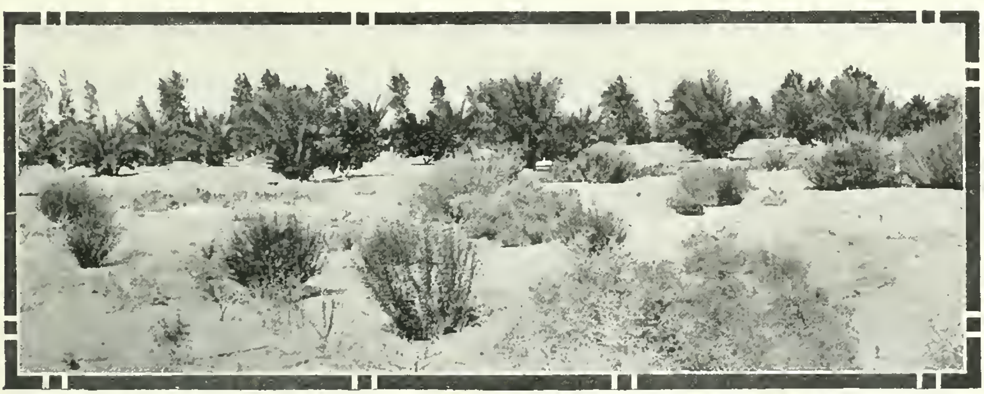
A source of revenue aside from the fruit is the sale of the off-shoots from the mature trees which are banked up so as to allow the shoot to form a root of its own. These may be cut away and used for extending the date orchard, or they have a ready market. This method of propagating by shoots is more satisfactory than that of planting the seeds even though the cost is greater, for the date has its peculiarities, one of which is that a seed of one variety may produce a tree of an entirely different nature and you never can tell whether you are going to get a superior or an inferior sort. Mr. W. F. Stevens, one of the pioneer date growers of the Salton Basin, states that one may expect at least one hundred plants of the best quality of dates from the one thousand seeds planted to the acre.

After the young trees come to flower it is possible to determine which are the fruit-bearing, or female plants, and then almost all of the male plants, perhaps half of the total number of seedlings, are taken up. But these are not a total loss as there is a good market for them in the cities for ornamental trees, and when the industry is conducted on a larger scale such trees would have a value as raw materials for cordage and other manufacturing products.

RIPE CALIFORNIA DATES.
Compare these with the dirty, messy "corner grocery" variety.

On the other hand the propagation by off-shoots seems to be a matter of certainty even though much more expensive, as the female tree of a given high grade date will produce nothing but female, or fruit-bearing, off-shoots of the same grade. Experiments show that on an average the grower can take off one shoot a year from a tree after its third year up until its tenth year, although cases have been known of off-shoots being produced up to the twentieth year.

The method of planting seedlings is to set the trees in rows thirty feet apart



DATE PALMS GROWING IN THE CALIFORNIA DESERT.

DATES AND SMYRNA FIGS GROW WELL TOGETHER.

and about eighteen inches between seeds in the row. In this way it is possible to plant about one thousand seeds to an acre. As the trees develop they are thinned out until finally there is a space of thirty feet between the trees in both directions. In setting out shoots there is the same space of thirty feet allowed between the rows, of course, but the shoots in the row are not placed so close together. When the trees are mature the long fronds will intertwine even at that distance, forming vistas of graceful arches and yielding a delightfully cool shade for the desert dweller. There is probably no tree in the world which is more beautiful than the date palm with its long curving leaves and its huge clusters of golden fruit from eighty to one hundred and thirty pounds to the tree.

A Department of Agriculture bulletin gives this statement:

"There exists already a large market for a date of superior quality, suitable for household uses, and for employment in confectionery, while demand for the finest grade of Saharan Deglet Noor dates far exceeds the supply even when they are sold for more than selected Smyrna figs. American orders for a quarter million pounds have been refused by the Algerian producers because the supply barely sufficed the European demand.

"It is clear from what has preceded in this bulletin that the Salton Basin is not only the most promising region in the United States for the culture of the best sort of dates, but it is actually better adapted for the profitable culture than those parts of the Saharan Desert where the best export dates are produced.

"There can be no doubt that the Deglet Noor date will ripen fully in the Salton Basin, even when the season is exceptionally cool. The importance of this demonstration can hardly be overestimated, since it renders it possible to establish in America the culture of this choice date, the most expensive of dried fruits, with certainty of success."

The foregoing bulletin states that at a conservative estimate 4,500 pounds of dates can be produced per acre.

This is not mere theory but conclusions from actual tests in Arizona and the Salton Basin, where the government has an experimental fruit station with ninety different kinds of date palms. In addition to this there are several ranchers in the valley who are producing marketable fruit on a small scale.

The market price of these dates ranges from thirty-five to fifty cents and even to a dollar a pound for the fancy grades. No expensive artificial process is required to prepare the date for shipment; its own sugar is a natural preservative.

LANDING FOR SMALLER CRAFT AT TAMPICO, A SEAPORT ON THE PANUCO RIVER.

NAVIGABLE WATERWAYS OF MEXICO

By

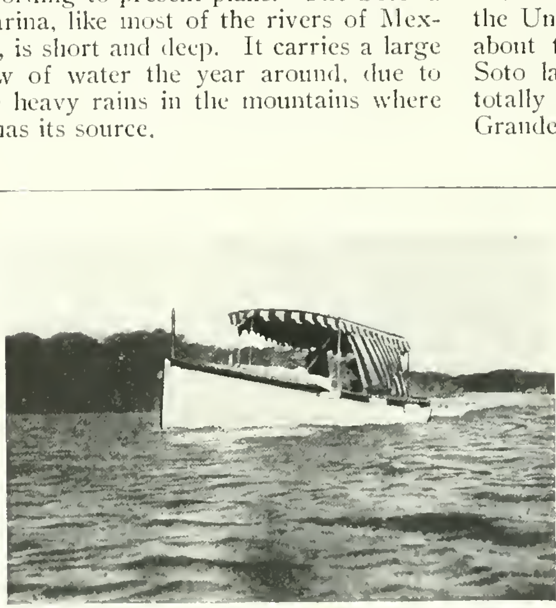
W. D. HORNADAY

THE Mexican government began the development of the inland waterways of that country several years ago. There are a number of navigable rivers which have been cleared of obstructions and opened for traffic, and the work is still in progress on some of the streams. Some of these rivers reach far into the interior and are the arteries of trade for large scopes of territory. The Panuco River, which is used as a deep water harbor at Tampico, situated a few miles from its mouth, is navigable for a distance of 160 miles for boats of considerable size. Regular lines of steamers and smaller craft ply up and down its course, bringing to the market at Tampico for export and local consumption enormous quantities of products which are raised upon the rich plantations that extend back from its banks for many miles. The Soto la Marina River which empties into the Gulf of Mexico about 150 miles north of Tampico, is broad and deep at its mouth. It is navigable for river boats for a distance of seventy-five miles. The government recently awarded the contract for removing the bar at the mouth of this stream by means of dredging. This is the first step towards the establishment of a new deep water port. The town of Soto la Marina is situated about

ON THE SHORES OF LAKE TAMIAHUA.
This is a lagoon, one hundred miles long, immediately south of Tampico.

thirty-five miles up the stream, and it will be made the future deep water port, according to present plans. The Soto la Marina, like most of the rivers of Mexico, is short and deep. It carries a large flow of water the year around, due to the heavy rains in the mountains where it has its source.

The Rio Grande, which forms the international boundary line for more than one thousand miles between Mexico and the United States, empties into the gulf about two hundred miles north of the Soto la Marina. The two streams are totally unlike in appearance. The Rio Grande water is muddy at all times, while the water of the Soto la Marina as well as the other streams of Mexico is clear as the blue sky which shines overhead. Below Tampico a little more than one hundred miles is the Tuxpan River which empties into the gulf at the town of Tuxpan. It is also navigable for a considerable distance, having a depth of more than thirty feet. But for the fact that the water over the bar at its mouth is only six and one-half feet deep ocean-going vessels would be able to tie up at the wharves at Tuxpan and it would become



One of the Boats That Ply the Waters of Lake Tamiahua.

a deepwater harbor. The Papaloapan River which empties into the Gulf of Mexico, near Vera Cruz, has been dredged and made navigable. Its principal tributary, the Santo Domingo, has been treated in a like manner. The opening of these rivers for boat traffic has proved of great benefit to the many towns and plantations which are situated in the interior. A direct outlet for their products is now afforded. The Coatzacoalcos River, on the isthmus of Tehuantepec, is a stream of considerable importance from a traffic standpoint.

Far down in the tropics and emptying into the Gulf of Campeche at Frontera is the Grijalva River. It is one of the broadest and most imposing streams in Mexico. Large boats ply regularly up this stream to San Juan Bautista, a distance of about seventy-five miles. The smaller boats go much farther, the boat traffic extending into the mountains where the stream has its source. The Usumacinta River is the principal tributary of the Grijalva. It is navigable far beyond the Guatemala line in which country it has its source.

Stretch of Heavy Concrete Work on the Tampico-Tuxpan Canal.

On the Pacific side of Mexico are several rivers which are of navigable size. The Balsas is a large stream, but rapids along its upper course interfere with the operation of larger boats. The Rio Grande de Santiago which empties into the Pacific about midway between the ports of Manzanillo and Mazatlan is navigable for some distance from its mouth and affords an outlet for an extensive territory that is without railroad transportation facilities. The Mayo and Yaqui rivers are navigable streams, but

VIEW OF TAMPICO FROM THE PANUCO FRONT.

on account of the undeveloped state of their rich valleys and tributary country they are used but little by boats.

As an adjunct to the navigable streams and deepwater ports of the eastern region of Mexico the government is building an intercoastal canal. This waterway is of the same character that is proposed along the gulf coast of Louisiana and Mexico to connect with the Mississippi and Rio Grande rivers, the importance of an intercoastal canal system was recognized by the Mexican government and the first step towards constructing the waterway was taken ten years ago. The canal now under contract will be one hundred and four miles long. It will connect the ports of Tampico and Tuxpan. The first section of sixty-six miles is finished and in operation. The canal will not be finished until about 1914. It took five years to build the first sixty-six miles, and the amount of dredging and excavation to be done on the second section is greater than on the portion already completed. This intercoastal waterway has a width of seventy-five feet and a uniform depth of ten and one-half feet. It connects with the Panuco River about four miles below the city of Tampico. At the point where it joins the Panuco the water in the latter stream is fifty feet deep. On the opposite bank of the river are government wharves and the docks of large private concerns where the ocean-going vessels load and discharge their cargoes. The canal is of a width and depth sufficient for the ordinary lake boats and river craft. The natives use long and narrow boats which are made with the view of carrying the largest possible cargoes. These boats are propelled by means of long poles, unless the wind should be favorable, in which case sails are hoisted. The opening of the first section of the canal quickly developed a great traffic and hundreds of these small boats are now constantly traversing the new waterway, bringing the products of the plantations and ranches to market and taking back with them supplies of various kinds.

A trip by small boat between Tampico and Tuxpan by way of the gulf is dangerous on account of the gales that frequently come up unexpectedly. The bar at the mouth of the Tuxpan River makes it impossible for the larger boats to enter that port, and these adverse conditions were a constant menace to the traffic between the two ports. The greatest incentive, however, that led to the determination on the part of the government to build the intercoastal canal was the fact that the country extending back from the coast is teeming in natural richness and was only awaiting an outlet for its product to start it on the road to wonderful development. Although the first section of sixty-six miles of the canal has been opened but a short time an enormous traffic through it has been developed and the tributary country has taken on new life and is pouring its tropical and other products into the market at Tampico. A large number of Americans have gone into the region and have acquired plantations which they are working by modern methods with splendid results. Pineapples, bananas, coffee, corn, sugar cane and many other products are grown with wonderful success.

It is claimed that when the canal reaches Tuxpan a country of still greater richness and possibilities will be opened up. The valley of the Tuxpan River is one of the choicest agricultural parts of Mexico. It has no railroad outlet and the little traffic that is done is through the undeveloped port of Tuxpan. No market is available for the tropical fruits which grow abundantly there, and the territory with its great natural resources is literally bottled up. The intercoastal canal will remove the barrier that has always existed to the development of the region, and it is expected that a marvelous change will quickly follow the completion of the waterway. There are good indications of oil at many places in the territory adjacent to the route of the canal. One American company has developed its oil land holdings on a considerable scale, having a number of producing wells and an oil refinery which is in regular operation. Many hundreds of thousands of acres of prospective oil land have been acquired by Americans in that region and prospect wells are being bored at many points. Several producing wells have been brought in at Furbero, fifty miles

ONE OF MEXICO'S NAVIGABLE RIVERS.

from Tuxpan. Oil has been struck in paying quantities at other places in that territory.

No great engineering difficulties are to be encountered in the building of the Tampico-Tuxpan intercoastal canal. Captain Charles Shillaber of Chicago has been connected with the enterprise since its inception. In fact, he suggested the idea for building the waterway to the government. This was in 1898. He spent nearly five years in making surveys and perfecting the plans for the work. He was given the contract for the first division of sixty-six miles and began the excavation work on the Tampico end on March 12, 1903. He has the contract for building the second division. A. B. Hitchman is the chief engineer.

Lying about midway between Tampico and Tuxpan is Lake Tamiahua. This lake is seventy-nine miles long and from five to twenty miles wide. It has a connection with the Gulf of Mexico through the Tanguijo River which flows from its extreme lower end and runs parallel with the coast for about eighteen miles, emptying into the gulf a few miles north of Tuxpan. This is a sluggish stream, and the salt water from the gulf enters

THE DEEP WATER HARBOR AT TAMPICO.

A STRETCH OF THE TAMPICO-TUXPAN CANAL THROUGH LAKE TAMIAHUA.

through it and makes the water of the lake or lagoon briny. The project of damming this river at the point where it leaves the lake is under consideration. By doing this the current of the stream would be thrown into the canal and diverted into the Tuxpan River. The lake is fed by five rivers which have their source in the adjacent mountains.

There is a chain of small lakes or lagoons connecting with Lake Tamiahua on the north for several miles. The water in Lake Tamiahua has a depth ranging from three to fifteen feet. The channel through the lake was opened by means of dredges. The bottom of the lake is a shell bank and the hard material when thrown upon the sides of the waterway rises above the surface of the water in places. Wherever banks are formed in this manner wild tule plants have been set out and are growing nicely. These aquatic plants make a beautiful border to the canal. It is also planned to line the banks of the waterway with trees, and a start in this direction has been made already by the planting of young cork trees at regular intervals along the banks of the canal.

The excavation on the upper end of the canal was heavy. At one place, known as Medano cut, the banks rise fifteen or twenty feet above the surface of the water. The formation at this point was rock and the material had to be loosened by blasting. It is estimated that the removal of about 2,300,000 cubic meters of material is involved in the construction of the second division of thirty-four miles. The hardest work will be in solid sand and oyster shell reefs. The canal will traverse the length of Lake Tampamachoco, just to the north of the Tuxpan River. This lake is about three miles long and two miles wide. It is only two and one-half to three feet deep. To reach the Tuxpan River from this lake a channel will have to be cut through a strip of land about one and one-half miles wide. The cut through this strip will be from five to fifteen feet above the water level.

The dredges used in the construction of this canal were all built at Tampico under the direction of Captain Shillaber. Four dredges are now in use. Three of them are small orange-peel dipper machines, each having a capacity of 8,000 cubic meters of earth per month, including hard and soft work. The average cost of the work done by the small dredges is about twenty cents, Mexican money, per cubic yard, which is equivalent to ten cents gold. The large dredge now in use has a capacity of about 20,000 cubic meters of earth per month at the rate of fifteen hours per day. This dredge is used in the heaviest stretches of work. It can handle any material except the solid rock. The cost of excavation per cubic meter by this dredge is much greater than by the smaller dredges. Another large dredge is being constructed for work on the lower end of the canal.

It is estimated that the canal will have cost when completed about $5,000,000 Mexican money, or $2,500,000 gold.

The completed portion of the canal has had one beneficial effect which was not expected when the plans for its construction were under consideration. It has served as a drainage way for a large territory which was formerly covered with a few inches of water, making the land unavailable for agricultural purposes. This land is now perfectly drained and is being placed in cultivation in many places. It is believed that when the canal is finished through to the Tuxpan River it will serve to carry off the surplus water from a still greater territory and that many thousands of acres of land will be in this manner reclaimed.

There are many beautiful vistas along the canal. The shores of the lagoons and lakes are lined with plantations of pineapples, bananas and other products. Pretty homes, with expanse of verdant lawns, slope down to the water's edge. An endless stream of boats, each manned with a picturesque crew, pass up and down the canal. Whole families of natives occupy some of these boats. They carry their cooking utensils with them and make their homes on board the frail craft day and night. There are places where the shore is lined with tropical forests, and in the waning hours of the afternoon flocks of brilliant-hued parrots fly from place to place and awaken the echoes with their cries.

The building of this intercoastal canal between Tampico and Tuxpan will be followed by the construction of a similar waterway to connect Tampico with the Rio Grande, where connection will also be made with the proposed intercoastal canal that the United States government is to construct through the lagoons bordering the Louisiana and Texas coasts. The distance between Tampico and the mouth of the Rio Grande is about three hundred miles. A series of salt water lagoons lie along the coast for a part of the distance, but much more excavation work will have to be done on the upper canal than is encountered on the Tampico-Tuxpan waterway. The territory extending back from the coast for 150 miles, between Tampico and the Rio Grande, is susceptible of high agricultural development. Like the Tampico-Tuxpan region it is attracting many Americans who have purchased large bodies of land and are doing a successful business in farming and raising live stock. They are handicapped, however, by the lack of transportation facilities. The building of the canal will secure for them a direct outlet for their products.

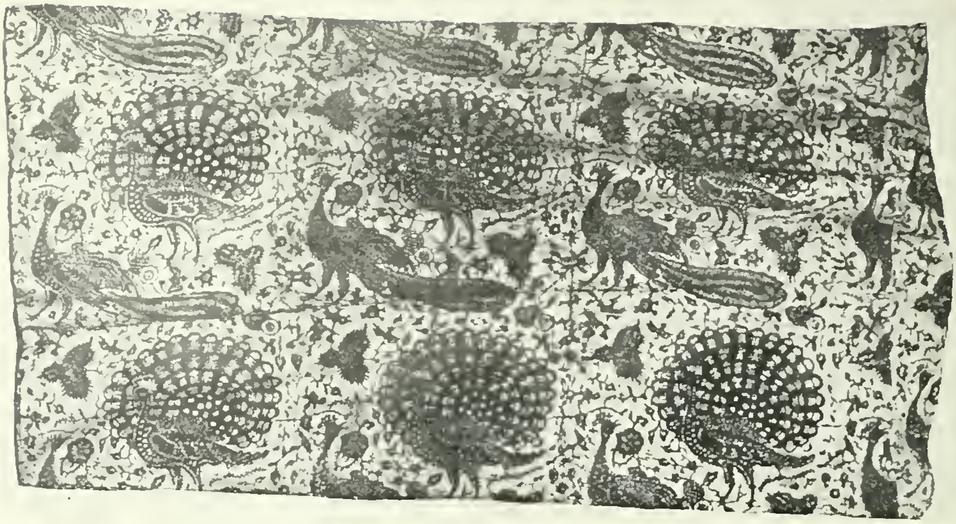
PEARL DIVING PROHIBITED

THE steamship *Maraposa*, recently arrived at San Francisco from the far away island of Tahiti, under French dominion, in the South Pacific, brings the first news that the French government has lately prohibited the use of diving apparatus in carrying on the valuable pearl fishing industry.

This action was taken to save one of the most profitable enterprises of the colonies from destruction.

The commission which investigated the matter, found that the native divers who plied their trade without any diving apparatus and gathered up these valuable shells only as fast as they naturally increased had been supplanted by Europeans in diving gear who were in the employ of large corporations, and who gathered these shells in such quantities that a great many of the pearl shell beds had been exhausted.

To keep temptation out of the way of the pearl hunters, all of the diving outfits, gear, etc., were gathered together by the French authorities and shipped away from Tahiti and the other islands.



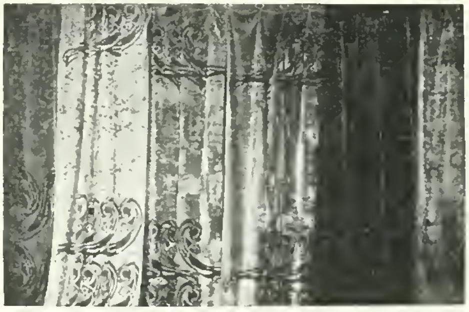
A PRINT IN BLUE AND GREEN, MADE BY NATIVES OF JAVA.

CLEVER FINGERS MAKE BEAUTIFUL FABRICS

By

J. HARTLEY KNIGHT AND MABEL TUKE PRIESTMAN

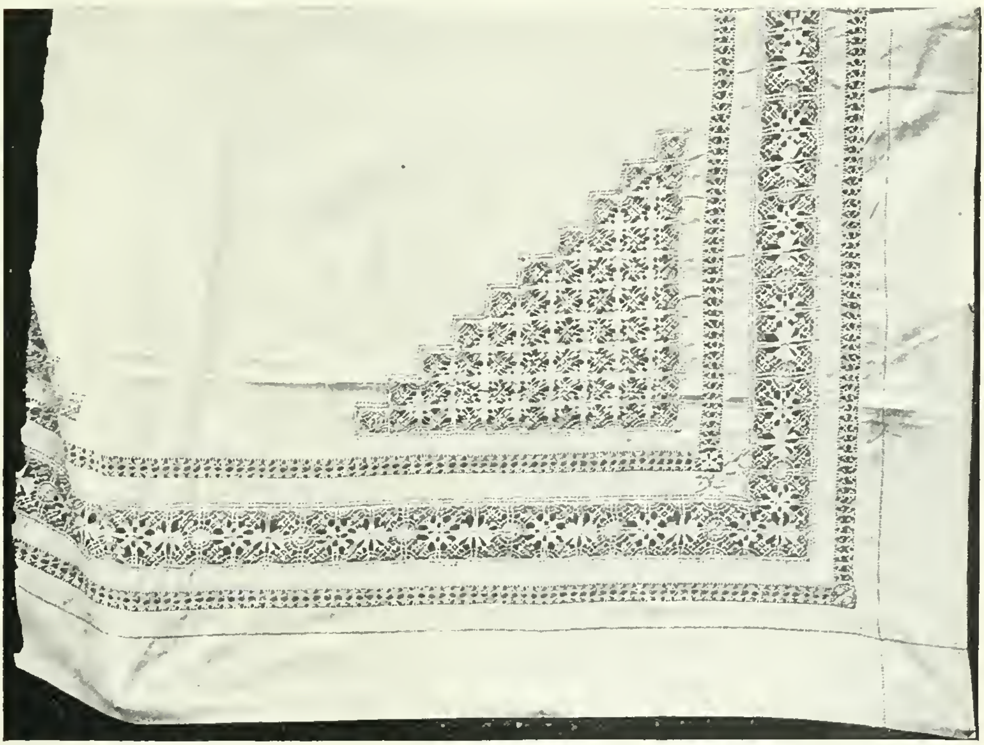
TO the deft fingers of the dark-eyed señoritas of the Canary Islands, off the northwest corner of the African continent, is due a very considerable share of the prosperity of that portion of the King of Spain's dominions. Altogether, some 12,000 women and girls are engaged in the industry, for so it can now be called, the majority of them residing at Teneriffe—famous the world over for its wonderful mountain peak, a fascinating landmark to those who "go down to the sea in ships" between Europe and South Africa.



Batik Hangings Shown at the Arts Exhibition at the Hague.

Calado is the local word for hand-drawn threadwork, the great merit of which lies in its beauty of design and simplicity of execution. The raw material consists of linen, which is imported in large quantities from Ireland, which still holds her own in the linen industry, notwithstanding the fierce competition of Germany and other European countries. Calado work is indigenous to the Canaries and has been carried on there for local use for generations. Its origin, however, is "wropt in mistry." It is supposed that it was introduced by some political refugees who settled in Teneriffe, but this is by no means certain. Originally the work was of the poorest description, so far as the pattern was concerned and the materials employed. Of late years—thanks to careful organization and the introduction of superior qualities of linen—Calado work has vastly improved and is now in great vogue, whilst the peasant women engaged in it have made great strides as regards skill and manipulation. But not all the thread-work produced in the Canary Islands today is of uniform quality. Much of it is, indeed, of a very shoddy character—the product of unskilful workers who are only too ready to trade on the reputation of their cleverer sisters. Not infrequently visitors to these beautiful islands are offered bad work which the would-be sellers know only too well would not be looked at by the regular exporters, and thus the industry as such suffers considerable harm.

As an article of export the history of Calado work is quite modern. Less than twenty years ago an observant young Englishman, Mr. J. Audley Sparrow, went out to Teneriffe for the benefit of his health and was so impressed by the possibilities of the drawn-thread work and the skill and industry of the workers that he set to work to reorganize the whole thing and put the product on a business basis as an article of export. At first he found that "the trade" in England regarded the Calado work with no very great favor. He worked to such good purpose that he was ultimately able to arrange for a regular export of Calado goods to London and, subsequently, to other parts of the continent and America. Mr. Osbert Ward in his book on "The Vale of Orotava," relates in detail how Mr. Sparrow was first attracted to Calado work and foresaw its great possi-

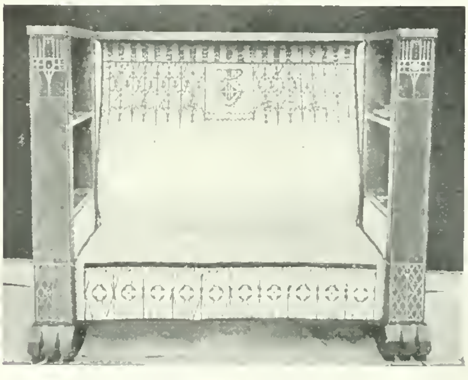


SPECIMEN OF CALADO WORK.

EMPLOYEES IN A CALADO FACTORY, ON TENERIFFE, ONE OF THE CANARY ISLANDS.

bilities as a revenue producer. "He procured books of designs," says Mr. Ward, "of drawn work from other countries, vigorously set to work and organized the proper development of the industry."

Needless to say, Mr. Sparrow's example was duly emulated, and today the local Calado trade is in the hands of two British and two German firms, the lion's share, it is believed, falling to the former. The Teneriffe peasants are adepts at work of the kind—especially drawn-thread work and cushion lace work. The former is that open work embroidery in which some of the threads of the linen material are drawn out, the remaining threads being stitched into lace patterns. The resultant effects appear to be that which is technically known as "an insertion," but as a matter of fact the pattern is an integral part of the material itself.



AN ART NOUVEAU SETTEE UPHOLSTERED IN LEATHER AND ORNAMENTED WITH BATIK DECORATIONS.

The lace work—rueda, as it is called—consists of wheels or medallions, made by winding thread round pins on a cushion and then with a needle completing the desired design by knotting and darning. Some of the Calado work is of exquisite design and workmanship and of considerable value. Especially was this the case with the bed set of drawn-thread and lace work which was specially made by the loyal islanders and given as a wedding present to King Alfonso of Spain and his queen, Victoria. Even finer was the christening robe presented as a gift on the occasion of the birth of the heir to the royal couple. The robe was cut on the latest Paris model and was certainly one of the handsomest of the many superb gifts presented to the proud young Queen of Spain.

A Family That, Working Outside the Factory, Creates Fabrics at Home.

Batik making is one of the oldest arts in the world, having been done by the native Javanese women and children for many generations. For some years past several artists in Holland have tried to follow the Javanese methods in ornamenting fabrics but the honor of really developing Batik making into a beautiful craft is due to the energy of a woman. Mrs. Wegerif Granestein has not confined her work to cotton fabrics, like the Javanese, but has worked on parchment, leather, silk, and velvet, giving a wide and varied scope to the uses of her craft. She has worked in conjunction with well known architects, and has introduced Batik into original decorative schemes that have made her work recognized in Europe. So successful has she been, that many orders have come to her, and she now employs thirty craft workers in her studio who do this work under her supervision. These beautiful hangings can be seen at most of the Arts and Crafts exhibitions in Europe and within the last year the knowledge of the work has spread to England and beautiful hangings can now be obtained from private studios in London.

As this has proved a lucrative employment to those who have taken it up, it is to be hoped that we will not be behindhand in developing Batik to the best of our ability.

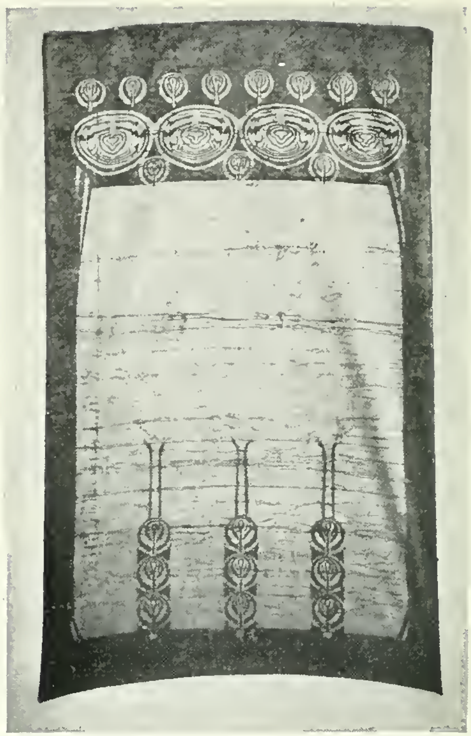
The bold barbaric designs made by the natives of Java have usually been adhered to, but there is no reason why other motifs should not be developed. Mrs. Wegerif Granestein makes many of her designs after the art nouveau, this style being still so popular in some countries in Europe. In this country it would seem more appropriate to develop it along Indian lines. The rather crude designs of the latter would lend themselves well to the technique of this interesting art.

The actual process of Batik making is primitive in the extreme. It is merely the protection of certain parts of the material by the application of hot wax. The material is emersed in dye which does not color the parts protected by the wax.

In Java the batik makers do not draw the design directly onto the material but apply the wax by means of an instrument called a tjanting onto the cloth. It is not necessary to use a tjanting to get the desired results, as this can be accom-

Chair Covered with Velour Designed in Batik of Dark Color.

Christening Robe of the Heir to the Spanish Throne.
This was woven at Teneriffe and presented to the Royal couple.



A Piece of Batik That Has a Place in One of the Famous Studios at Apeldooin, Holland.
This bit of art work is highly prized by the Dutch.

plished by means of a stencil, or by using a confectioner's tool for covering cakes with sugar. This enables batik to be made without drawing it first, a plan to be recommended when the worker is an artist, but for a woman who is only capable with her hands the stencil would be much more practical. If the confectioner's tool is used, however, the hot wax is put in the reservoir, which is refilled from a pan of boiling wax as it empties itself onto the material.

When the design is covered by the wax, the material is dipped in a dye bath which must not be above the heat of sixty degrees or it will melt the wax, and the batik will be spoiled. When several colors are used repeated applications of wax and several dippings in the dye are required to get the desired results. As this is somewhat a tedious process batik is usually done in one color, while the natural color of the ground is left to form the design.

When a dark design on a light ground is planned the wax is applied on the background and the design formed by dyeing the uncovered parts. It is needless to say that this takes considerably more time than the other. The wax cracks when applied in large masses, and fissures of color appear through the material giving the appearance of veined marble, and adds no little to the interesting qualities of the work. It will be noticed that most of our illustrations are all done with a dark pattern on a light ground. I have seen quite a number of batiks with a light pattern on a dark ground and they are just as beautiful as those in the accompanying illustrations.

In cutting a stencil for a dark pattern on a light ground it will be necessary to cut out the background of the design.

Batik is particularly beautiful when used for ornamenting leather. Crinkled sheep skin is well adapted to this interesting form of decoration.

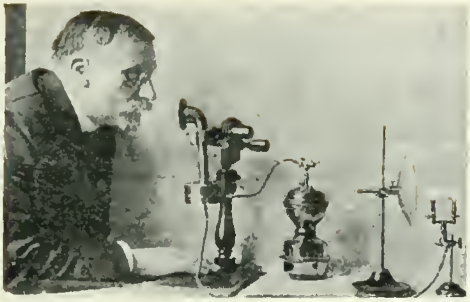


Figure 1. Speaking Through the New Wireless Telephone.

Figure 2. Receiving the Message Over the Wireless Telephone.

WIRELESS TELEPHONY BY LUMINOUS RAYS

IN wireless telegraphy either electricity or rays of light connect the microphone of the transmitting station to the telephone of the receiving station.

Ruhmur invented wireless telephony by luminous rays. At the focus of a parabolic mirror installed at the transmitting station he placed the positive carbon of an arc lamp, the latter forming part of the primary of a transformator, the secondary of which comprises a battery of accumulators and the microphone. When one speaks before the microphone the secondary current varies in intensity and modifies by induction the primary current, consequently the brilliancy of the arc lamp changes every instant, and the luminous reflective rays, varying in intensity, are concentrated at the focus of a parabolic mirror placed at the receiving station. These differences of brilliancy modify the electric resistance of a conductor of selenium which is connected with an accumulator and a telephone reproducing the words pronounced at the transmitting station. The German inventor imprisoned the cylinder in a glass bottle deprived of air, as its electric resistance diminishes in the open air.

Wireless telephonic machines recently invented by L. Ancel work on the same principle. At the transmitting post shown by Fig. 1 a speaking trumpet receives the sonorous vibrations and carries them to the vibrating membrane of a manometric capsule 80 millimeters in diameter through which a stream of acetylene flows. The movements of the vibrating walls modify the rapidity of the current of gas; consequently the flame of the acetylene burner, placed at a little distance, presents variations of intensity in harmony with the vibrations of the voice. The parabolic mirror, at the focus of which is placed the burner, sends a ray of light parallel to the mirror of the receiving station. At the receiving station this parabolic mirror like the preceding one collects the luminous rays rendered vibratory by the voice, concentrates them on a selenium cell placed at its focus attached to an accumulator and to a telephone. Thus the variations of the luminous intensity of light is translated on the selenium receiver by corresponding variations in the resistance of the selenium cell, and in the current which flows through the telephone.

Unfortunately even with these latest improvements by M. Ancel, communications by wireless telephony can be made only when the stations are visible the one to the other. They will, however, render useful services as models of demonstration in the course of physics in the laboratory.

Correct Usage

A TEACHER asked her scholars to give a sentence using the word disarrange. An Italian boy submitted this: "My mudder she gotta da coal range. My fadder get up in da morning, make da fire he say, 'Damma dis a range!'"

Pretty Quick

HE—"But couldn't you learn to love me, Anna?"

SHE—"I don't think I could, Harry."

HE (reaching for his hat)—"It is as I feared—you are too old to learn.—*Harper's Bazar.*

Reassuring

HE—"Good-night, dear. We must not kiss or you would take my cold."

SHE—"Never mind—I can pass it on."—*London Opinion.*

The Greater Tragedy

THE man whose daughter had just been united to the husband of her choice looked a little sad.

"I tell you, squire," he said to one of the wedding guests, a man of his own age, and himself the father of a number of unmarried girls, "I tell you, it is a solemn thing for us when our daughters marry and go away."

The squire assented, not altogether heartily.

"I suppose it is," he conceded; "but I tell you, it is more solemn when they don't."—*Youth's Companion.*

Why Didn't He Say So?

THE motorist emerged from beneath the car and struggled for breath. His helpful friend, holding the oil can, beamed upon him.

"I've just given the cylinder a thorough oiling, Dick, old man," said the helpful friend.

"Cylinder!" said the motorist, heatedly, "that wasn't the cylinder; it was my ear!"

All in One Class

WIFE—"Can you remember the first cigar you ever smoked, John?"

HUSBAND—"Yes, love; also my first sea voyage and our wedding day."

For All Time

MRS. HIGHUP—"The judge decreed that they should be separated, never to see each other again."

MRS. BLASE—"Are they?"

MRS. HIGHUP—"Yes. They are living next door to each other in a New York apartment house now."—*Puck.*

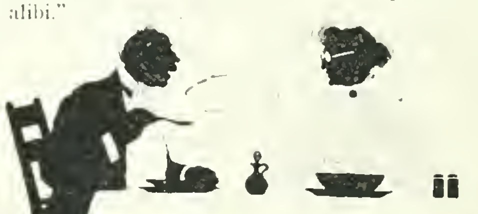
A Good Name Forever

"WE'VE just bought a Rembrandt." "How many cylinders?"—*Boston Transcript.*

Could Locate the Fluid

"How do you find the chicken soup tonight, Mr. Newcomb?" inquired the boarding house landlady.

"I have no difficulty in finding the soup, Mrs. Hasher," he replied, "but I am inclined to think the chicken will be able to prove an alibi."



Wonderfully Gallant

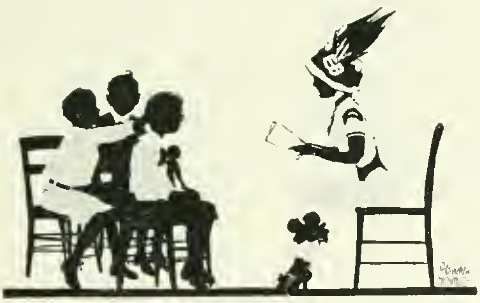
SHE—"Do you prefer an ugly woman with brains or a pretty woman without brains?"
HE—"Madame, I prefer present company to either."—*St. Louis Mirror.*

Even a Funeral

"How can you be so cold to me? I would die for you," sobbed his wife.
"I know it," he answered cruelly. "You'd do anything to put me to expense."—*Life.*

Circumstances Alter Cases

"WHY, Tommy," exclaimed the Sunday school teacher, "don't you say your prayers every night before you go to bed?"



"Not any more," replied Tommy; "I uster when I slept in a folding bed, though."—*Philadelphia Record.*

His New Password

"I WANT to change my password," said the man who had for two years rented a safety-deposit box.
"Very well," replied the man in charge. "What is the old one?"
"Gladys."
"And what do you wish the new one to be?"
"Mabel. Gladys has gone to Reno."—*Judge.*

No Frenzied Financier

"Do you assimilate your food, aunty?"
"No, I doesn't, sah. I buys it open an' honest, sah."—*Baltimore American.*

A Bad Egg

"HE always was a bad egg, but nobody seemed to notice it while he was rich."
"Yes, he was all right until he was broke."—*Sacred Heart Review.*

Prodigious

"PATTY," said Grandma, "I think it about time you stopped playing with boys. Little girls ought not to care to play with boys, when they're as large as you."
"Oh, that's all right, Grandma. Why, the bigger we get, the better we like 'em!"—*Lippincott's Magazine.*

The Question

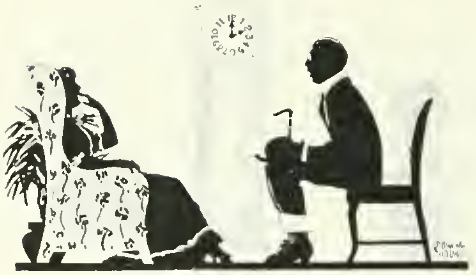
DREMER—"Did you ever think what you would do if you had Rockefeller's income?"
MUGLEY—"Yes: and I've often wondered what he'd do if he had mine."—*Catholic Standard and Times.*

Caution

"A VERDICT for $10,000 isn't so bad," said the junior partner. "How much shall we allow our client?"
"Oh, give him $50," answered the senior partner.
"But hold!"
"Well?"
"Don't be hasty. Promise to give him $50."
—*Louisville Courier-Journal.*

Not As Easy As He Thought

A TRAMP went to a farmhouse, and sitting down in the front yard began to eat the grass.
The housewife's heart went out to him: "Poor man, you must indeed be hungry. Come around to the back."
The tramp beamed and winked at the hired man.
"There," said the housewife, when the tramp hove in sight, pointing to a circle of green grass, "try that: you will find that grass so much longer."—*Everybody's.*



The Hint That Failed

VISITOR (waiting an invitation to lunch)—"Two o'clock! I fear I'm keeping you from your dinner."

HOSTESS—"No; but I fear we are keeping you from yours!"—*Meggendorfer Blaetter.*

Ladies First

Two miners were returning from a lecture at the village Institute, when one of them after a thoughtful pause remarked:

"Say Bill, I don't see the necessity of bringing chaps from the East to teach us about manners in the home. We ain't so bad as that fellow made out."

"Of course we ain't," replied Bill.

"Not by a long shot," went on the first. "I never swears before my wife ——"

"No more do I," put in Bill. "I always says 'Ladies first'—that's me."

Another One on Mother

TOMMY—"The doctor brought the baby."

FREDDY—"It looks just like ma's been shopping by telephone again."

A Cook in Need

HUSBAND—"Did the cook you hired show up?"

WIFE—"No. Wasn't it fortunate? Another one rang our bell by mistake looking for Mrs. Gillet next door, and I've kept her instead.—*Harper's Bazar.*

Not Unusual

"I WAS surprised when I heard that Grabrox had joined the church." "I wasn't. I happened to be present when he and his business partner shook dice to see which member of the firm should join."—*Indianapolis Journal.*

Oh, I Say, Now

SUITOR—"I would like to see the photo of the lady with the $500,000 dowry."

MATRIMONIAL AGENT—"We don't show photos with the large dowries."—*Fliegende Blaetter.*

Looking Ahead

"My dear," says the husband, as his wife comes to join him for a walk, attired in her hobble skirt, basket hat, and other things of the present mode, "I want you to come to the photographer's and have your picture made just as you are."

"Why, do you like me so well in this costume?" she beams.

"Well, my idea is that two years from now I can show you the picture, and you will say the things about it that I would like to say about your appearance just now."—*Life.*

She Knew

DOCTOR—"Well, Mrs. Jones, did you test your husband's temperature, as I told you?"

MRS. JONES—"Yes, doctor. I put the barometer on his chest, and it went round to 'very dry,' so I gave him a pint of beer, and he's been to work this morning."

Odds in Her Favor

ANGRY MOTHER.—"You've got an awful nerve to ask me to give you back your ball when you nearly killed one of my children with it."

BOY—"Well, mum, you've got ten children, and we've only got one ball."—*Short Stories.*

Would Make Him Care

JUGGINS—"Who was it that said if he could make the songs of the people he wouldn't care who made the laws?"

MUGGINS—"Don't know. But if he's the chap who's making the songs of the people nowadays I'd just like to have the making of the laws a little while! That's all!"—*Red Hen.*

Room for More

"COME, Willie," said his mother, "don't be so selfish. Let your little brother play with your marbles a while."

"But," protested Willie, "he means to keep them always."

"Oh, I guess not."

"I guess yes! 'Cause he's swallowed two o' them already."—*Catholic Standard and Times.*

His Money's Worth

"SIXTANE shilluns a da' did they charrge me for my room at the hotel in Lunnon!" roared Sandy, indignantly, on his return to Croburgh Burghs from a sight-seeing expedition.

"Ou, aye, it wasna cheap," agreed his father; "but ye must 'a' had a gey fine time seein' the sichts."

"Sein' the sichts!" roared Sandy. "I didna see a sicht a' the time I was in Lunnon. Mon, mon, ye dinna suppose I was going to be stuck that much for a room, an' then no get the proper use o't!"—*Tit-Bits.*

A Hint

HE—"Do you think that your father would offer me personal violence if I were to ask him for you?"

SHE—"No, but I think he will if you don't pretty soon."—*The Watchman.*

Imprudent

"SAY, old man, did I ever tell you about the awful fright I got on my wedding day?"

"S-s-s-h, no man should speak that way about his wife."

She Was All Set

THE minister was shaking hands with a new member of his congregation, a girl fresh from Sweden, and said, cordially: "I would like to know your address, so I can call on you."

"Oh," said the girl, innocently, "I haf a man."

Knew the Effect

TEACHER—"Tommy, do you know, 'How doth the little busy bee?'"

TOMMY—"No; I only know he doth it!"

A Noble Spirit

HUSBAND—"You are quite comfortable, dear?"

WIFE—"Yes, love."

"The cushions are easy and soft?"

"Yes, darling."

"You don't feel any jolts?"

"No, sweetest."

"And there is no draft on my lamb, is there?"

"No, my ownest own."

"Then change seats with me."—*Ideas.*

A Clever Ruse

WIFE—"Please match this piece of silk for me before you come home."

HUSBAND—"At the counter where the sweet little blonde works? The one with the soulful eyes and——"

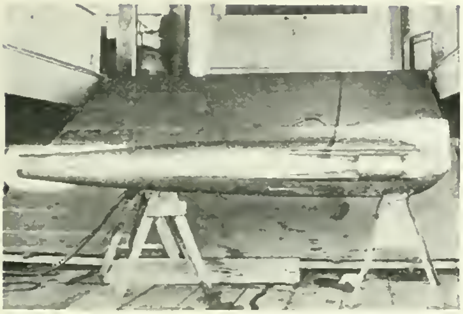
WIFE—"No. You're too tired to shop for me when your day's work is done, dear. On second thought, I won't bother you."—*Detroit News.*

POPULAR · SCIENCE & MECHANICS SUPPLEMENT

ONCE DEATH TO EAT THIS FISH

AMONG the reefs that skirt the shores of the Hawaiian Islands are to be found, at certain seasons, great numbers of a little white fish which is exceedingly good to eat. It is called the "moa." So great a delicacy is it, in truth, that in earlier days the fish was declared "tabu" to the commonalty, only the great chiefs being allowed to eat it, under penalty of death. But nowadays, hap-

CASTING THE NET FOR THE DELICIOUS HAWAIIAN MOA—A FOOD FOR KINGS.



Side View of Model of New Type of Submarine.

Front View, Showing the Propellers in the Tubes

pily, anybody is permitted to catch and eat the "moa," which is taken by means of a circular net twelve feet in diameter, weighted around the circumference with bits of lead, and thrown from the reef in such a way as to fall upon a school of the finny tidbits and enclose them—whereupon they are pulled ashore. The manner of casting the net is rather strikingly illustrated by the accompanying photograph.

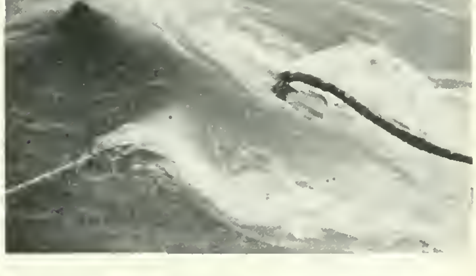
SUBMARINE OF A NEW TYPE

A SUBMARINE craft which embodies new principles has been invented by a Los Angeles man, and a ten foot model of his device was recently given a test in the waters of a small bay near that city. The features which differentiate this model from all other submarine vessels is the use of propellers near the prow instead of at the stern, thus pulling the boat through the water instead of driving it. These propellers are enclosed in short tubes, or wells, and when the water is forced through them by the rapidly revolving blades the boat travels at remarkable speed. On her experimental try-out the model almost ran away from the launch which was following and made a speed that was estimated at more than twenty knots. The lines of this new model are very slender and graceful. At the prow is an upright blade or nose which cuts the water and has a tendency to prevent rolling. From there the lines taper gradually to the stern, where are located the two sets of rudders, vertical and horizontal, and these resemble the rudders of the Antoinette monoplane, directing it right or left and up or down.

Power for this ten foot model was supplied by a gasoline engine on the launch, equipped with a generator, and transmitted by a length of cable to the motor within the submarine. The rudders were also operated from the boat, the wires directing the steering gear being bound together with the power cable.

The operator was able to sink the craft and raise it at will, either with the rudders or by filling the ballast tanks with water and emptying them by means of compressed air. At all times she was under perfect control and would plunge into the deeps or rise to the surface with a leap like a flying fish in obedience to the guiding hand.

It is proposed to start work immediately on a fifty foot boat of this type and great things are expected of it. It is claimed that the danger of running submarines at a high speed is minimized by the device of placing the propellers in front, as most of the accidents to these craft have been the result of their diving



The Submarine Coming to the Surface.

Last Aid Treatment as in Use in a London Hospital.

Flying Machine Looks Like a Bird.

California Rose Vine Covers House.
"The Mother Rose of the Santa Clara Valley," planted fifty years ago, towers above two story dwelling.

at too abrupt an angle when trying to make speed below the surface and thus losing their balance and getting quite out of control.

TO AID THE DYING

AMONG the few quite reliable devices for rendering last aid to the dying is the instrument depicted in the accompanying photograph which is the outcome of many years' close study and observation on the part of the inventor, Mr. Leonard Hill of the London Hospital, Whitechapel. The device, as will be seen, is very compact and easily transportable. The tube containing the vapor of oxygen is placed against an upright standard, and a tap which is seen being actuated by Mr. Hill regulates the supply of oxygen into the small mixing chamber seen on the right of the supporting standard. In this chamber the oxygen is mixed automatically with alcohol and water and this mixture is conveyed in the connecting tube to the frame of the device seen being held over a patient's face. The mixture which is released is breathed direct to the lungs and heart and has proved to be of incalculable use in cases of drowning and the like where the action of the heart has practically ceased, or in other cases where the patient is in most imminent danger of death. The device is equipped with a partial head covering which prevents the escape of the gas during inhalation.

MONOPLANE LIKE HUGE BIRD

IN their search for a flying machine that combines stability, buoyancy, and ease of guidance, aeroplanists are making many departures from the type of machine with which the Wright brothers have made us most familiar. At the recent meet at Ivisy, France, the monoplane *Diapason,* piloted by M. Schreck, was one of the novelties that attracted a very general attention. Besides imparting an unusual equilibrium to the machine, the peculiar structure adds a rigidity and strength far above the average.

M. Schreck declares himself as more than satisfied with this departure from the conventional type of monoplane.

ROSES TO HOLD SAND BANKS.
Hardy species along railroad track between New York and Boston to prevent the blowing about of the loose sand.

FUMIGATING BY AUTO

AN automobile, drawing a disinfecting box on wheels, is being used in the various cities of France, by the health officers, to ward off all possible results from contagious diseases. It is especially important that bedding which the patient has used should be thoroughly fumigated. For this purpose vapors of formic aldehyde are becoming recognized as best. It is not required to detach the box from the automobile for using it, but it is run out upon rails and rests upon a support. According to the ideas of the inventor, Dr. Charles Ott, the best way is not to introduce the fumigating box into the contaminated bed-room, as this would require a special disinfection of the room itself, after the box had been removed. Besides this, people object to having materials brought into their home from places where other contagious maladies prevail. The sanitary automobile is therefore stationed outside while the employes are proceeding with their work inside the building, the infected clothing, etc., being treated in the fumigating box at the same time.

A "TRACKLESS, TROLLEYLESS" STREET CAR.

DISINFECTING BOX USED IN FRANCE.
This shows the method of fumigating bedclothes, etc.

NO TRACK; NO TROLLEY

THE efficiency of the storage battery street car is now fully recognized by engineers throughout the world. It is not surprising, therefore, that its invention should be soon followed by a new application in the form of a motor buss or "a trackless, trolleyless" street car.

The omnibus, as shown in the illustration, has a seating capacity of 30 passengers and is built to operate within a radius of 50 to 75 miles on a single charging. It is 22 feet long, about seven feet wide, and weighs four tons.

The car itself is of the lightest possible construction consistent with adequate strength. Twenty per cent of its total weight is that of the storage cells. The mechanical equipment consists of two motors driving the rear wheels through noiseless steel chain gearing.

HOMES RUINED BY A DESTRUCTIVE FLOOD IN THE VALLEY OF AOSTA, ITALY.

WRESTLERS FROM ICELAND.
Their style is catch as catch can, but with a harness.

SAVES BOATS FROM SHOCKS

WHAT, in the illustration, appears to be a huge bale of wire is in reality a bale of specially woven reed, used as a buffer for boats at one of Germany's sea ports. It is a great protection to the wharf, and a great improvement over those heretofore constructed of wood. Owing to the elasticity of the reed, not only the dock is safe from injury, but the boat is also relieved of sudden shock from landing, and this buffer might really be called a shock-absorber.

Some idea of the massiveness of the arrangement may be obtained from comparison in size between the man seated upon it and the bale itself. Its length is about eight feet, diameter six feet, and weight something over 110 pounds. The ordinary life of a buffer made from reed is five or six years.

WRESTLER LIFTING HIS OPPONENT BY MEANS OF THE HARNESS.
This certainly is a distinct novelty.

WHY INDIA DOES NOT PROGRESS

THROUGHOUT the provinces of India the laborer, be he agriculturist or otherwise, still clings to the ways and customs of his forefathers. In our photograph a native carpenter is seen plying his trade. He uses a saw of peculiar construction and his assistant, as will be seen, helps the downward stroke of this strange implement to give it force.

CRUDE METHODS OF HINDU CARPENTERS.

BUFFER OF WOVEN REEDS FOR VESSELS.

PASSENGERS CAN'T FALL OFF

You Can't Fall Off This Car.
The gate protects you.

STREET cars arranged with a separate entrance and exit do not always save passengers from disastrous falls, no matter how carefully the street car company employes may guard against starting the car too soon. A gate has recently been brought out that affords the most adequate protection possible. In this device the human equation is practically eliminated, inasmuch as the gates are open only when the car comes to a stop. Hence no one can be injured either by falling off or jumping from the car. The mechanism is quite simple in construction, cannot easily get out of order, and is automatic in action.

MACHINE SPLITS FIREWOOD

Supplants the Woodsman with His Axe.

TO split ordinary knotty and crooked wood economically into chips by machinery process was a problem which bristled with difficulties, and the efficiency of a new English machine used for this purpose is unquestionably very remarkable, as knots several inches in length can be cleanly cut into sticks, such as must otherwise either be thrown aside as unsuitable for splitting, or mashed up and wasted by less efficient machinery.

There always has been a little difficulty if the wood happened to be wider at one end than the other or badly sawed, be-

Shooting Off the Gun Camera.
Can be set to expose from 1 to 10 seconds.

As Large as the Human Hand.
A cacao pod from which the breakfaster gets his cocoa. The oily kernels are roasted for this purpose. The cacao also yields cacao butter. The tree is native to tropical America.

Photo Taken by Gun Camera One Second After Being Fired.
It is caught in a net when it comes down.

AEROPLANE PROPELLER CARVED BY A PREACHER.
The blade, at left, is finished; that at right, incomplete. It will be observed that several pieces of wood go into a single propeller.

cause having to be fed by spiked rollers at each end, if both rollers did not grip the wood almost simultaneously, the end gripped first would be fed forward first, so that in the new splitting machine special means were provided for counteracting these difficulties.

All such difficulties are now obviated, as the wood, of whatever size or shape, is carried along bodily in vertical position, being supported both in front and rear by other pieces of wood, so even the smallest pieces of wood cannot now fall over or be improperly cut by the knives.

The photograph shows how readily the metal box belt may be filled with every variety and shape of wood.

"THE WHITTLING PARSON"—REV. GEORGE S. GASSNER, OF PHILADELPHIA.
He is carving an aeroplane propeller.

PARSON MAKES PROPELLERS

A MINISTER in Philadelphia has taken up the making of propellers for airships. The photo shows the Rev. George S. Gassner of Philadelphia, whittling out a model of a propeller, and some of the propellers he has made, for which he is becoming nationally famous. These are not carved from one piece of wood, as some may suppose, but are made by carefully overlaying several separate pieces of wood, carved scientifically, as shown in the pictures of finished propellers, in which the separate portions of wood can be seen. It is not likely that the wood for the propeller will cost more than a few dollars, but so important is it that the propeller shall be made as sound as art can make it that as much as a hundred dollars is paid for one of the kind that the Rev. Mr. Gassner carves.

WASTE MATERIAL PUT TO GOOD USE.
Boards being scarce, an enterprising Californian makes dwelling out of odds and ends of tin.

BARGES AS BASIS FOR FACTORY SITE.
A string of worn-out craft that an enterprising contractor is using.

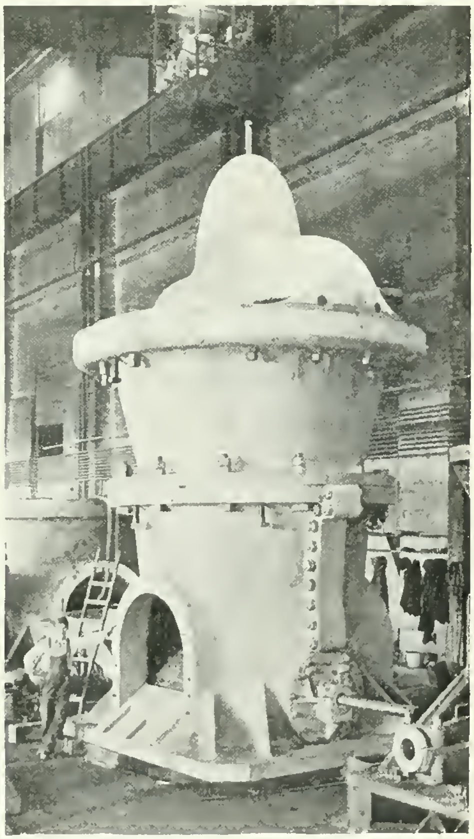
OLD BARGES MAKE NEW LAND

AN original method of reclaiming land is now being carried out on the Hudson River where the inlet of Kingsland Cove is being filled for use as a factory site. A string of barges, twenty-seven in all, will extend across the inlet end to end and be held in place by piles. The basin is now being filled and when the work is completed the chain of barges will form a bulwark which is said to be unique.

MODEL HOME OF CONCRETE

IN arranging for the elimination of the slum district in Los Angeles the "City Planning Conference" recently held in that city considered the building of concrete houses for the poor, which are to be sanitary, artistic and so economical in construction as to rent for a low price. In Los Angeles the tenement situation is quite different from that in Eastern cities, as the poor are housed in "courts" rather than in large structures, which makes it much easier to do away with the insanitary and antiquated frame buildings and to put up model structures on their site.

EXPERT IN FIRE-PROOF CONSTRUCTION.
Thomas Fellows, designer of "model home."



PRODUCES A FORTY-CAR TRAIN-LOAD OF CRUSHED ROCK EVERY HOUR.
Giant stone-breaker at Biwabik, Minnesota.

CONCRETE DWELLING FOR THE MAN OF SMALL MEANS.
An artistic model that attracted attention at the Los Angeles, California, "City Planning Conference."

The small model shown in this illustration was designed by an architect and former building inspector of the city, Mr. Thomas Fellows, who is an expert in cement and other fireproof construction and whose official advice on such matters is sought far and wide. His concrete house has added new laurels to his professional reputation.

As the design shows, the appearance of the house is artistic, being reminiscent of the flat roofed dwellings of Palestine. It is also a matter of economy and health to have a flat roof, available for sleeping purposes in the warm weather and as a play ground for the children. Mr. Fellows' house is somewhat different from the ordinary concrete structure in appearance as the exterior of the house is treated with a preparation which gives it a very close resemblance to unpolished granite.

The cost of building a four room dwelling on this model is estimated at $750, the house to contain toilet, bath and combination wash basin and wash tub, a gas heater for water, a small fireplace and plenty of windows with a specially designed system of ventilation. The dimensions of the house are to be twenty-four feet square and it is to be absolutely fireproof.

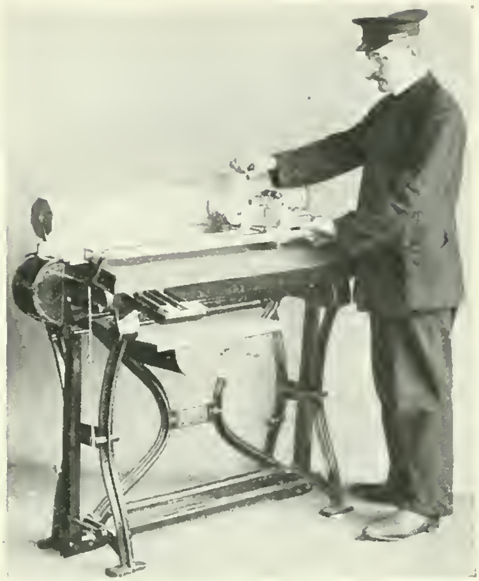
Mr. Fellows' design has attracted widespread attention. The combination of modern conveniences with the extraordinary low cost of construction has thoroughly aroused the enthusiasm of city planners.

RATIONS OF A JAP SOLDIER IN THE FIELD.
Three little bags of rice, and a bunch of dried vegetables form a day's food supply. Each soldier cooks his own food.

MACHINE PRINTS TICKETS

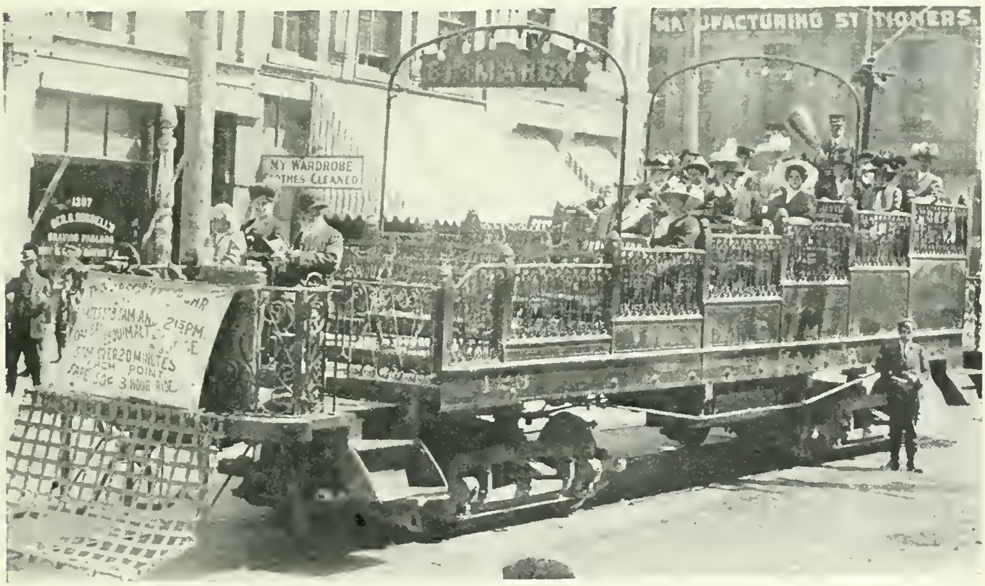
IN view of the ever increasing volume of railway traffic and the serious difficulties experienced in a rapid dispatching of travelers at the ticket offices, especially those of the more important termini, attempts have been made from time to time to design a machine, which, by automatically printing all the various sorts of tickets, would simplify to an enormous extent the mechanism of such offices. Apart from reducing to a minimum the most troublesome accounting work, the apparatus described in the following allows the sales to be checked with absolute safety, thus protecting the railway officials against any chance of mistake or false suspicion.

The apparatus, a German invention, shown herewith, enables tickets to be printed with any text desired at a moment's notice and with a far less expenditure of trouble, time and personnel than according to the methods so far in use in dealing with the traveling public. At the same time it prints checking tapes, the number and value of which correspond to the sales of tickets, so that a surprisingly simple, rapid and reliable checking and accounting are warranted.



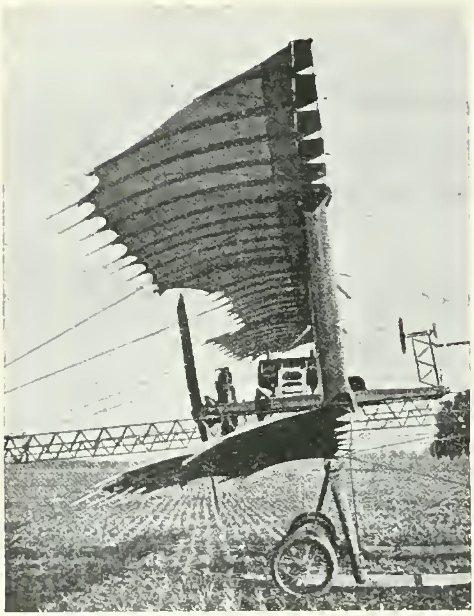
TICKET SELLER FOR A GERMAN RAILROAD PRINTING HIS OWN PASTEBOARDS.

In commencing his duties the operator at first prints a checking ticket on which his name as well as the date and hour of commencing work are filled in. This checking ticket is marked with a current number—like the remaining

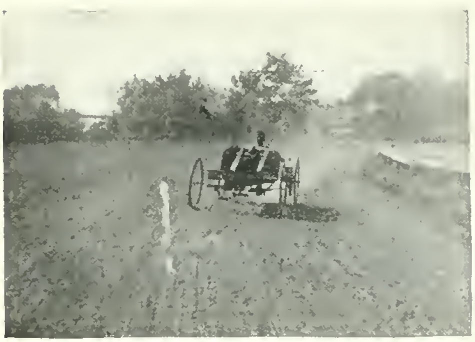


FIFTY CENTS FOR A THREE-HOURS' RIDE.

"Seeing the City," Victoria, B. C. An enjoyable and unique trip for the tourist. Stop-overs of twenty minutes are made at various points of special interest.



Looks Like a Chinese Invention, But It's One of the Latest of French Aeroplanes.



"Exceeding the Speed Limit."
Auto for juveniles making fifteen miles an hour.

The Youngster is Proud of His Home-Made Machine.

tickets to be printed—and is kept by the official as proof of the tickets—from a given number—having been printed by him.

THE NEW PAULHAN AEROPLANE

AT the second salon of Aerial Locomotion in Paris the Paulhan machine attracted considerable attention. It is a biplane constructed of timber built wings with rod ribs. It has superimposed surfaces joined by vertical bars. Two long rigid beams, parallel, carry at the rear a stabilizer and at the front an equilibrator.

The car with its motor occupies the central part of this frame. The screw propeller turns in the rear of the carrying planes. The vertical rudder is in the center of the stabilizer and carries a cramp arm break. All rests on a combination of two landing slides, each one provided with two launching wheels. One of the characteristics of the Paulhan machine is the supple joining of all the parts. A solid semi-metallic strap of leather which confines the heads of the parts to be joined, renders wedging and ruptures impossible.

The equilibrator is controlled by a rigid connecting rod with a turning joint which gives more security than the control by cables.

The car, suspended by cables between the two large planes, is covered with a weatherboard of aluminum and canvas terminating in a pointed arch, to make it a shelter for the pilots. It has two seats side by side.

One fly wheel controls the equilibrator, the rudder and warping of the wings.

BOY'S HOME-MADE MOTOR CAR

USING bicycle wheels and an air cooled motor for supplying the necessary power, an ingenious youth has constructed this juvenile automobile, said to be able to travel at a speed of 15 to 20 miles per hour. The gasoline engine has a rating of 1½ horse power. The enthusiastic contriver of this machine lives at Greenville, Ohio.

ELECTRIC SCRUBBER AND POLISHER

THE accompanying illustration shows an electric driven machine for scrubbing and polishing hardwood floors. There have been many contrivances devised from time to time for the purpose of renovating floors by machinery, and this device seems to be one of the most efficacious. In large structures the building manager is well aware that a monthly saving can be made if he can secure a properly constructed machine for this work.

This machine weighs less than fifty pounds and can be attached to any electric light fixture. It is extremely simple in construction. All the working parts are packed in grease and enclosed within a dust- and water-proof case.

There are no belts, no chains, no moving parts exposed to break furniture, damage woodwork or maim the operator. Owing to peculiarity of construction, it will scrub the inequalities of the floor as well as the high places. It is under absolute control at all times.

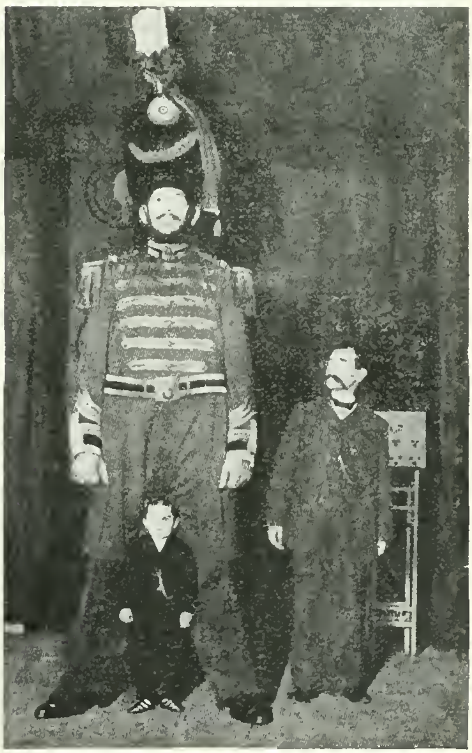
For ordinary scrubbing of wood, marble or composition floors, a stiff scrub brush is attached by a clamp to the revolving disk; a bucket of hot water containing soap powder is poured into the tank. The water is fed through a hose into a tube, which sprays it on the revolving brush. The handle is kept slightly below the working position, allowing the entire weight of the machine to rest on its casters.

This machine is also a great labor-saving device for removing varnish, paint, stain, etc., by the use of a steel brush and chemicals, and any unsightly floor can be cleaned down to the white wood, then sandpapered smooth for finishing, and finally waxed and polished. All of these operations may be accomplished with the same machine by applying the different brushes or disks.

EASY WORK FOR THE MAID AND A FINE POLISH FOR THE FLOOR.

LARGE AND SMALL

THERE were on exhibition in a Berlin, Germany, museum recently two curios that have attracted a great deal of attention, the largest and the smallest man in the world.



GIANT OF GIANTS, AND PYGMY OF PYGMIES.
A queer exhibit in a Berlin Museum.

Where the Ten Commandments Were Given.
Stone chapel on Mount Sinai, said to mark the spot where Moses saw the Glory of God pass by.

At Work on the Gatun Dam, Panama.
Placing the concrete that forms huge monolithic walls for the dam.

Joseph Dussorc, the giant, is a native of France and is 26 years of age. His height is 8 feet 5.6 inches, while his weight is 348.3 pounds. He wears a number 63 shoe and a number 16 glove. To make him a suit of clothes his tailor requires over 8 yards of material. He is the oldest son of a family remarkable for their stature, and who are all of a powerful build. The youngest girl, a child of but 12 years of age, has a height of 5 feet 9 inches.

Joseph finds it a very difficult matter to use any of the furniture in a room furnished for people of the usual height. When he travels a specially constructed bed accompanies him which is 9 feet 10 inches in length. Before being exhibited in the different museums of Europe, Mr. Dussorc was engaged in tilling the soil.

"Prince Atom," the smallest man in the world, travels with the giant. He is 16 years of age and weighs but 20.9 pounds, and has a height of but 2 feet 3.6 inches. His parents are of normal stature and his three sisters are also of about the usual height.

Daring Sweep in Burmah's Famous Bridge.
At the curve is a silver bolt which was the last bolt used in the work.

BURMAH'S FAMOUS BRIDGE

DISTANT from Mandalay, Burmah, 83 miles, stands one of the most remarkable railway bridges in the world. It is 2,260 feet in length and at the fourteenth trestle has a height of 820 feet. It was built by an American firm in eighteen months, nearly 5,000 tons of steel being employed in its construction. Not only for its extreme height is it remarkable, but also for its daring curve, two distinct sharp bends being taken by the rails as they cross the valley.

GAS WELL MAKES TROPICS IN WINTER

FOURTEEN years ago a party of oil diggers made a bore at Pelican, on the Athabasca River, Canada. They were working under the Geological Survey of Canada, and their instructions were to find if the reported existence of petroleum in the Western North was a fact. An oil-boring outfit was an in-

Party of Belated Surveyors Who Slept, on a Cold January Night, in Comfort Close to Burning Gas Well.

Band Stand on the Way to a Concert.
Minneapolis has solved the problem of music in the small parks.

It Does Not Take Long to Set in Place.
Costs but $300; answers the purpose of a $5,000 structure.

Odd Experimental Flying Machine, the Work of a French Inventor.
The maker is striving for a semi-kite effect.

novation in the wilderness, but it was finally gotten in, set up, and started at work. When the drill had reached a depth of 820 feet it struck gas. There was so much of it that an iron ball would not go down the hole when the gas was coming out, and the noise it made in escaping could be heard three miles away. The flow did not lessen any, and after various attempts to renew work, the men were at length compelled to quit the job.

After they went, some one came along and lighted the jet, probably in a spirit of mischief. It is still burning. Local report has it that it has been burning continuously since, but it is more than likely to have been extinguished now and then during the past fourteen years and re-lighted by settlers and passers-by. That the gas flow is undiminished, however, is quite certain, for the accompanying photograph, on page 599, taken a few months ago, shows a flame nearly fifty feet high and of very substantial circumference. In January a party of returning surveyors camped, on a bitterly cold night, at the gas well, whose cheerful flame so warmed the winter atmosphere for a radius of many yards around that they slept in the open, after the hardships of the day, as comfortably as if they were in a well-heated hotel or in their own home.

This Aeroplane Is Drawn Through the Air by Ropes.
A member of the San Francisco Aero Club in "towed flight," 200 feet above the ground.

WHERE THREE TRAINS CRASHED INTO ONE ANOTHER.
Remarkable triple wreck on a French railroad.

TRIPLE RAILROAD WRECK

A RECENT railroad wreck in France was one of the most remarkable that have ever occurred in that country or elsewhere, for that matter. The Paris to Brest express, while running at a speed of fifty miles an hour, ran into a waiting freight train at Courville. Just as the two trains collided, a third train—a freight—pulling out from the station of Courville, plunged into the mix-up. The wreckage took fire, and when the rescuers had completed their work, it was found that ten persons were dead and one hundred and fifty injured.

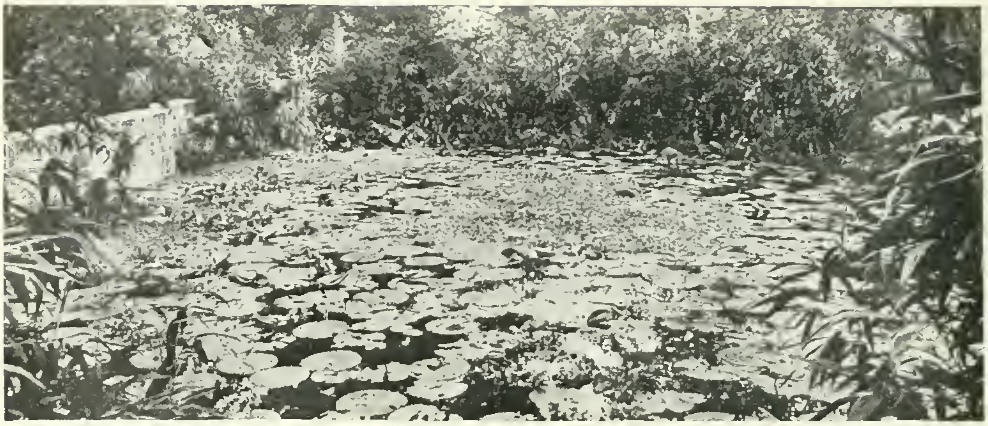
In spite of the greater number of passengers carried in the United States, according to statistics recently issued, the casualties in Enrope are greater proportionately, than in this country. This is said to be due to the difference in character of the coaches employed, those in the United States being heavier and more substantial, and hence affording the passengers better protection in the event of collision or derailment.

ONE OF THE LAST OF THE WOODEN TRESTLES.
This is over a small stream in California. Steel is rapidly replacing such bridges as this.

WHERE SEX PREVAILS BEYOND THE GRAVE.
In this Turkish cemetery the tombstone with turban top in the foreground marks the burying place of a man; that in the background, of a woman.

PASSING OF THE WOODEN TRESTLE

OUR photograph depicts the erection of a trestle bridge over Strawberry Creek in California. It is over one hundred feet from the ground and has a length of 1,200 feet.



WATER LILIES GROWING IN AN ARTIFICIALLY HEATED POND IN WINTER.
An experiment that a clever Swiss proved a success. Heated pipes do the work.

FRENCH AUTO USED FOR TRANSPORTING GUN TO BE USED AGAINST AIRSHIPS.

A VOLLEY OF MUSKETRY, FRENCH MILITARY EXPERIMENTS SHOW, IS MORE EFFECTIVE AGAINST AN AEROPLANE THAN A FIELD GUN.

Steel is now displacing timber because the latter, although less costly at first, requires frequent examination and renewal. The first of the large metal trestle structures was built over thirty years ago, and some of these have a height of 300 feet above river-level and are made to carry on one span the concentrated load of two locomotives each of 130-ton weight. The factor of safety is less than in the wooden structure, but it is sufficient.

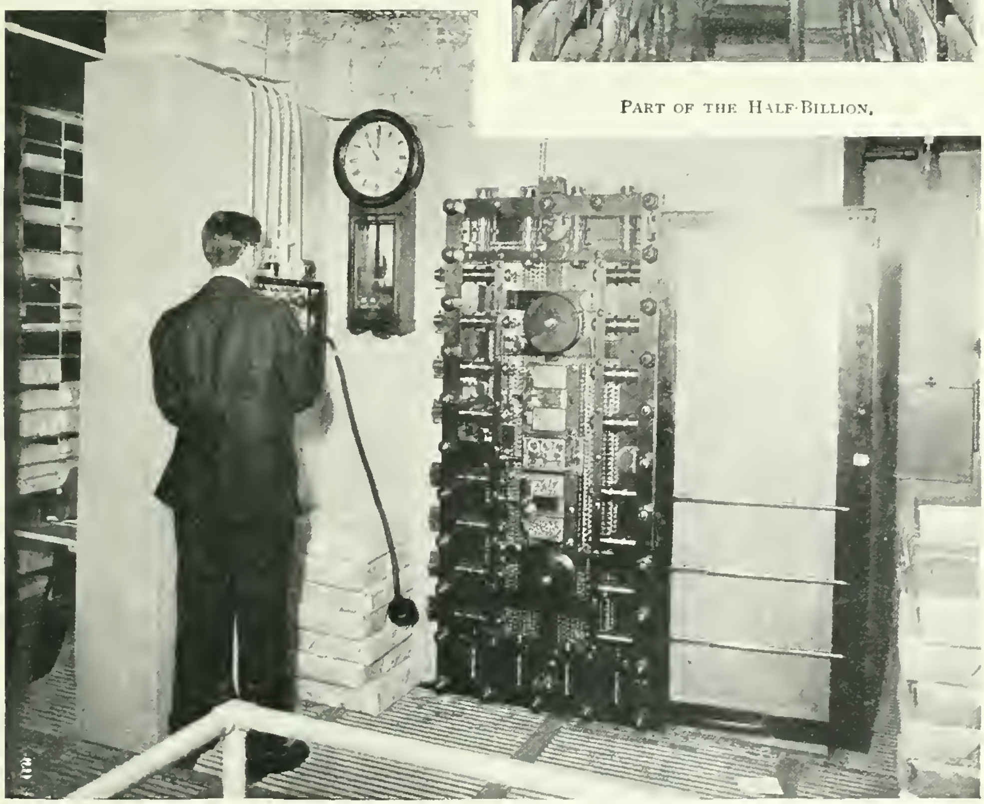
America is the home of the trestle bridge. When a census was taken some few years ago it was found that there were 150,000 wooden trestle bridges extending in the aggregate to 2,400 miles for single-line railroads. These had 730,000 spans. The average of such bridges was 100 feet per mile of railroad. But of the total spans 95 per cent were of less than 50 feet, although 1,150 were over 200 feet. Many of these trestle bridges of wood were of great length; the longest over Lake Pontchartrain measured twenty-two miles. In 1884 there was built the Intercolonial Railroad bridge at Halifax, 2,050 feet long with trestle and a swing span over the river. In the Selkirk range of the Rocky Mountains the Canadian Pacific Railroad was carried over Mountain Creek on a trestle bridge 152 feet high, the longest span being 149 feet and the total length 1,071 feet. Probably one of the highest wooden trestles is on the St. Paul, Minneapolis and Manitoba; it is 211 feet high.

GUARDING A HALF BILLION

WHEN congress passed the Aldrich-Vreeland currency bill in 1908 providing that the comptroller of the currency should have printed and cause to be kept on hand at all times, 50% of the total capital stock of the national banks of the country, few had cause to realize what the passage of the bill meant more than the Comptroller himself. Briefly, it meant the printing and storing of half a billion dollars of printed currency, aggregating the designated fifty per cent of the total resources of the seven thousand national banks of the United States.

The new vaults have recently been completed and the negotiable currency contained therein amounts to slightly over $510,000,000 at this writing, this amount having been said to be the largest amount of money ever kept in a single vault in the United States. The burglar protective system alone cost $9,000 and

PART OF THE HALF-BILLION.



A HALF-BILLION DOLLARS GOES INTO THIS VAULT.
How the big vault door looks from the inside. The glass door, swung aside, is filled with electric wires in meshes as an alarm in case a single wire is broken.

YOUTHFUL FRENCH BEAUTY AND OLD-FASHIONED AMERICA—A CONTRAST IN COSTUMES.

Miss Fowler—the lady at the right—of Vineland, New Jersey, has worn a costume of this sort for forty years, when the bloomer movement first started. She would probably disapprove of the harem skirt as immodest.

in the system are 17 miles of wire. It is tested every 15 minutes day and night, by means of telegraph sounders.

NORDINI, THE AUSTRALIAN ATHLETE, STOPPING THE BEATING OF HIS HEART.

MAN STOPS HIS OWN HEART

NORDINI, an Australian athlete who recently gave public exhibitions in London, England, has such extraordinary control of all the muscles of his body, including those of the heart, that he can stop the beating of the latter organ for as long a period as twenty seconds. Moreover he can retard or accelerate his pulse at will.

Many men have, by exercise, developed enormous muscles, but they have always been visible and remained firm to the touch, even when relaxed. Nordini can relax his to such an extent that by shaking his arm he can make the triceps quiver like reeds shaken by the wind, and, by a simple effort of will, without even clenching his hand, can make his upper arm as hard as iron while the forearm remains perfectly soft.

THE ROOSEVELT HUNTING TROPHIES THAT HAVE BEEN MOUNTED.

Though a number of men are engaged, the work goes forward slowly, owing to the skill and care required.

TEACHING BOYS TO BUILD AIR-SHIPS

AVIATION is bound to develop rapidly as long as it possesses its fascination for boys and young men. Imagination is a quality of youth and when applied to things mechanical it spells progress. This was shown in a recent air-ship contest at the Los Angeles Manual Training school, where many original models were shown, together with others built upon well-known lines. This helicopter with four circular planes and twelve vanes, or propeller blades, is operated by a spring mechanism. It was designed by one of the students, who is shown ready to launch it.

THE ENTRANCE TO THE PRIVATE DOMAIN OF A FORMER MORMON CHIEF.

GATEWAY TO A HAREM

THE Eagle Gateway, which spans State Street, Salt Lake City, was built under the personal direction of Brigham Young, and marks the entrance to what was once the Prophet's private domain. To the left of the gateway are the Beehive and Lion Houses, the connected residences where he lived with several of his many wives and variously assorted families. Across the street is the Gardo House, formerly "Amelia Palace." It was built as a reception place. It was never used for this but was given as a residence to Young's favorite wife, Amelia.

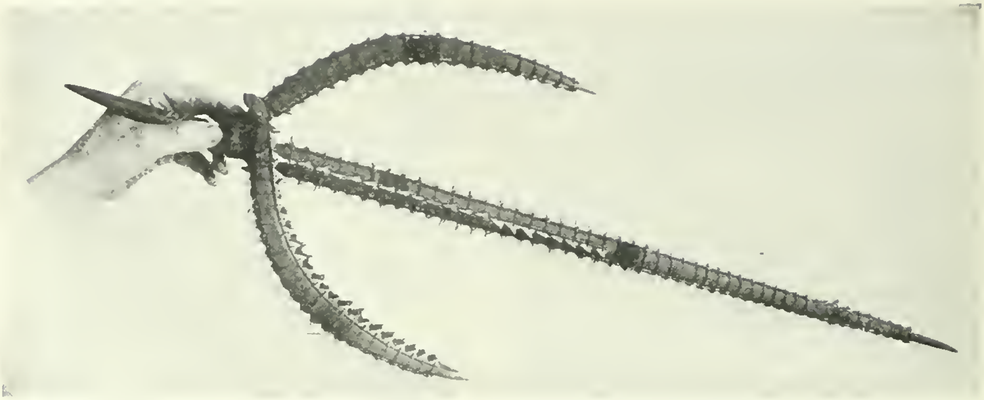
The Beehive House is now the office of the First President, while the Lion House is occupied by departments of the Mormon University.

CURIOSITIES CAUGHT BY THE CAMERA.

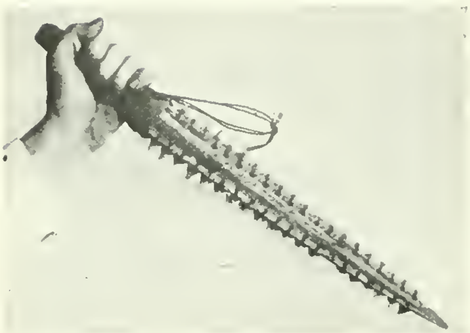
Flying machine made by an enthusiastic manual training school student under the direction of his teacher.

These lambs, losing their mother, the cow has kindly undertaken the task of rearing the hapless little orphans.

This little girl fell into a tub of water. Her mother, being too busy to put her into other clothes, hung her out on the clothes line to dry out.



SPEAR HEAD EDGED WITH SHARK'S TEETH.
A wicked-looking weapon in use in Polynesia.



A Shark-Tooth Stabbing Knife.

SHARK'S TEETH FOR WEAPONS

SHARKS' teeth are largely used in Polynesia for the making of weapons. Stabbing-knives edged with rows of them are extremely formidable, while spear-heads similarly ornamented are capable of inflicting dreadful wounds—the object of this sort of contrivance being to cut up the adversary as much as possible at a single blow. Once thrust into the flesh, such an instrument could hardly be withdrawn except by cutting it out, so jagged are the edges. It is certainly a cruel weapon.

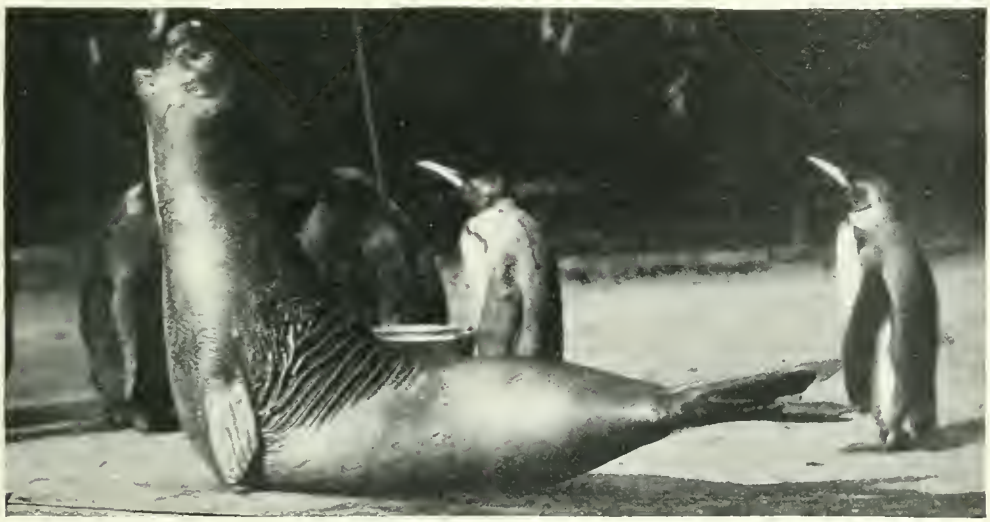
COLD AIR TREATMENT THAT REQUIRES A HARDY CONSTITUTION.
Taking a snow bath in Norway.

Lighthouse on the West Coast of Heligoland.

View, from the Heights, of Lower Heligoland and the Dock.

GERMANY'S GIBRALTAR

TWENTY years ago Germany and England made an exchange of Zanzibar and Heligoland. Lord Salisbury thought he had done very well in getting rid of the little island in the North Sea. At the time, the Kaiser was laughed at. Heligoland was splitting up bodily. Great scientists agreed that its doom was certain, and that it was not structurally strong enough to stand the strain of being fortified. But the German Emperor saw further than the British statesmen. "The island is destined to be a bulwark toward the sea," he declared, "to offer protection to German fisheries, or support for German warships, a strong place in the German Sea against every enemy who may show himself there." So the Kaiser began on a scheme of rebuilding the little island. Since 1890 he has practically reconstructed the island. He has spent, on an average, $1,250,000 a year in providing Heligoland with granite buttresses on all sides, sixteen feet thick and eighty yards and a half high. The numberless cracks and fissures, caused by each winter's frost in the higher parts of the wasting cliffs, he has filled up and bound together with thousands of tons of ferro-concrete. Tirelessly by day and night, this work has been going on for twenty years. At the



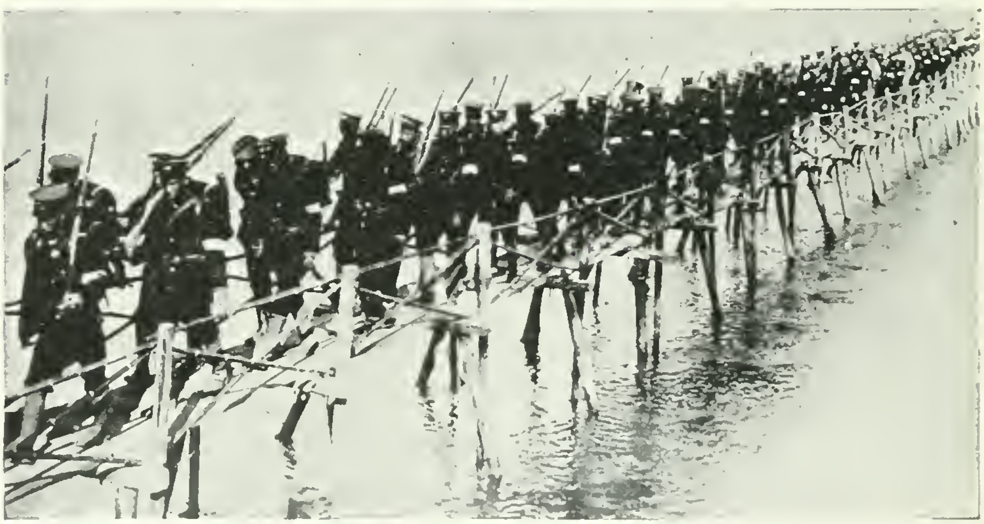
A YOUNG SEA ELEPHANT IN CARL HAGENBECK'S HAMBURG ANIMAL PARK.
The first of these creatures in captivity, the youngster, a year old, is a great curiosity.

A Pony in a Drawing Room.

present day the island is wholly incased with a cemented belt of armor three miles in circumference, which has cost $30,000,000. Thus strengthened, the island has been fortified, at a further cost of $7,500,000 during the last three years. Heligoland is only twenty-six miles from the mouths of the Eider, the Elbe and the Weser, and it is a defense for all three rivers. The Kaiser has also fortified the chain of islands which lies to the north and south of Heligoland. This chain of forts has made it possible for the Kaiser to transfer his naval base from the Baltic to the open sea. Under pretense of erecting breakwaters, to protect Heligoland from erosion, he has spent large sums on harbor construction on the north and south sides of the island, in addition, the east coast has a roadstead with forty-eight fathoms of water. Here can be accommodated the entire German fleet, which is thus brought one hundred miles nearer England. The Kaiser has spent the cost of five or six super Dreadnoughts on Heligoland alone. It is the key to a maneuvering base one hundred miles in length, from any point on which mosquito craft can dart between the island fortresses. In naval circles it is agreed that this long base doubles the fighting value of the German fleet.

WALTER WINANS AND HIS PET PONY

OUR photo, taken at Surrenden Park, Kent, England, Mr. Walter Winans' beautiful Kentish home, shows this famous sportsman with one of his "pet" ponies, which is a diminutive little quadruped, and which follows him about like the domestic dog. It is seen in his drawing-room being petted by his master who has just given it a nibble of sugar in order to tempt it to pose for the photographer.

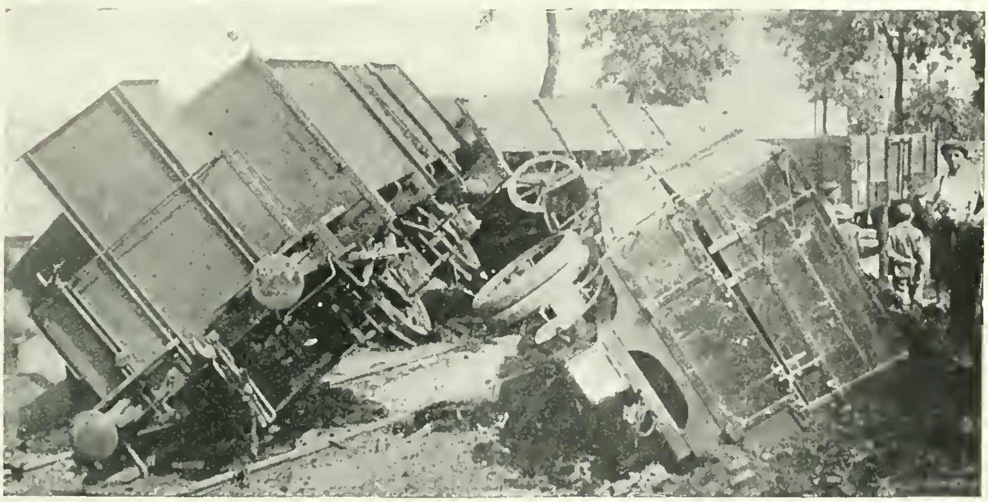


THE SORT OF ARMY CHINA COULD NOW CALL INTO THE FIELD.
Foreign drill officers have accomplished wonders.

SENDING THE NON-SINKABLE LIFE-BOAT OUT THROUGH THE SURF.
It will hold eight passengers.

NEW TYPE OF LIFE CAR

RECENTLY there was received at the Nahant, Mass., life saving station a new type of non-sinkable life car. It is the only one on the entire Atlantic Coast. It consists of an egg-shaped boat built of steel, accommodating eight people. The frame-work is of steel and it is decked over so that the hatch through which the rescued party enters the boat can be battened down, after which the boat is hauled ashore by the life-savers. It is so light that it can be hauled on a handcart, or carried on the shoulders of four men, and it can be launched by floating it out through the surf. A line is attached to the ordinary life line which is shot from a gun by the life-savers over the rigging of the



MILITARY MOTOR CAR COLLIDES WITH A FREIGHT TRAIN.
After this curious mishap, which occurred in Germany, the auto was able to continue its course under its own power to the repair station.

King and Queen of Spain Skating at Madrid During the Past Winter.
This photo was taken early in the year at their private lake at La Casa de Campo.

"Best Lighted Office Building in the World."
This is the claim made for Denver Gas and Electric Company's new building.

wrecked vessel. It is then hauled out by the people aboard the vessel and then hauled ashore by the life-savers by means of another line attached to the shore end of the car. After the hatches are battened down there is enough air to last for several hours when the complement of eight passengers are enclosed in it. Its non-sinkable character is due to its lightness of construction and shape. When fully loaded it rides steadily, but when less than four people are in it, it has a tendency to bob about somewhat like a fishing float or bob.

MONSTROUS MEXICAN TREE

ONE of the largest trees in the world is found in the village of Tule in southern Mexico. It is larger in circumference than the famous redwood trees of California, but is not nearly so high as those monsters of the forest. It equals the largest reported specimen of the gigantic baobabs of Africa which have been regarded as the largest specimens of trees existing anywhere. This immense tree, which is of great antiquity and still growing, is 154 feet in circumference six feet above the ground. Twenty-eight people with their hands outstretched and touching their finger-tips can just encircle it. The height is about 160 feet and the diameter of the spreading branches, 140 feet. It is claimed that these spreading branches once sheltered the army of Cortez while he was subduing this region after the conquest of the Valley of Mexico and, on beholding the monster, one can credit the statement.

A Tree Larger Than the California Redwood.
Reputed to have sheltered the army of Cortez, nearly four centuries ago.

Electric Auto-Hearse, Chicago.
Said to be the first ever turned out of an auto factory in this country.

HOT-AIR AS MEDICINE

THE machines now in use for producing hot air for the treatment of diseases present many inconveniences. The alcohol machines utilize the gas produced by the combustion of alcohol which is impure air saturated with steam.

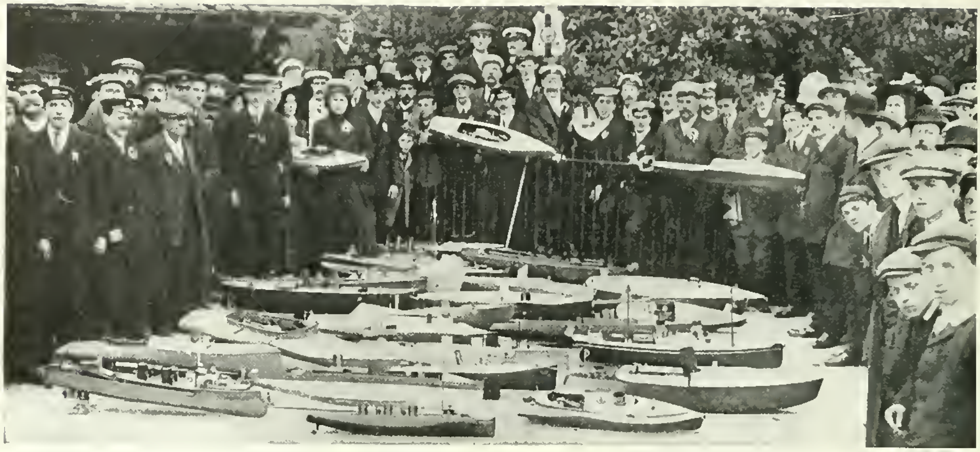
Hot air should be pure and dry, as humid air prevents the cutaneous evaporation, and electric machines unfortunately do not admit of sufficient temperature; besides they are difficult to regulate.

There is a question then of finding an alcohol machine which admits of attaining a high temperature that may be regulated; also that it be portable and capable of furnishing pure, dry air.

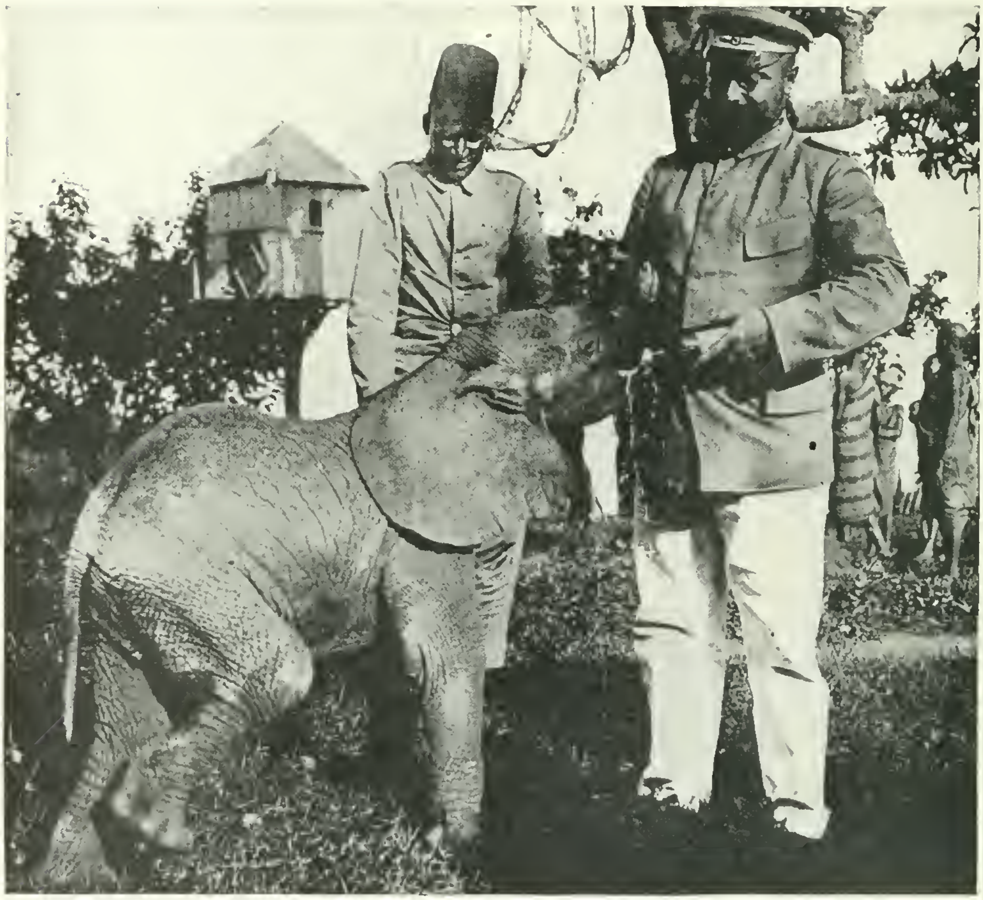
Two machines have recently been constructed which appear to realize this desideratum. One serves for the application of douches of hot air, the other for local baths. The common principle of these two machines is that they do not employ air which has served for the combustion. Our photograph gives a view of the latter-named machine. The alcohol flame of a Bunsen burner heats with intensity a tube through which the air passes. In the machine for douches, the air is brought by a powerful hand ventilator. In the one for local baths the tube is fed with the exterior air, and the draught is produced by the difference of density between the exterior air and the air heated by the machine.

Physician Giving Local Medical Treatment with Hot Air—a French Device.

"Queenie," the Pet Tortoise of an English Lady.
This is the way her mistress takes the little creature out for the daily "constitutional."



MODEL MOTOR BOAT REGATTA IN LONDON.
Participants, and their various craft, who took part in recent races of miniature vessels at Victoria Park, inaugurating a new sport.



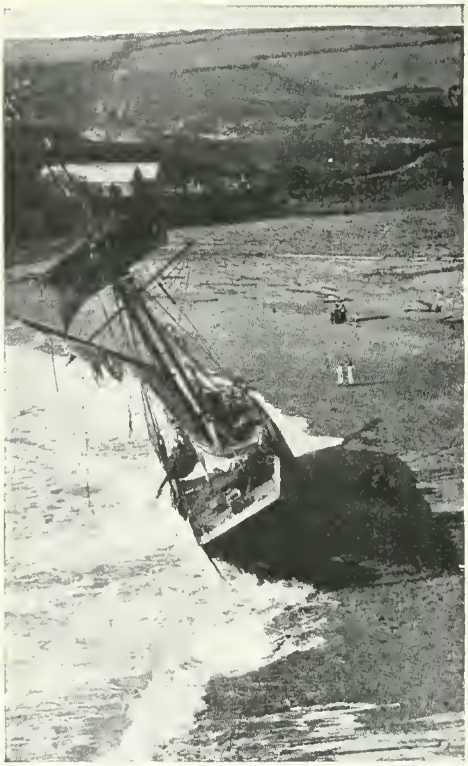
BABY ELEPHANT FEEDS FROM BOTTLE.
Scene in German East Africa. The elephant is a pet of an officer and has been "raised," so far, literally on the bottle.

WHICH IS CHEAPER—HORSE OR AUTO?
A scientific test seems to answer this question.

HORSE VS. MOTOR

AN interesting test of the comparative cost of operating a four cylinder automobile and driving a horse and buggy has just been completed by a New York manufacturer of motor cars, with results that explode the old theory that the automobile is a "rich man's toy" while the horse is the poor man's friend. A six-day test took the experimenters over the average country roads as well as through the congested parts of New York City, and each day the exact cost of up-keep was carefully noted. Allowance was made for the wear and tear, and the total cost of traveling by each conveyance was figured down to the mile. The total number of miles covered by the automobile was 457.9 at a total cost of $6.20. There were no repair charges and the gasoline and oil were purchased

THIS AUTO ROAD, NEAR ST. GIRONS, IN THE PYRENEES, FOLLOWS A STREAM THROUGH SOLID ROCK.
The white square is a placard warning motorists to go slow.



A French Schooner Driven Clean Ashore by a Gale on the Cornish Coast, England.
It is seldom a vessel so wave-pounded holds together.

along the way at the average retail price, just as the feed for the horse was purchased at livery stables *en route*. For depreciation an allowance was made of $8.24, making a total cost of $14.44 or per passenger-mile an average of $.0157.

The horse and buggy in the same time, and under as nearly possible similar conditions, made the following record: They covered 197.3 miles at a cost of $5.80 for the distance, no charge being made for repairs. Depreciation was allowed for at $1.47, making a total cost of $7.27, or per passenger-mile a cost of $.0184.

Thus it will be seen that the expense of operating a runabout is a trifle less per mile than that of driving a horse and buggy, but as the test was for only six days and as no charges for repairs occur in the case of neither automobile nor buggy, this item of up-keep remains to be compared if a fair estimate is to be made.

The judges assumed that the cost of shoeing, bedding and axle grease for the horse and buggy will offset the omission of grease charges in the operating cost of the automobile. In order to get a fair decision, disinterested observers were appointed to keep the records of the test and also, as a matter of fairness, the automobile was kept locked up while not in use so that no repairs could possibly be made without their being charged up against it.

Of course the fact that the automobile covered three times the distance in a given time should be taken into consideration for, as the business man or the traveling man on a salary knows quite well, "time is money" in a very literal sense indeed.

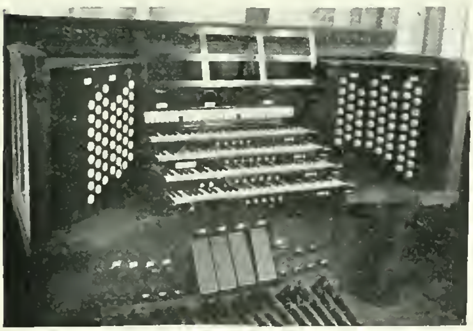
Further tests of a nature similar to the one outlined will probably show like results.

Gag for Gossips.
A bridle that effectually shut the mouth of a woman scold in the good old days in England.

Bird's Nest Which Is Used for Soup.
The nests of the salangani, in Java, are esteemed a great delicacy by Chinese, Japs, and French.

EXPOSITION OF AERIAL LOCOMOTION

AT the international aerial locomotion exposition in Paris, the biplane Coanda was without doubt the principal attraction. It is built of wood, including the wings; the interior frame work is of steel, two uprights only, uniting the lower planes; and passive resistance is very greatly diminished. It seems by its structure to be capable of greater speed than the monoplane. The efforts in the biplane are about the same from one end of the wing to the other. The greater part of the carrying surfaces are reinforced toward the forward part and taper toward the rear. The slender end has a certain suppleness, and consequently under the effort of propulsion the extremity of the wing will inflect upward like that of a bird's wing. This effect has



World's Largest and Most Powerful Organ Keyboard.
Just installed in the new cathedral, St. John's the Divine, New York—this instrument has 109 stops; the ordinary organ has but 25. It cost $75,000.

A Fleet of Air-Ships Maneuvering.
Various types at the international exhibition, in Paris.

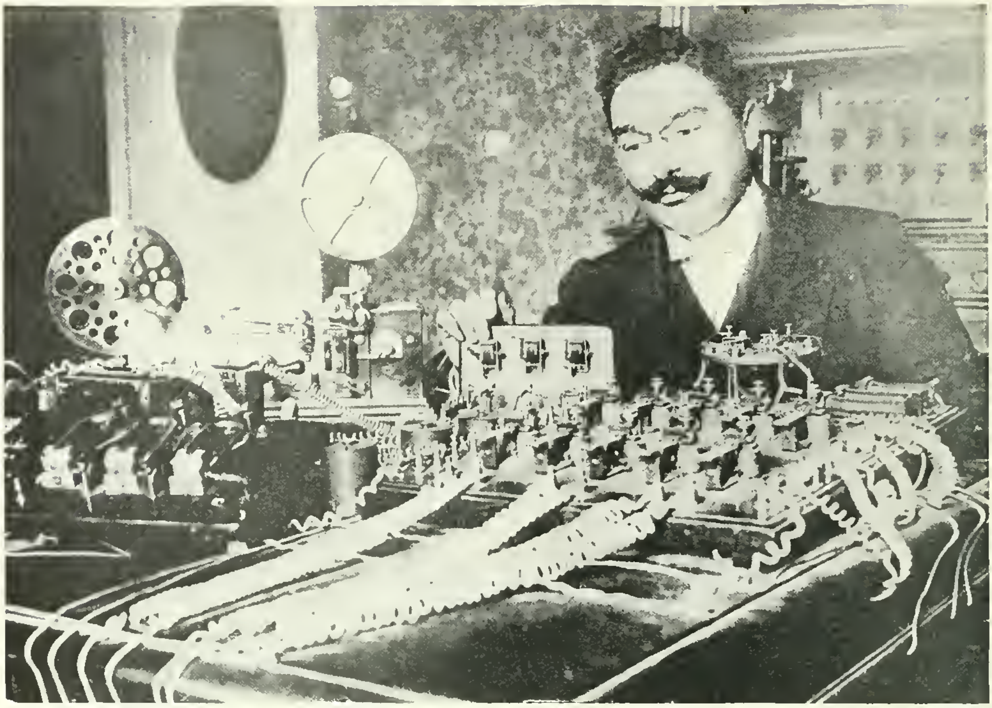
Testing an Automatic Parachute for Aviators, at Vincennes, France.
A guinea pig is being tied to the model for an experiment on a small scale.

been accentuated in the Coanda biplane. This machine presents another remarkable peculiarity: the screw propeller is replaced by a turbine, drawing in the air at the front and rejecting it at the rear. When ready for flight the Coanda weighs about 925 pounds.

The many improvements in the construction of this biplane may very well place it on an equality with its competitors.

MULTIPLE TELEGRAPHY IN ITALY

RECENTLY a demonstration was held at Florence, Italy, in the presence of scientific authorities, of a new apparatus for multiple telegraphing. This was invented by Cerrade Andrini. It was given the finishing touches by the engineer, Luis Maino, Chief of the technical department of the Italian Government Telegraph Service.



LUIS MAINO CONSTRUCTOR, BUT NOT THE INVENTOR, OF THE MULTIPLE TELEGRAPH—A REMARKABLE CONTRIBUTION TO COMMERCIAL SCIENCE.

Soaring Above the Audience Suspended from a Wooden Eagle.

A German actress amusing the crowd in a Berlin theater.

This invention is used for transmitting and receiving the Morse system. It can send ten telegrams at the same time. Each touch puts in movement a vibration which sends over the line ultimate currents of high potentiality with unvarying and established periods. These currents are received at the station to which they are sent by a special mechanism and based on the different Morse Telegraph apparatus.

With the Andrini system it is possible to send from ten to fifteen telegrams at the same time and on the same circuit. This makes it possible to transmit from 300 to 600 telegrams an hour, the original line being able to handle only from 30 to 40. The invention needs only a simple and inexpensive installation and does not interfere with, but rather supplements the telegraph system already in use. The remarkable value of this is easily understood, especially with its relation to the newspapers, etc.; which above everything else require a prompt transmission of long messages with the least possible delay imaginable.

REMARKABLE POWER OF AUTOMOBILE

PROBABLY no more remarkable feat has been recently performed by an automobile than that shown in the accompanying illustration below. The local agent of a well known car in Los Angeles, Cal., gave a demonstration of the pulling strength of his machine by attaching it, by means of a rope running from the rear axle of the car to the pilot of a 110-ton locomotive, and drawing the locomotive along the track.

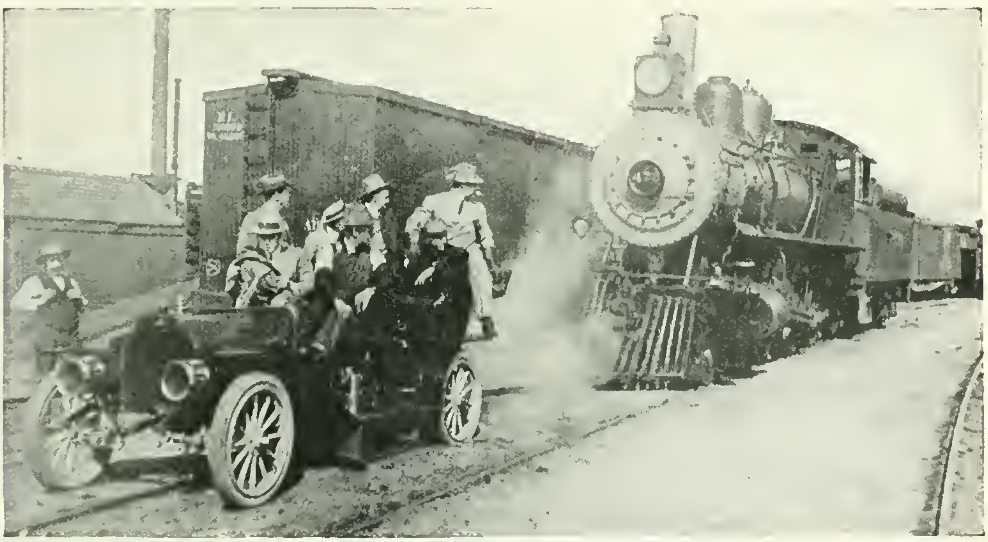
The start was made from a dead standstill and it was at first thought impossible to move the great mass of iron and steel as the wheels of the auto slipped badly and the locomotive seemed to be glued to the track. After weighting the car with six good-sized men, however, the tires took a firmer hold and after a long, steady strain the wheels of the engine began to slowly revolve.

The accomplishment of the task is testified to by a number of witnesses who at first declared it impossible and looked for the breaking of the rear axle or the pulling out of the entire end of the car. The engine was gotten under way, however, and drawn for some distance down the track without injury to the automobile in any way.

A JUVENILE SEAT FOR AUTOING.

AUTOMOBILE SEAT FOR THE CHILD

A CONVENIENT seat for a child can be adjusted in an automobile as shown in this photograph, and it has the advantage of being easily removable as it rests upon an iron rod which is bolted to the bed of the car. This small seat is arranged so that it can revolve, making it possible for the child to face either the front or the rear of the car, and it has this great advantage over the extra seat placed behind, that the parents can watch the little passenger and steady the child at rough places in the road. This is an inexpensive and convenient device which will be appreciated by parents who are fond of automobiling.

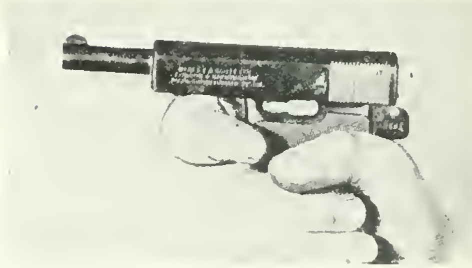


MOTOR CAR DRAWING 110-TON LOCOMOTIVE.
The start was made from a dead standstill.

The Colt Revolver.

The Steyr Revolver.

The Mauser Automatic.



The Webley Pistol.

NEW VARIETIES, AMERICAN AND FOREIGN OF THE REVOLVER.

ENORMOUS BALL BEARINGS

THE accompanying illustration shows the construction of an enormous center ball bearing made at Norfolk, England, for the Breydon Swing Bridge, at Yarmouth, for a railway.

As this bridge turns about 400 times every month, after several years' service the "V" grooves of the original bearing were found to be much worn, mostly due to not having been properly hardened. The original bearing consisted of two rings having "V" grooves in which there were 69 balls 2 inches in diameter, the largest made at the time the bridge was installed.

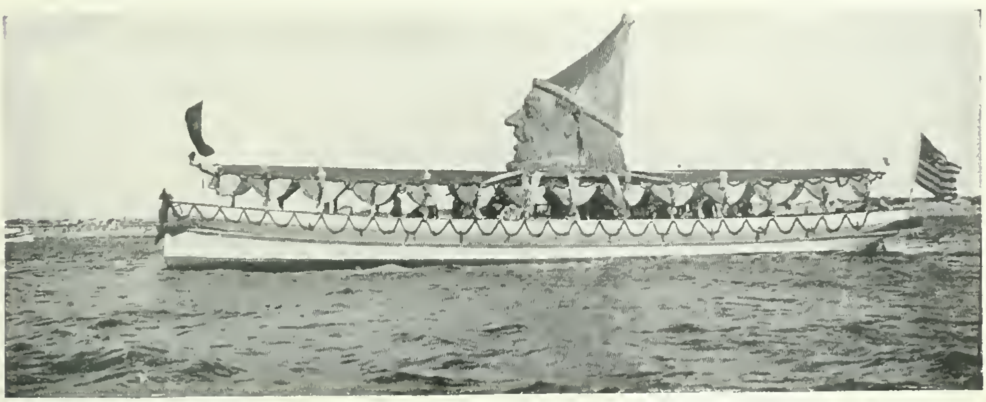
The new center ball bearings have a diameter of 3½ inches. They are arranged to run in segmental grooves, the radius of which is 2¼ inches. There are 22 balls.

HUGE BALL BEARINGS MADE BY AN ENGLISH FIRM.

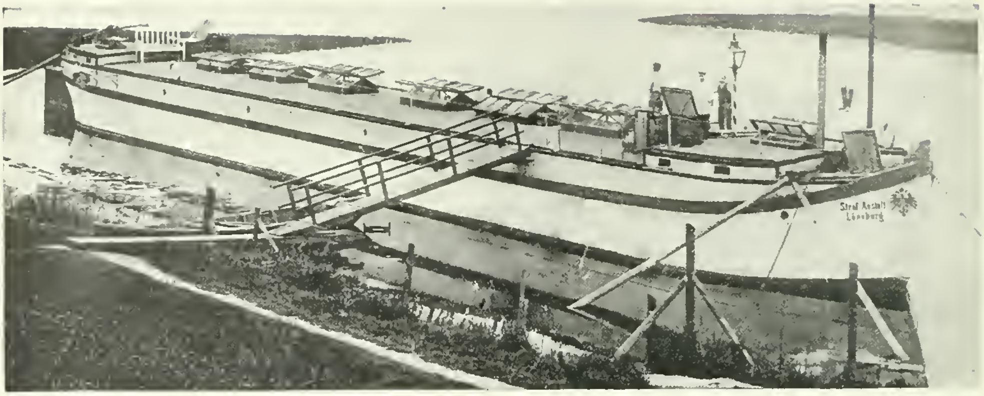
NEW VEHICLE KNOWN AS THE "MULOMOBILE."
Freak device of an army officer for fun-making at a carnival recently held at Manila.

CARNIVAL IN THE PHILIPPINES

THE Philippine carnival, originated by Americans in Manila, is one of the biggest and most entertaining annual shows in the Orient. Interesting exhibits from all over the archipelago, from China, Japan, Siam, Singapore, the Federated Malay States, the Straits Settlements, and other surrounding countries, are shown, while magnificent land and water parades, athletic tournaments and field sports, add to the amusement of the visiting throngs. The accompanying photos of certain features of the carnival are typical of the islands' festival of fun. The first shows Captain George T. Langhorne, U. S. A., one of the original promoters of the carnival, in his ingeniously contrived "mulomobile," where it cannot be said the cart is before the horse. The decorated, grotesque-appearing launch shown in the second illustration is the creation of one of the foreign colonies of Manila, and was designed to take part in the water parade, which was one of the striking features of the carnival. The giant head surmounting the boat's awning was placed immediately over the smoke-stack, the cap having an opening in the top for the smoke to pass out. The effect was of course very curious and the vessel quite naturally attracted its full share of attention as it took its part proudly in the pompous pageant.



LAUNCH OF THE GIANT'S HEAD.
Odd decoration of a boat at the carnival held recently in the Philippine capital. The head is a colossal imitation of the clown's and the top of its cap is the steamer's smokestack.



A PRISON ON THE WATER.
Comfortable quarters for law-breakers at Hanover, Germany.

A FLOATING PRISON

AN object of curiosity to tourists who happen to visit Hanover, Germany, is the floating prison "Leuneburg." This boat resembles the freight boats used on the Great Lakes in this country.

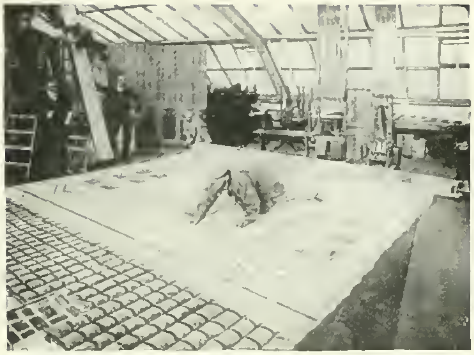
The prisoners are put to work on the canal and other work of a like nature. They seem to enjoy their detention. There are twenty-six prisoners. The cells are directly underneath the deck and are unusually well ventilated.

INCUBATOR FOR OSTRICH EGGS

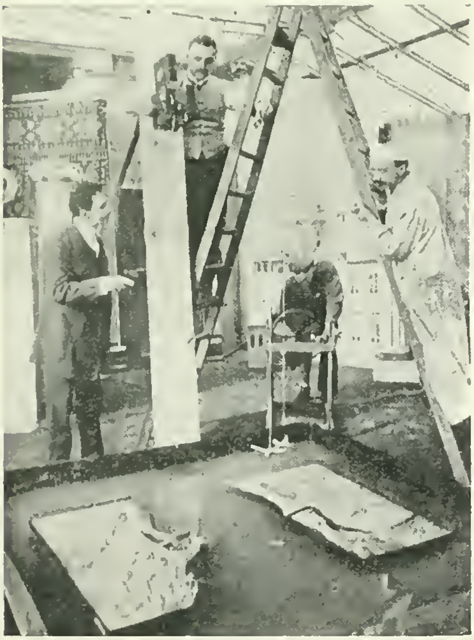
AT Mr. Carl Hagenbeck's ostrich farm at Hamburg, Germany, the most northernly institution of its kind in the world, ostrich eggs are now placed in special incubators. The average period of incubation is sixty days. So far over sixty eggs have been hatched and ninety per cent of the birds are alive and healthy. The farm occupies nine acres of ground and contains nearly 200 birds

YOUNG OSTRICH JUST HATCHED IN AN INCUBATOR.

RAILROAD TRAIN COLLIDING WITH AN AUTO.
The audience little suspects that such scenes are all in miniature.



THIS IS THE WAY THE BURGLAR CLIMBS UP THE SIDE OF A HOUSE.
He is really crawling on a painted canvas, that looks like a house, in a studio.



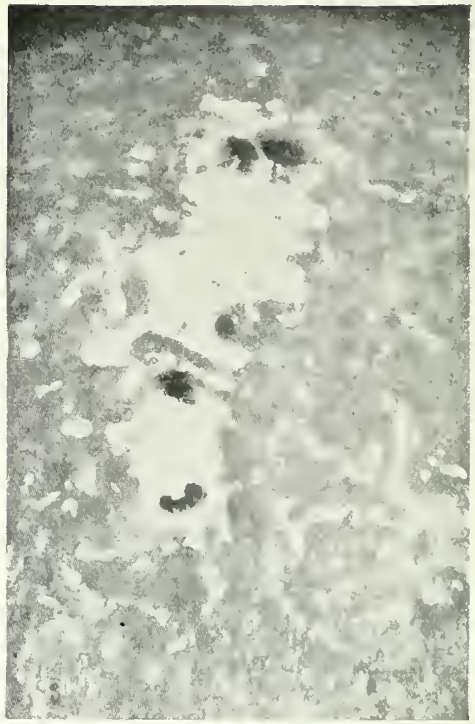
BATTLE BETWEEN SEA AND AIR FORCES.
Fortresses may be seen on either side, and the "aeroplane"—in the center—will drop bombs. The fan produces waves on the water.

THE WAY A CUP OF COFFEE "POURS ITSELF."
In the film, the man and the string are painted out, but when the picture is thrown on the screen, it looks as if magic had a part.

HOW MOVING PICTURE SCENES ARE PRODUCED.

MAGNETISM AND SOLAR SPOTS

BY means of the spectroscope, spectroheliograph, polarizing and magnetic apparatus, it has been satisfactorily proved that sun spots are clearly of a cyclonic nature; some photographs taken in June, 1908, were particularly convincing of this fact. At that time it was observed that a great floculi of dark hydrogen apparently advanced towards the whirling mass in the spot at the average speed of 60 miles per second, as if it were attracted by it, and being engulfed in its center. This suggested to



PHOTOS TAKEN OF THE SUN SPOTS, WHICH PROVE THESE SPOTS ARE OF CYCLONIC ORIGIN.

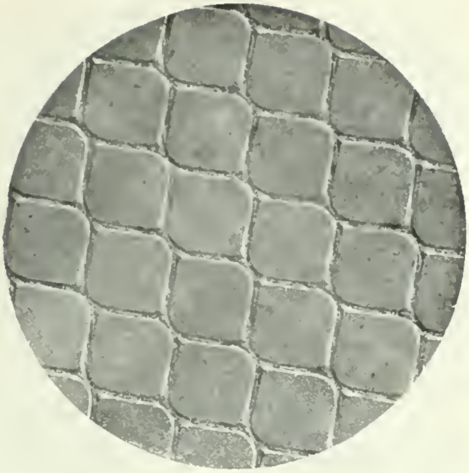
NEW WAY TO SERVE LOBSTER.

The photograph depicts a design recently executed by an English chef who won a prize for his skill in creating and executing this idea for serving lobster. The dish is *Homard a la Drexel*, the lettering of which is done with the eggs from the lobster. The creature is mounted on a carriage, while the outspread wings give a distinct idea of a flying machine. The idea created quite a sensation when the first lobsters so decorated were first served at a banquet. The effect is certainly very unusual.

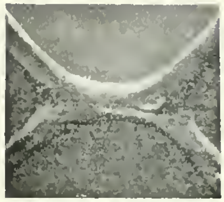
Prof. Hale, the director of the Mt. Wilson observatory, that solar cyclones create magnetic fields, for if sufficient quantity of electrified atoms were animated with cyclonic movements in the spots a magnetic space must result.

Experiments have demonstrated that the distance of two components is in proportion to the intensity of the magnetic field and to the square of the length of wave. In fine, that which distinguishes these duplicates from the double lines produced by other known phenomena is, that the lights from the components are polarized in a circle, but in an inverse sense, consequently if we meet in the spectrum of any substance, a duplicate which appears to come from a magnetic field, this origin will be revealed by the circular and inverse polarization.

These deductions applied to the solar spots have been crowned with success and Prof. Hale has proved that magnetic fields exist and are caused by terrific whirling masses of electrified atoms.



ARTIFICIAL SILK SEEN UNDER A MAGNIFYING GLASS



WHERE THE SILK THREADS UNITE.
They do not cross but merge into one another.

WORLD'S LARGEST DITCH DIGGER.
In use in the Imperial Valley, Mexico.

JAWS OF THE DINOSAUR TYRANNOSAURUS FOUND IN MONTANA.
This gigantic creature lived 2,000,000 years ago.

MAN-MADE SILKS

THERE is now being manufactured in an artificial silk factory in the north of France gauze or tulle which has the remarkable brilliancy of synthetic silks. But by careful examination with a magnifying glass one can discern a singular peculiarity of the material: it is found to be composed of an even mass instead of elementary intersecting fibers. At each angle of the hexagonal meshes, the threads composing the sections are joined, forming a single thread, each one of the same size. It is very evident after such an examination that the product is indeed an artificial fabric.

The net work which forms the gauze is moulded by a metal'ic cylinder which is finely engrossed with intersecting lines. This roller turns parallel with the receiver which contains the cellulosic solution in such a way that the mould engraved on the surface becomes filied with the mixture, rollers and scrapers clean perfectly the cylindrical surface, so that the grooves alone retain the paste. The cylinder-mould meets afterward a sort of belt on the surface of which, under the influence of the pressure, a transfer of the tracing is produced. The net work of the cellulosic fibers is detached from the principal cylinder and adheres to the cloth. The phenomenon is, however, quite difficult to obtain, the nature of the receiving surface plays a certain role and the mesh or net work must be carefully detached from the cylinder, as the gauze is extremely fragile. It is finally solidified by immersing in a coagulating bath. However satisfactory the results obtained may be, the utility of these fabrics is very limited and the usual processes of spinning and weaving are therefore not seriously menaced.

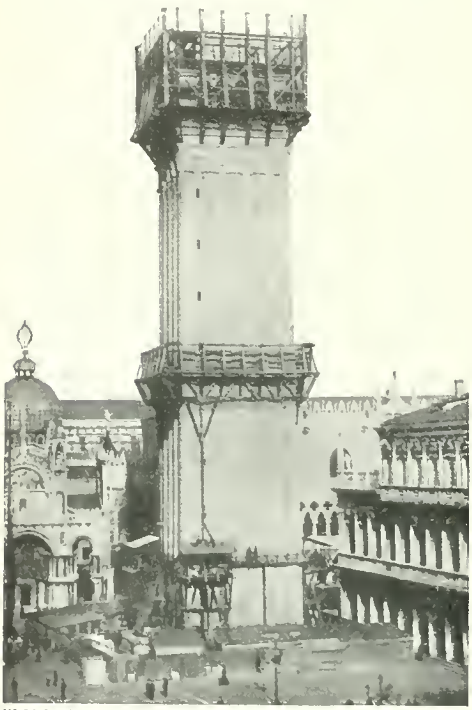
It would be practically impossible to imitate a closely woven fabric by this method.

The manufacture of artificial silks has developed rapidly and possibly artificial cloths may some time be successfully produced by means of solidifiable solutions without tissues. That day, however, is probably not close at hand.

PRIMITIVE WARRIORS OF THE REINDEER TRIBES OF NORTHEASTERN SIBERIA.
These nomadic people live by breeding and selling the reindeer. They fight hostile tribes with bow and arrows. They use an arrow of metal and a shield of walrus hide.

A Warm Lunch for the Baby.
This peculiar feature of the electric heater ought to appeal strongly to the enthusiastic young mother, for what is of more importance than the baby?

Shaving Water in a Jiffy.



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The New Campanile of Venice.
The famous Square of St. Marks is beginning to assume its wonted appearance after the collapse of the old tower in 1902.

ELECTRIC HEATER AS FAMILY FRIEND

AN electric heating device not much bigger than a tablespoon and easily slipped into the pocket or suit case, might be termed the friend of the whole family, as it will warm the baby's milk in a jiffy, bring the big brother's shaving water to the proper temperature while he dresses, heat a bowl full of water for sister's hair washing while she waits, is ready for instant use in a sick room where hot water is needed in a hurry and (not forgetting father) will heat up the cold coffee in the "dinner pail with a cupola."

If father happens to be a doctor or dentist, he will find it useful for sterilizing his instruments. If a barber, it will provide him with hot water without the necessity of keeping the gas going under the boiler.

This handy little invention is only six inches long and is supplied with a length of wire and a plug which can be screwed into any electric light socket. Then all that is necessary is to put the heater into any liquid that is to be heated and turn on the switch. A glass of water or milk is brought to the boiling point in a few seconds and moreover, the glass will not break from the heat.

The Latest Parisian Novelty—the "Spider Web" Veil.

SPIDER WEB VEIL

IT may be through lack of charm, overweening vanity to display such charm as she may possess, or only mere desire for novelty and excitement that produces the type of woman who parades in the sheath gown, the harem skirt, or—as shown in the illustration—the spider web veil. And like the other freak garbs just referred to, this newest covering for the face has its origin in the French capital. The sheath gown wasn't a "go" because it attracted too much attention, its rather daring wearers thought; the harem skirt, American fashionables declare, makes one look old. What will be the verdict for the spider web veil?

In its way the veil is artistic—artistic at least in the sense that it reproduces faithfully the feeling of repulsion, tinged with curiosity, that the real spider in his web arouses in the normal observer. The center of the web is placed across the forehead, and the reproduction of a spider rests on the cheek between eye and ear. The effect at first glance is distinctly startling, and may earn for women of a certain type the appellation "spider" instead of "cat" or "vampire."

PARACHUTE THAT MAN CAN GUIDE

HERE is a new type of parachute, the invention of a Frenchman, which has a very distinct advantage over all others. If obliged to make use of the device to escape a downward plunge in his disabled machine, the aeronaut may guide this parachute in various directions by pulling on corresponding cords. It thus overcomes the very serious objection to the average parachute that no choice can be made as to the place of descent, it being impossible to avoid either church spire, or lake, should misfortune so guide the ill-fated aeronaut.

The illustration shows a recent test of the apparatus that was made from the first floor platform of the lofty Eiffel Tower. The parachute, which has its trapeze directly in front of the aviator's head, and which folds up like an umbrella, can be easily released. The fall, of course, was from a stationary body. Just how effective any parachute would be if suddenly launched from an aeroplane shooting through the air, remains yet to be seen. In the test the parachute descended at a moderate speed, and under most satisfactory guidance of the cords.

Leaping from the Eiffel Tower in a Parachute.

A HIPPOPOTAMUS, COSTING $3,000, STAR BOARDER IN AN ELEPHANT HOUSE.

The new elephant house at the New York Zoological park, is the largest and finest building of its kind in the world. It is high, well lighted and is entered at the center of each side, instead of at each end. The main roof is of green tiles, and has a lofty dome covered with glazed tiles laid in an elaborate color pattern of browns and greens.

HARRY DE COE AMAZING THE BERLINERS BY A VERY UNUSUAL BALANCING FEAT.

This American's extraordinary tricks have kept agape for the time being, the mouths of Kaiser Wilhelm's subjects.

AMERICAN'S EXTRAORDINARY FEAT

IF Berliners do not take kindly to American cocktails, they are nevertheless deeply interested in the extraordinary feats of an American, Harry De Coe, performed with the aid of a glass and a bottle. The Germans do not, as a rule, take up such unusual tricks for public exhibition purposes, their genius apparently not running in that direction, leaving such work to their French neighbors in particular. But Harry De Coe's feats have seldom been equalled even by the ubiquitous French acrobats. His performances at the Theatre Pasage, which include the extraordinary act—that is shown in the illustration—have attracted capacity houses nightly for the Germans know when a performance is good and patronize it with enthusiasm accordingly. Harry De Coe's name will long be remembered in the German capital.

AUGUST

THE HIDDEN HANDICAP OF OUR SCHOOL CHILDREN.
About seventy per cent in groups such as this were found to have imperfect teeth. "The unfortunate result of lack of early treatment may range all the way from digestive disorders to actual malformation of the jaw."

"Free Dentistry for Poor Children."—P. 664.

THE TECHNICAL WORLD MAGAZINE

VOL. XV AUGUST, 1911 NO. 6

REJUVENATING THE EAST

By

AGNES C. LAUT

SPITE of the cry "back-to-the-land," the last census shows that the trend is still from farm to factory, from country to town. In one section of New York State alone more than 400,000 people have abandoned the country for city life. Perhaps, that word "abandoned" is a misleader. The farms are still owned, but their owners are trying in vain to sell them; just as the farms were deserted in the first place because the owners tried in vain to make a living from them.

If you gathered up all the untenanted farms of the United States and laid them in an oblong block, they would cover an area twice the size of Massachusetts, four times the size of Connecticut, fifteen times bigger than Rhode Island, half as large as the State of Ohio; or if you stretched them out on a straight line ten miles broad, they would cover from Maine to Florida—16,000 square miles—literally a world more tenantless than when Christopher Columbus discovered America; for when Columbus came, at least Indians were getting a living from this wilderness of waste land.

What is the matter? Is it a case of wanted-a-new-discoverer-of-Down-East? Look at the facts; then look at them again! Where does the most of that abandoned farm area lie? Within a hundred mile radius of the biggest cities in America. The two largest areas of unworked farms are in the southeast and in New England—within commuting distance of the biggest markets in the world. The city and commuting population of New York is estimated at 6,800,000; and one-third of the abandoned farms in America lie within a hundred mile radius of that market.

"You can today buy hundreds of thousands of acres of land in Indiana, and Ohio and Kentucky and Tennessee and Pennsylvania for $10 an acre, which twenty-five years ago brought prices of $100 and $75 an acre," declared a soil expert of the Mississippi Valley. In one section of New York—from Pennsylvania northward—there is said to be a section seventy miles wide where you can practically buy a farm for nothing. That is—you pay a bargain counter price for the buildings, and get the land free.

What is the matter? Where is our Christopher Columbus to explore a way through this sea of waste?

When you come to examine the average yearly incomes in these abandoned farm areas, the thing is still more hopeless. The average yearly income in the abandoned farm area of the South is not $75 a year—a figure that would put a

THE COLORADO WAY OF PICKING AND PACKING APPLES.
The East has been obliged to turn to Western methods.

peon of Mexico, or a shepherd of Egypt, or a serf of Russia to the blush. The average yearly income of the farmer in the abandoned farm areas of New York and New England runs from $300 to $400 a year—less than half an Italian ditch digger earns, about the same amount as a little girl in one of the sweat-shop shirt factories can earn.

Again, what is the matter? Are we land-sick, or man-sick, or gone to punky-headedness from dry-rot in our methods? This does not mean that there are not thousands of splendid modern paying farms Down East. There are; but they are so far outnumbered by the degenerate farm that the averages are reduced to these miserable figures.

It costs $150 an acre to clear fruit lands in Washington; and when those lands are set out in fruit, they earn ten per cent. on a valuation of $500 an acre—earn it easily. I know one fruit ranch that yielded 200 per cent. on a valuation of $500 an acre. You can buy fruit land in the East and Middle West for nothing, with fine buildings thrown in at about ten cents on the dollar, with old orchards only waiting the pruning shears and spray wagon to do their bestest, and—take a breath and look at it—the owners can't sell those lands at any price.

What is the matter?

You look wise and talk vaguely about "the labor question." Prices for produce have increased only twenty-five per cent., and the middleman gets most of that; while the cost of labor has increased one-hundred-and-fifty per cent. Very true; but if that is not so much piffle, why does it not apply to the West as well as to the East? You have to pay $2 a day for a good orchard man or wheat harvester in the West; and love or money cannot keep him longer than six months; for he is determined to own his own land and hire his own labor. In the East, you can get an orchard man or harvester for $25, at most $40 a month; and I give you my word of honor from a variety of experiences, his enterprising spirit will never rise to the heights of owning his

ELECTRIC RAILWAY BUILT BY THE ORCHARDISTS OF GRAND VALLEY, COLORADO, TO CARRY THEIR PRODUCE TO THE SHIPPING POINT.

own land and labor. The labor question is a difficulty impartial as the dews of heaven. It falls alike East and West; only in the West, you pay higher for the difficulty.

You say the soil of these Eastern areas is exhausted; but that is as vague an explanation as the talk about labor. The greatest soil expert in the world—Sir John Lawe of England—declares that when you come to analyze the chemical constituents of soil, the difference in farming areas is not so much in chemical composition as condition of tilth—or how the soil is kept; and that brings you down to the rock-bottom of your explanations—methods. You talk of the great wheat yield from the plains of the West; but do you know that the special wheat sections of Massachusetts and New York can raise wheat crops that make the thirty bushel yields of the West look small? I say—*can* raise, not *do* raise. That is—a few men raise them like a specialist, who got up in the fifties and sixties per acre in Massachusetts last year. The rest don't; and again your explanation resolves itself not into soil, but the man and his methods. Or take the apple soils! Apples don't want humus. They want sandy loam and upland and light and drainage and air. Haven't the hilly plateaus of New England such uplands good as Colorado's mesas? Yes—but the orchards have too often been planted down in the chill of the valley; or else like Topsy have "just grow'd," though Eastern apples can boast a brilliant coloring and fine flavor not possible in warm irrigated areas. Why hasn't New England, then, such fabulous apple records as Washington and Oregon and Colorado? Because orchard farming has not been the custom; and there your soil explanation is, again, back to the rock bottom fact of man and methods.

When you come to discuss market, the advantages are all with the East. The market is practically at the back door of this whole abandoned farm area. Yet the West is beating out the East in farm values and profits.

You say the East is a dairy country; and with the increased cost of labor on one side and the city authorities forbidding an increase in the price of milk—there is no longer any profit from a dairy farm. You quote the story of that appalling New Hampshire cow. Some expert figured up the yearly average returns from the dairies of New Hampshire — they didn't exceed $49 a year for a cow; and it cost $42 to keep one — leaving a margin of $7 for labor and profit; but what if the New Hampshire cow yielded $65 or $85 as many good Guernsey and Jersey and Ayrshire ladies do? There would be money enough for labor and profit; and there you are again back to methods.

This Gravel-Strewn Land at Canawangus Sells for from $80 to $125 an Acre.
On it big crops of wheat, corn, beans, etc., can be raised.

I admit when you come to compare Eastern and Western country schools, there is good ground for the complaint that the Eastern school has been educating away from the farm to the city. The high school is purely a feeder for the universities; and the country school—the least said about the country school, the better. Within an hour's drive of where I sit writing, within commuting distance from New York, are cross-road back-line schools that would be a disgrace to a sod hen house. I can think of a dozen in this county that you would never take for anything but a shut up hog house or the closed cabin of a wood cutter. "Squabble Hole," one is called. "Sin Patch" another; and I think of a third not far from the city of Poughkeepsie that I had driven past for six years before I guessed it could be a school—crowded between the bush and the weed grown road, solid board shutters always closed, a dirty floor littered with old paper, shut off from sunlight by the mountains on both sides, and at least a mile from the nearest house, evidently on the principle that land could not be spared from the farm for the school, so it was dumped in this back water ditch with the result that a generation of such schooling produces such an exodus to town that the schools can't spare the youngsters any more for the land. In twenty years' life in the West — when the West was frontier — I never saw anything remotely equal to the absolute badness of the back-road schools of the Eastern States. Again, the school argument brings you back not to the fault of the land but to the fault of the methods.

William Allen White once wakened a state by asking: "What's the matter with Kansas?" We need a William Allen White with a trumpet loud as Gabriel's to waken the Rip Van Winkles of Down East with a similar slogan.

If any one wants proof that something very deadly vital is the matter, he has only to begin farm hunting on the spot in the East. Two years ago, I entered on that joyous crusade of back to the land by inserting an advertisement in a big daily, and following up the leaders that seemed to promise anything. I think the answers came at the rate of about eighty a day. It took a month to sort out the impossibles—the stone piles on top of mountains where you could sit drinking in scenery at $30,000 a gulp; ideal sites for "them millionaires" of which the bred-out New Englander sits dreaming till he stagnates of dry rot with the effortless patience of a tombstone and the big hopes of an Arizona mining promoter looking for a sucker.

PEACH TREE HEADED LOW TO FACILITATE SPRAYING AND PICKING.
Orchard at Grand Valley, Colorado.

It need not be explained here that "an abandoned farm" is not one on which any comer may squat and take possession. It is just exactly what the word connotates—abandoned by its owner and for sale at pretty nearly any price.

Here are some typical answers that came to me, and on investigation proved

TYPICAL FARM IN "DISUSED" AREA, CLINTON COUNTY, NEW YORK.
New owners in this region have proved that scanty crops in the past were due, not to poor land, but to improper methods of cultivation.

exactly as they had been represented:

> 400 acres upland meadow, 300 level as a floor, fenced in 40 acre fields, five acre orchard in perfect condition just coming on to bear, 125 acres heavy growth oak and chestnut, two fairly good barns, house gone to wreck from disuse, eighty miles from New York, six express trains a day, one mile and a half to station. $5,000.

If that land had been in Colorado or the Kootenay, it would be called a mesa. The orchard part would be valued at $500 an acre, the clear fields at $150, the timber at not less than $40, in all $40,000.

> 160 acres, 60 acres timbered hilly, 100 acres clear level meadow, fine brick house, 800 apple trees, good barns, brook, eight miles to train. The agent apologized for the exorbitant asking price of $3,000.

This is in Vermont; and Vermont does not raise apples enough for home consumption.

This land is located in a peculiarly good orchard belt. Even eight miles from the railroad, in Washington, the cleared land would command $150 an acre, the timber $30, the apple orchard $500 an acre, in all not less than $20,000.

> 200 acres, twenty miles south of Albany, fine view of Hudson, modern house, barn burned, 60 acres timber, 10 acres apples, 100 level, fine tilth, one mile to railroad. $2,000.

If this land were in the Canadian Northwest, twenty miles from Winnipeg or Calgary, it would command $40 an acre; if in South Dakota $50 or $75. Two years ago I hunted for a ranch in South Dakota. Forty miles from a railroad, semi-arid lands were commanding $17 and $14 an acre without any house, and judging from the parched appearance of things at least forty miles on the vertical from any water.

From New Hampshire, Massachusetts, Connecticut and Maine came literally myriads of answers, the average 260 acre farm not more than three miles from the railroad with good house and barns seldom being listed higher than $4,500; and outside the three mile radius from the railway, were hundreds at $2,000 and $3,000.

NEW YORK PRODUCES MAGNIFICENT CROPS OF CELERY.

What is the matter? Kismet! Is it the will of God? We have such a habit of ascribing the results of our own blockheadedness to the will of God; but is it?

"Tell you what it is," publicly declared an Eastern farmer not long ago, "those Western fellows have us beaten to a frazzle the way they co-operate. They have their own sellers. That wipes out the middleman. They have their own freight agent. That gets prompt attention from the railroads—best terms for shipping. Then, they hang together and pull together and boom and advertise for all they are worth. We tried that in our district; but in three months they had raked up all the old family quarrels, Aunt Sara's Uncle John's fourth nephew by marriage and all that, till they had busted our association. These folks would rather lose a dollar than see another man make two. We'd rather be skinned alive by an outsider, than pull together and see each other prosper." And the very day I read that farmer's explanation, came a letter to me from the Fruit Growers' Association of Grand Valley, Colorado. On the letter head was the motto—"All Together."

Is that motto the key that unlocks the secret of the whole situation?

Did you ever know of the people of an abandoned farm area getting together to advertise?

Did you ever know of the people of an abandoned farm area forming a co-operative association to buy machinery for common use, such as an orchard sprayer or motor truck to carry produce to market?

Did you ever know of an abandoned farm area appointing a head packer to prevent cheating in the apple barrel—putting first grades on top and cider culls in the middle? At one of the last apple shows in Baltimore, New York apples were ruled out because of dishonesty in the packing, though on the authority of President Brown of the New York Central, three shipping points of New York State each ship more apples than Washington and Oregon and Colorado combined.

Did you ever hear of an abandoned farm area using oil heaters in spring to prevent the frost killing of the early bloom; or of a whole Eastern city going out in wagon loads on a cold spring night to help keep the kerosene burners going and to fight the frost, as they do in Colorado and California?

I was once deluded into helping to form a village improvement in a Down East hamlet. I don't know yet whether the experience is to be recorded as comic opera or "bluggy" tragedy. It had elements of both. It lasted three months.

HERE IS AN ABANDONED FARM THAT ITS NEW CULTIVATOR MADE PAY FOR ITSELF IN TWO YEARS.

I didn't! Having something else in life to do than chase over back-yard fences trying to stop the spites and age-old jealousies and family feuds and brood of lies of a century, I dropped it quicker than I ever dropped measles or whooping cough or any other form of spiritual growing pains to help people who don't want to be helped. They raised money, raised it royally, most generously, and had lights and sidewalks within those three months; but the dead scandal of Aunt Sara's Uncle John's fourth nephew by marriage was a simple rule of subtraction and multiplication—especially multiplication—compared to the binomial geometric progression of all-fired cussedness that flowed from that innocent village improvement. "They ain't goin' to run us!" "Them new-comers has jus' come in here and stirred up things and made all this trouble!" "We always have *fit* here, and I guess we always will *fit*, it's been fittin' and fittin' always here." "What's good enough for us all these years, I guess is good enough for anybody." So it is—far too good; but that spit-cat policy of trying a claw on everything new that comes your way, has driven progress and prosperity just three thousand miles from the degenerate sections of New England; but as the Easterner said: "We'd rather be skinned alive by the outsider, than pull together and see each other prosper."

Of course, it is only a matter of time when degeneracy cures itself. The third mortgage, like the curse to the third and fourth generation and other sick-unto-death maladies, works its own most excellent and undodgable cure; and that is the door of hope for Down East today. It recognizes its own condition. This "what's-good-enough-for-us" policy has somehow left its progress at the tail end of the long procession. While other communities have prospered, Down East has grown poorer and poorer. When a house that would have sold for $8,000 or $10,000 twenty years ago now fails to find a buyer at $1,000, or a farm drops in value from $150 an acre to $10, the owner feels as if he had butted his thick head against a fairly hard fact. That is the time he comes awake with a jounce to feel how big the bump is. It is the turning point, and a mighty good place to turn at.

Says the New York Agricultural Society: "We have reached the turning point." Says the New York State Department of Agriculture: "We are flooded with inquiries from the West for land in the East." Don't smile, but these Down East values that I have given are one-third higher than they were eight years ago when I came from the West. I lived through that same period in the West when having reached the collapse of the first boom, the country gradually righted itself and came up on the great ground swell of the last ten years' prosperity. It is risky playing prophet; but it is *not* prophecy if you put your ear to the ground and hear the same ground swell coming East.

"It cannot be denied," declared Dr. Schurman to the New York State Fruit Growers, "farm orchards in New England are melancholy testimony to decline. We have at our doors the great markets. Why is it we are stationary? Why is the West forging ahead? It is their optimism, their enterprise, their confidence; they expect to succeed and they use the means to succeed. The West is ahead of us in methods."

A New York Farm of the Catskill "Abandoned" Area, Albany County.
Scientific cultivation reclaims such areas as this.

Western methods—that is the slogan for the new day Down East!

Two years ago, not a single orchard heater was used in the East to fight spring frosts. Today, in the Southeast alone at latest report 90,000 are in use; East and West, 3,000,000 are in use.

Two years ago, you could drive through county after county of the apple growing sections of New England and never encounter a spraying outfit at work, unless some special pest happened to have got to work first. Today, they don't wait for the curse to come. They avert it. They spray before bloom and they spray after bloom and they spray all through the summer—that is—the few, who are beginning to adopt Western methods so spray. I am sorry to say you can still see hundreds of thousands of wild blighted distorted orchards where neither spraying nozzle nor pruning shears have ever come. The most successful orchard men are even beginning to nip out the inferior fruit soon after bloom to permit the best to come to perfection.

One of the Unoccupied Farms,
Albany County, N. Y.

You hear in Kootenay and Washington of apples coming to bear four years after planting. It is perfectly true. I have eaten apples in Kootenay orchards grown from the seed four years after planting. Formerly, it was thought trees must grow in the East for fifteen years before bearing; but by following the quick clean culture methods of the West fruit is being brought to bear in New York State four and five years from planting the whip tree. How? By cultivating and cultivating and yet cultivating again—not permitting a blade of grass or weed the size of a match to grow under the trees, but keeping the soil harrowed and rolled soft as flour. Any one who wants details of such orchards can get them from the Wadsworth Fruit Farms.

Orchards are no longer being planted in the chill wet valleys as a sort of shaded hog run, but on the well drained uplands. Low headed trees are used to facilitate spraying and avoid bruising the fruit at picking time.

Perhaps the greatest reform reluctantly adopted from the West and having to fight its way for adoption has been in the matter of packing. It is to the dishonest packer that the East chiefly owes her maligned reputation as to fruit. A bushel box of Colorado or Washington apples sells in New York for from \$3 to \$5. A three bushel barrel of Down East apples on the very same market sells for the same or less. Why? Examine the differences. The box is graded and uniform, large size two and a half inch apples, three or four layers to a box, each apple wrapped in separate paper, the name of the grower and number of apples stamped on the outside of the box and on the wrapping paper. Not a wormy apple in the box—every apple without a flaw, and all so packed that by opening either end the buyer can see the quality of what he buys. You see that policy what's-good-enough-for-us isn't packed in a Western apple box. The barrel, on the other hand, has grade one apples packed three deep at each end. Between the two good ends are cider culls, worms and rots. Nor is this the fault of the grower. The apples are bought on the tree, grade one price for grade one, cider cull price of a few cents a bushel for the fallen and bruised; but the packer so manipulates his packing that he sells his whole barrel at grade one price to the consumer; and as neither name nor grade is guaranteed, there is no redress.

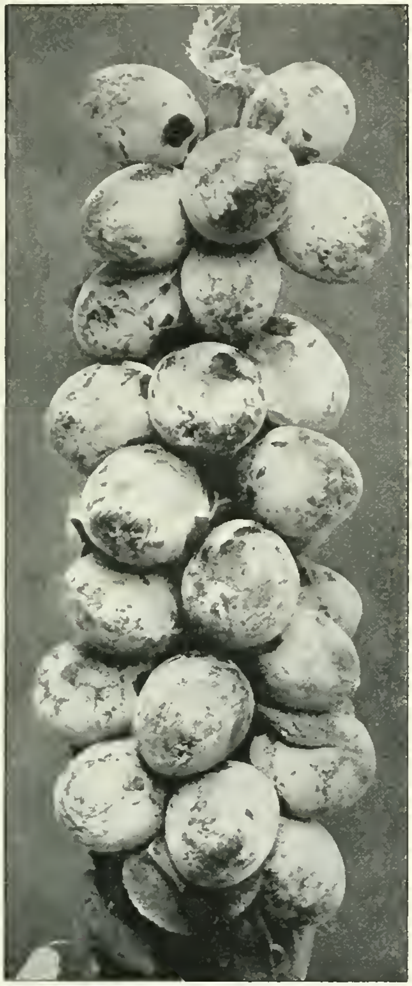
When your Western co-operative association finds one of its members has slipped culls among the good ones, he is fined and expelled. As a matter of fact, dishonest packing is impossible; for the association does its own packing. Likewise, in some of the Canadian apple sections, misgrading lays the dealer open to action in the courts. Lack of such care was what ruled New York apples out of the Baltimore show. When Virginia began to work for orchard uplift—thousands of acres being set out to trees—one of the first moves was to send to Oregon for a manager to oversee the packing. Senator Lupton has been the leader of this reform. His own apple orchard is one of three hundred and fifty acres; and there is one orchardist in the East with an orchard of two thousand acres, which yielded $45,000, apples sold on the trees in 1910. Western grading is done by means of a board with two and a half inch holes through it. Apples dropping through the holes do not class first grade. Printing, paper, packing, boxes—cost in all 18 cents a box and work is paid by piece work, women and girls doing fifty boxes each a day for 5 cents a box. "Small packages," declares Dr. Schurman, "are the means to prevent fraud." It may be said that the Niagara District of New York has just declared publicly for the reform methods of packing.

When it comes to marketing, sales agents, advertising and apple shows to arouse public enthusiasm Down East has not yet begun. Nor has the Central West.

What farmers' association do you know east of the Mississippi that pays its Eastern manager $5,000 a year to camp on the market, keep tab of prices and push prompt delivery? Until the big railway men and New York Chamber of Commerce united in a farm improvement association, what farm organization of the East do you know that knocked down cash payments for a campaign of public awakening? Sugar beet men in the West, apple men, citrus growers, sheep men, cattle men, irrigation farmers—all have their special organization of propaganda, management, marketing and new methods. What groups do the same work in the East? I know of one dairy organization that is calling and calling in vain for union and work. I know of a grange that meets annually and annually fights, or as the lady in the village improvement said "fits and fits." But I don't hear of the Easterners getting anywhere with their organization.

I know of one Nova Scotian who not only wiped out the middleman by doing all the marketing himself, but accompanied his three hundred barrels to London, England, and on this specially fine lot netted $15 a barrel. Experts say there is practically a difference in returns of 90 per cent. for the farmer between old style and new style methods of marketing. Alone, the individual farmer is helpless against middlemen and railroad and market. United in solid counties and blocks of counties, he is absolute dictator of the situation, commanding favored terms from the railroad, giving a cheaper product of better quality to the consumer, and getting 60 per cent. higher price for himself.

I personally visited the banner orchard of Grand Valley, Colorado. It is a twenty acre block of apples, ten acres on each side of the entrance drive. The first year Mr. Hamilton owned this orchard, he was unable to get labor to attend scientifically to both fields; so he


Burbank Plums—Results of Western Culture.
Two weeks after bloom, the small and imperfect fruit was clipped off.

left one to itself after Eastern fashion and concentrated his care on the other, spraying almost weekly, clipping out the culls before they had robbed strength by growth, keeping the floor of the orchard clean of weeds and grass. Results, no returns from the ten acres treated Down East fashion, for the association would not pack such culls: net profits from the ten acres treated scientifically—two men at $60 a month working constantly—$7,500.

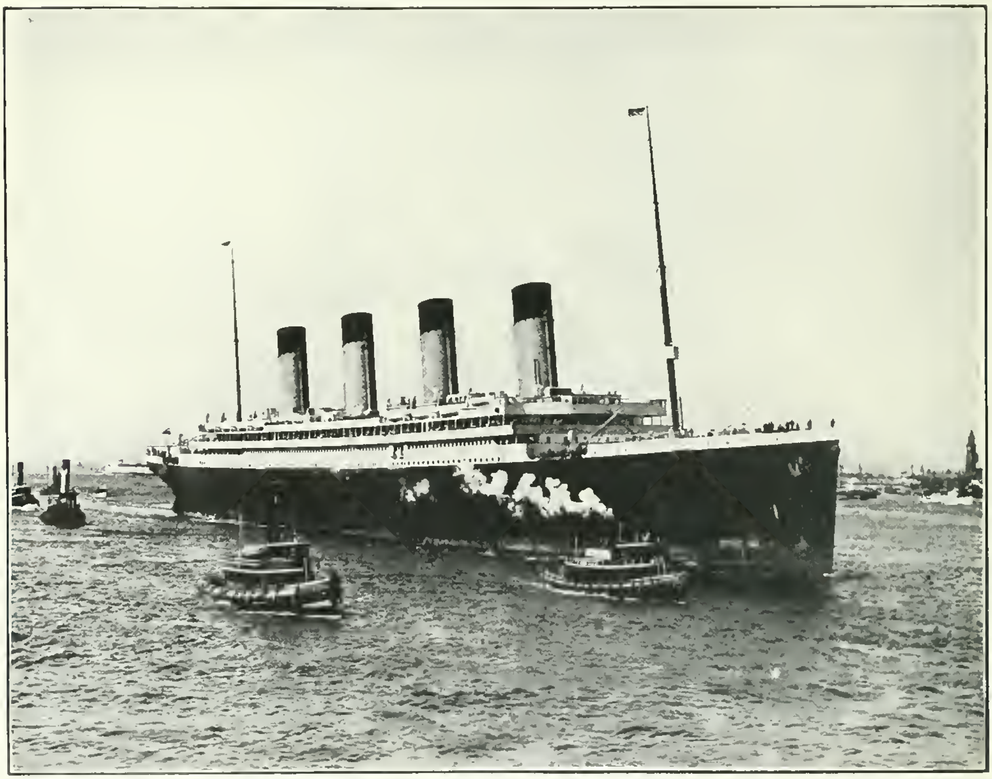
The game is worth the candle—isn't it?

Wherever similar methods have been used in the East, similar rewards have been won with the advantage that the East does not ordinarily need to irrigate and can begin by rejuvenating an old orchard. If space permitted dozens of examples could be given. There were the fifty-four old trees in a worn out Michigan orchard, some of them half a century old and fifty feet broad on a sandy field of about an acre and a half. The buyer in a spirit of pure dare set out to see what he could do. He cut back the wild horns 12 feet, the pruning slanted to keep out wet, and every wound paraffined or waxed. He sprayed and sprayed and sprayed yet again, keeping the floor a clean mulch. Results—$6,000 in ten years, from old trees, which, please to note, is higher record per acre than Colorado's banner orchard.

Nor is the new evangel confined to fruit. In no line of Down East farm life is the slogan more needed than in dairying. "We have been tied to a cow's tail for forty years and it has been the mischief," said one of the largest dairymen of Duchess County to me, who takes in $6,000 a year but pays out $5,000 in labor and feed and depreciation. What are $49 yearly average cows doing in any white man's herd? With profits of $65 a cow, your farmer can prosper. With profits of only $7, farm and farmer are on a greased plank slanted for a sheriff sale. Your Down East farmer tells with pride of his ton and a half an acre of hay. If you tell him of five tons an acre from alfalfa, he shakes his head at the big Western yarn. Five years ago, they told you it wouldn't grow Down East. Today, they show you specimens that got in their clover seed by mistake and refuted their inertness by coming up persistent and strong. Ten years ago, one North Carolina farmer was getting five bushels of corn from an acre. That did not pay horse hire, let alone man help. That man was up against a fact, and the bump awakened him. He turned on the new methods—Iowa methods this time; and today he grows 226 bushels on that land. New methods have increased Pennsylvania land values 20 per cent. New Jersey, from its necessities for truck gardens, was, perhaps, the first of the Eastern

States to adopt the new intensive methods; and New Jersey has become the fruit garden for New York.

As I said before, the East still lacks co-operative organizations for marketing and advertising; but the ground swell is coming. The next boom is due not West but East. Ten years ago, we saw it coming in the West; and those who trimmed their sails rode into port with fortunes. Those, who didn't, who held back and yapped and guessed good-enough was good-enough—are today just where they were—stranded, stuck in the mud, but—please to note—still growling. And now the ground swell is coming East. I wonder if we shall be ready for it; or will we let those Westerners head back East, and repeat their success? Colorado's motto is all together. Down East's motto should be get together and do it quick; or the third mortgage, like the curse to the third generation, will work its remedy and wipe you out, for other workers to come in better worthy of your heritage. I write this as a life-long Westerner now living in the East, but as one whose ancestors homesteaded and peopled one county of New York's most hilly region, and wrested fortune from those hills before they joined the migration westward.



THE HUGEST STEAMER IN SERVICE, THE *OLYMPIC*, OF THE WHITE STAR LINE, BEING ESCORTED BY TUG BOATS INTO NEW YORK HARBOR.

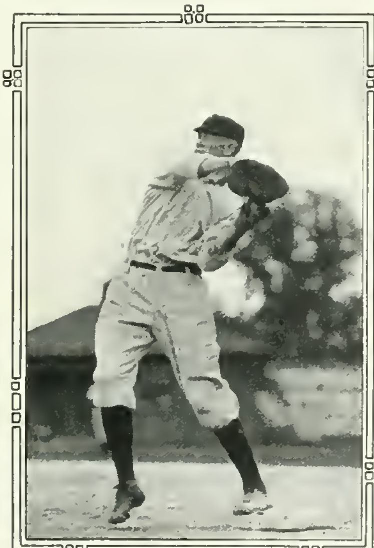
She sailed from Southampton June 14, on her maiden voyage, and reached New York June 21. This initial run was made in about 6 days 20 hours. Temporary extensions had to be made to the piers to berth her length of 882 feet

Inside Facts About Baseball

By Barry Cornell

TO the baseball "fan," the "science of the game" is the generalship exercised by team captains, the strategy employed by players and the skill of the individual in batting, fielding, pitching and catching. He seldom recognizes that the great national game has an underlying foundation of exact science, and that everything which happens upon a ball field has an exact scientific reason, or that, quite beside the excitement of the play, or the tenseness incident to bases full, two men out in the ninth inning, and two runs needed to tie the score, there is a deep interest attaching to the mere physics of the ball, the bat, the running man, and to the mental equipment and thought processes of players and managers.

Ask any "fan" how fast an average "grounder" travels during its first hundred feet from the bat, and his answer will be anywhere from twenty to two hundred miles an hour. Split second watches and careful timing of many ground balls have established the fact that the average speed of ground balls—that is, those struck by the bat of the batsman from a fair pitched ball, which strike the infield before they land in a fielder's hands—go at the rate of almost exactly sixty miles an hour, faster than the fastest mail trains.



Hal Chase, the Marvelous Fielding, Left-Handed, First Baseman of New York Highlanders.
The photo shows him "dumping" the ball from his mitt to his left hand for a cross-diamond throw.

Sixty miles an hour is eighty-eight feet per second. The bases are ninety feet apart. A man who can run a hundred yards in eleven seconds, which is fast running for any one, but particularly so for a man with baseball shoes and uniform on, can run ninety feet in 3.3 seconds. Is it any wonder that a ball which is fielded in its first hundred feet of travel usually reaches first base just a fraction of a second before or after the runner sets foot upon it?

Every fan knows that the many close decisions at first base form one of the fascinations of the game. The speed of a batted ball, the speed at which a fielder can travel from his position to the point where he can meet and field the batted ball, the speed with which he can stop the ball, pick it up, set himself for the throw, make the throw, the speed of the ball across the diamond from his throw, and the speed of the traveling runner, are so nicely balanced that it is always a question of whether or not the runner will get there in time for the crowd to see the umpire's hands go down, or whether he will face a thumb over a shoulder indicating that he is out.

Baseball players all

recognize certain spots on the playing field as "grooves," places where batted balls will, in all probability, go "safe" and be recorded as "hits." Two of these are narrow paths between the foul lines and a space something less than two feet wide just inside the foul lines at the bases, two of these are spaces between first and second baseman, and short stop and third baseman, which represent territory to which neither fielder can get fast enough to field a ball batted in or over them, and the fifth "groove" in the infield is directly over second base, representing uncovered territory. Theory says the pitcher should stop balls batted down this groove unless they be over his head, and to his credit be it said he not infrequently does put out his hands and, at a distance of sixty feet, stop a ball traveling more than a mile a minute and weighing five ounces, but it is always at the risk of certain injury to his hands or body that he does so. The risk is not in the speed of the ball or the force in it, so much as in the fact that, in the fraction of a second between the crack of the bat and the landing of the ball, the pitcher must see the ball, calculate where it will go, and get his hands there. And this brings the reader right up against one of the psychics of the game — nervous reaction time, of which more in a moment.

"CONNIE MACK"—CORNELIUS McGILLICUDDY—THE CANNY LEADER OF THE PHILADELPHIA AMERICANS.

It was due to his "baseball brains" that the "Athletics" beat the greatest inside ball team" history has ever known, the Chicago Cubs, out of the world's championship, in 1910.

But to return to the infield grooves—the average width of all the grooves is approximately 25 feet. There are 180 feet of territory to be defended. Logic and science would argue then that out of every 180 balls batted through the infield, 25 ought to be safe hits. Records show that to every 180 batted balls through the infield, only eleven and a quarter are "hits." It is this fact which is the despair of the scientist when he applies rules of mathematics to a game like baseball. A team is not a collection of automatons. Opposed to the scientist and his rules is a thing called "inside baseball." It is the generalship which places infielders in certain positions with reference to certain batters and certain pitched balls. A man "at bat" who is known to hit nine balls out of ten between first and second base when the pitch is fair over the center of the plate and waist high, will find the third baseman playing shortstop, the shortstop hovering over second base, and second baseman crowding the guardian of first base. There will be an "infield groove" forty feet wide between third base and the nearest fielder—there isn't an inch of unguarded territory for him to put his hit through where he usually hits it. But just as he and you and the scientist have decided he must, according to the laws of logic, be "out," the pitcher slips up on his delivery, the ball "floats" to the plate, the batter steps around it and whangs it down the third base foul line for a home run.

MUSCLES MUST RESPOND IN A FLASH.

In the illustration to the left, the man wasn't quick enough to jump and the ball got by. In the other, the player's glove has not yet opened! Yet he is making a catch of a wild one. His brain must have ordered his muscles to open that hand 1-10th of a second before.

Ask any ball player which ball he can hit the hardest, a fast, straight pitch or a slow "floater," and he will tell you the former. There are two lines of argument you can employ on this question, each seemingly incontrovertible. You can say that the force of the pitched ball must be subtracted from the force behind the bat, since the momentum of the bat must first overcome the force of the pitch, stop the ball dead and reverse it; hence, that the harder a ball is pitched, the less distance it should travel from the bat. You can argue that, were the pitcher infinitely powerful, he could pitch a ball the forward momentum of which would equal the momentum of the bat, and that, therefore, were the pitcher powerful enough, he could so graduate his delivery that the forward motion of the ball, just equal to the motion of the bat, would neutralize it, and the ball drop "dead."

On the other hand, you can argue this way. If you toss a baseball at a brick wall, it rebounds. The harder you throw it, the harder it rebounds. The harder a ball is pitched to a batsman, the further he can hit it, because the force of the pitch acting in the rebound, must be added to the force of momentum in the bat.

A BALL THROWN ACROSS THE DIAMOND FROM FIRST TO THIRD BASE TRAVELS THE 120 FEET IN TWO SECONDS.

In this picture the ball has a distance of one foot, or 1-60th of a second, to go. Milan, outfielder of Washington, has his foot on the bag. Moriarty—Detroit—is running across the bag to make the catch. Milan is safe, of course, but think of the instant's judgment necessary to make the play, and for the umpire to decide it!

The latter is the correct theory, evidently, since it is a fact that the longest hits are made off the swiftest pitching. The fact that few long hits are made off swift pitching is no argument, for all such questions depend upon the condition of the batter meeting the baseball fair, when, as a matter of fact, not one baseball in a hundred is struck by the bat "on the nose," but always a little above or a little below the median line of the sphere, therefore knocking it up or down and not straight out. Moreover, the various peculiar curvatures and "jumps" which the pitcher puts upon a ball have much to do with the length of a fair hit.

What makes a ball curve? Revolution of the ball. What makes a ball "jump" in the air? What makes it drop and wobble, and look big at one time and small another? Why can't a batter hit a slow easy ball the first time he sees it coming and knock it out of the lot if the pitcher sends two "floaters" up to the plate in succession? Why does a pitcher pitch an absolutely baffling delivery on one day, and the next day, when the weather is different, fail absolutely to stop the batsmen? You can answer "revolution" to all those questions.

It is true that the revolution of the ball about some one of its infinity of axes is the cause of its curving in the air. All thrown balls have a natural curve, one imparted to them by the fingers of the thrower. Take a baseball in your hands and hold it as you would, naturally, to throw it. You will see that it will leave your finger tips last, which, dragging against the cover, will impart a motion to it which is, approximately, a motion of revolution from left to right, your left to your right. Such a ball will curve slightly in its flight from your left to your right, or "in" to a batter who bats right handed. Development of the proper grip on the ball, ability to squeeze the ball tightly at the instant of release, and a powerful arm, enables pitchers to increase this curve to such an extent that a ball which appears to the batter to be sure to pass well outside of the plate, will, just as it comes near him, make an inward sweep and go over the plate, counting as a strike, to his disgust and bewilderment. Remembering this, the

SHOWING HOW THE CATCHER HIDES HIS SIGNALS FROM EVERYONE BUT THE PITCHER.
For the batsman to learn whether he will be given a "curve," a "fast one," a "slow one" or a "spitter" is to increase his chances of hitting by fifty per cent.

next ball the batter sees, which seems coming directly towards him, he argues, "This will break inward and hit me—I must step back." But the ball, instead of breaking inward, breaks outward or from the pitcher's right to the pitcher's left, again goes over the plate, and the umpire calls "Strike tuh!" Ball number three looks good to the batter. He can see the seams. It has no revolution at all, or, at most, but a slow one. It is fast, too; the batter saw the pitcher's great effort in throwing. The batter takes a step, grips his bat, gives a mighty swing, and hits at the ball when the ball is yet ten feet away from him. Why? Because this ball was a "floater," a ball pitched with the same motion as the fast one, but released in a different manner, held in the hand in a different manner, and so controlled that it has no revolution at all. Remember, the batsman has less than a second to judge the ball, make up his mind what it is going to be, where it is going to travel, and what he intends to do. Seeing the motion for a fast pitch, he calculates his swing. Seeing the ball look large and watching the seams, he knows it is coming straight. But he cannot, looking at it coming towards him, judge its speed. And, as it happened to be a slow one, he struck at it before it got there, and "yereoutbatterup" is all the comfort he gets from the umpire.

The revolution of a ball makes it curve in this way. All moving bodies tend to move in a straight line. If a counter force be exerted on a moving body, it will strive to get away from that force, or, in other words, take the path of least resistance. The ball revolving in the air masses a billow of air in front of it, which retards its speed. If this air acted on all parts of the ball at once, the ball would simply lose speed on both sides at once and drop. But when a ball is revolving in the air, say from left to right, the friction is greater on the left side of the ball, which is revolving towards and into the billow of air raised by the motion of the ball, and less on the right side, where the ball is revolving away from this billow of air. Hence the ball travels towards the point of least resistance and away from that of greatest resistance, and a curve is the result.

The curve of a ball to right or left, however, is but one manifestation of the physical laws governing a moving and revolving ball in the air. A "straight fast one," as pitchers call their speedy

THE SPEED OF A BATTED BALL MAY REACH MORE THAN A MILE A MINUTE.
Here the ball is about seventy feet from the bat and twenty in the air. Still the catcher has not taken his hands apart in trying to catch the ball which never got there.

"shoots," usually possesses a "jump." That is, at some point between the pitcher and the batter, the massed pillow of air in front of the ball becomes solid enough to offer material resistance. The momentum of the ball will not be denied. The ball, then, either climbs over or drops under the pillow of air, and, as a result, "jumps." It may be a change of direction from its natural downward course along a level for a few feet, which is misnamed the "up" jump, or it may be a sharper, downward shoot, in which, of course, the "jump" is aided by gravity, but it is on the "jump," and the effect of speed on the batter's eye and mind, that the speed ball pitchers depend for their success.

Various ways of holding the ball result in various curves and combinations of curves and shoots. Sometimes a physical peculiarity will aid in a peculiar "delivery," as in the case of Three-fingered Brown, of the Chicago Cubs, whose hook curve is largely the result of the malformation of his pitching hand. Left handed pitchers, of course, pitch with ease all those curves and shoots which are hardest for the right hander, because unnatural, and, per contra, pitch all his easily hit balls with difficulty.

Patrons of ball parks must often note that some small, light players frequently make very long hits off certain pitchers, which balls travel low and fast without seeming to drop very much in the first two hundred feet. It is, obviously, not a matter of physical strength, since much bigger and stronger men only pop up little flies or hit grounders off the same pitcher's delivery.

The reason is found in the peculiar combination of a certain pitch with a certain style of batting.

Pitching a "drop" ball makes the ball have a revolution from the pitcher towards the batter, that is, the ball revolves in the direction in which it is traveling. If the ball traveled in the reverse direction, back toward the pitcher, with the same direction of revolution, it would have a tendency to climb up in the air, instead of climbing down. This force is never enough to raise the ball, but is enough to counteract, for a time, the action of gravity. Now, certain batters are able to hit just enough "under the pitch" to drive the ball out, slightly up, without raising it into a fly. When such a batter meets a drop pitch just right, the revolution of the ball as it comes from the pitcher is increased by

THE VALUE OF ONE-TENTH OF A SECOND.
Davis, of the Philadelphia Athletics, sliding into third base; Conroy, third baseman of Senators, also sliding into it and touching Davis with the ball.

the bat, which at the same time reverses the ball's direction. The ball then revolves rapidly away from its direction of motion, and "hangs in the air" while it travels, the result being a "hot liner."

The study of the curves imparted to balls by various twists is much easier made with a tennis ball and racket than a baseball, because the tennis ball is much lighter, has a surface which can be gripped by the strings of the racket to form a very wide curve, and does not travel so hard nor so far. In the "cut stroke" or "chop," one sees the ball just described travel the whole length of the court with hardly any drop and gradually "fade" to the earth. In the Lawford stroke, one finds a parallel to the pitcher's drop, in which the ball, revolving with its direction of motion, drops very rapidly after it crosses the net, striking well inside the court, to the confusion of the player who had judged it "out." In the right and left twist and reverse twist service, the right and left revolutions of the ball cause it to curve by many feet, instead of inches, due to the revolution of the ball in the air, and the great resistance of the cloth covered sphere to the air, coupled with its light weight and consequent diminution of momentum.

The psychics of a game of baseball are more curious than the physics, since they demand, for comprehension, a knowledge of how a man thinks. An incident will illustrate this better than a theory. A reporter, anxious to know how much guess work there was between the batter who tries to outguess the pitcher, and the pitcher, who tries to outguess the batters, instituted a game of matching pennies on several teams. Invariably, at the end of the game, the best pitcher and the best batter on the team, would be found fighting it out for possession of the pennies. They were better guessers than their companions—one reason why they were better pitchers and batters.

An amusing exception was noted when Tyrus Cobb, American League batting champion, played the game. He lost easily. When the idea was explained to him, he said,

"I don't try to guess what the pitcher is going to pitch to me—I depend on my eye and quickness to hit it after it reveals itself."

Nevertheless, in most cases, the best batter is not only he with the natural prowess of arm, quickness of eye and ability to think, to calculate what is going on in the pitcher's mind and what is likely to be pitched him next, from what has been pitched him last, but also the man with the quick nervous reaction time. This expression indicates the interval between thinking about doing anything and doing it. You make up your mind to stretch out your hand and open a door, but a

IF YOU HAD BEEN THE UMPIRE, WHAT WOULD YOU HAVE SAID?
Fred Parent, of Chicago White Sox, sliding into third base with Elberfeld of Washington trying to put him out. Silk O'Loughlin called the runner safe.

distinct interval elapses between your making up your mind to do this and your doing it. When the stimulus for the action comes from without, the time can be measured; thus, if at the instant "Open the door" were shouted at you, a chronograph was made to record the command, and the instant your hand touched the handle, the chronograph recorded the touch, the interval between the two touches would be a measure of your nervous reaction time, and further experiments would prove that this nervous reaction time was fairly constant for you in responding to exterior stimuli, regardless of how hard you tried to decrease the time. The same thing is true of the batter, and accounts, in a large measure, at least, for the success of some batters against speedy pitching where other batters fail in hitting this kind of delivery. It does take a measurable interval of time for a man to see a certain pitched ball, and make up his mind to hit it, and if he is a little slow in determining that it is a fast ball and making up his mind to hit it, and his nervous reaction time is not very small, he will hit at the ball after it has gone by—a thing commonly seen on the ball field. The large number of foul balls made from extremely swift deliveries are accounted for in the same manner, a foul ball being often made by the bat hitting the ball too late, thus knocking it to one side or the other instead of out straight.

In a very small degree, but still to some extent, the pitcher can, in this way, control a batter—if the "hit and run" play is to be tried, for instance, and the pitcher suspects it, and a man is at bat who normally hits to right field—which is the proper place to hit when the "hit and run" is tried—he will very probably find himself being served slow balls, instead of swift ones, in order that, if he hits at all, he will hit too soon, and either foul to left or hit to left field, this destroying the value of the play, which is aimed to put a man on first base around to third base on a "single" hit, which can hardly be accomplished if the ball is fielded near third base.

The uncanny ability of the human mind to judge the course of a fly ball, is not to be explained in terms of distance, speed, height, revolution, wind, drift and drop. The fielder in the far distance sees the ball leave the bat and mount high in air. From what he knows of the wind and his experience, he runs to the position to which the ball will fall, and gets under it and catches it, but by what mental process he does so, is one of the mysteries of baseball, so common a sight as to cause little comment, yet a

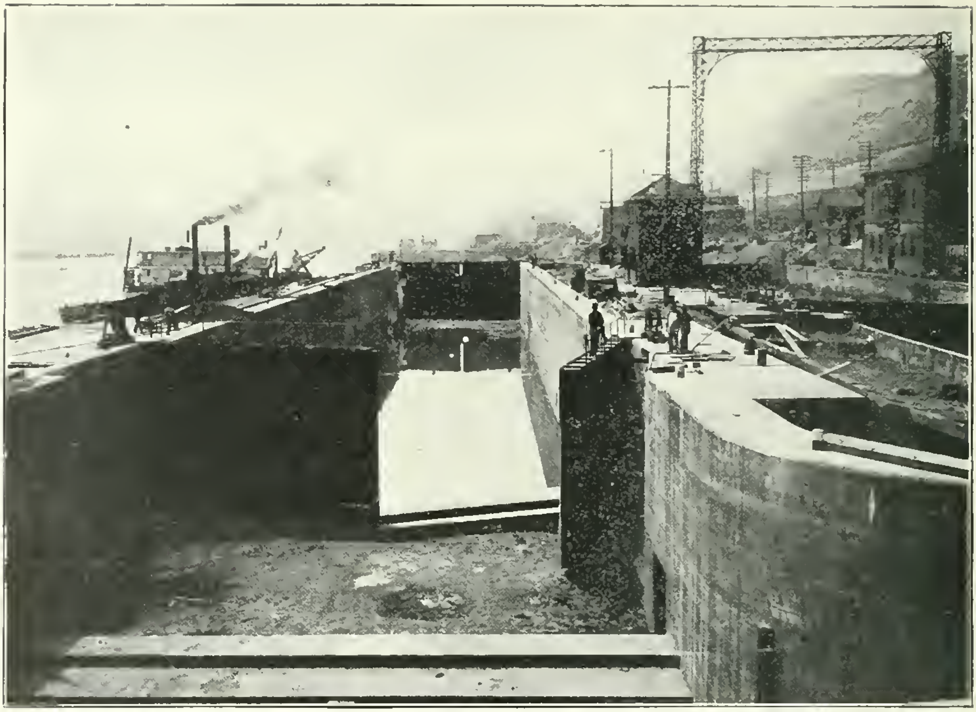
ILLUSTRATING SWIFT WORK NECESSARY ON PART OF THE CATCHER.
Stephens, St. Louis, just failing to get McBride, Washington, in a desperate slide for the plate.

wonderful example of the powers of ratiocination possessed by the mind without our conscious knowledge, nevertheless.

Still more wonderful is the action of a pitcher or third baseman in running to the proper point, putting up his hands and catching a ball hot from the bat, traveling at sixty, seventy, at times eighty miles an hour. Between the time of the crack of the ball and the bat, and the time of the catch, may elapse less than three-fourths of a second, yet in that time, the fielder has not only determined the course of the ball, its height, direction and speed, but has made up his mind what he will do with it when he gets it, where he must throw it, and already "set" his muscles for that particular turn and throw which may "pull off" a double play.

Most mysterious of all in the psychics of baseball is the "jinx," that peculiar "hoodoo" which affects, at times, a man, at other times a whole team. Let a man begin to think that there is a "jinx" about, and he is done for for the time being. If a pitcher "has it on" a batter, it means that that pitcher has always been able to fool that batter, or nearly always. The pitcher goes to the box confident that he will fool the batter, the batter goes to the box sure that he will be fooled. The chances are he will be fooled, too, although he may hit the deliveries of other, similar pitchers, with perfect ease. When a "jinx" hits a whole team, and the whole nine men have a batting slump together, the reason can only be looked for in that mysterious region of the human mind which is so little understood, since they are the same men, hitting the same ball under the same circumstances as they have done all season. Yet, for a time, their "eyes" are in eclipse — they cannot "see them straight," and from eight, ten and twelve hits a game, they drop to one or two. Some day, something happens, no one knows what, and the "jinx" disappears. All at once the whole team regains its form, all the men begin to bat up to their normal averages as if nothing had happened, and the cloud passes away. But what sent it, what made it stay just so long, or why it left, no one has ever been able to find out.

The effect of mind on mind in a ball game is well exemplified in the fact that certain pitchers do better work with certain catchers than with others, although the favorite catcher may be much less skillful than another. It is, apparently, all a matter of confidence, yet how confidence in the man who will catch the balls you pitch can affect the accuracy of your own delivery of a ball, is something no one can say.



NEW LOCK ON DAM IN MONONGAHELA RIVER, PITTSBURG.
The government saved a small fortune by doing this work itself.

CHEAPER THAN CONTRACT WORK

By HARTLEY M. PHELPS

A TYPICAL illustration of what Uncle Sam can save when he acts as his own contractor is shown at Pittsburg, Pa., where the new Number One lock and dam on the Monongahela river, one mile above its junction with the Ohio, was recently built. The saving on the two locks alone is $89,000. Uncle Sam is ahead the neat sum of $176,000 for the whole improvement, the official estimated cost of which was put down at $491,437. This saving is 28 per cent of the cost figured on the contractor's basis. By doing his own river and harbor work Uncle Sam would save no less than twenty-two million dollars on the eighty millions set aside for such work by Congress.

The old crib or "log-cabin" dam put down in 1840 was used as the substructure for the concrete dam. This crib is sixty feet wide. The crest of the dam is fifteen feet above the river-bed.

The two locks, 360 feet long and 56 and 34 feet wide, are of the most modern design permitting the locking of a steamer and four coal boats. The old locks being much smaller, the breaking up of "tows" of coal was therefore greater. The "lift" at the dam varies from two to ten feet; that is, the water must be raised to that height in the lock chambers to equal the river level above the dam. In lieu of opening the lock gates by the old method of hand-operated chains wound on drums the new steel gates work by compressed air.

HOUSES SHOT from GUNS

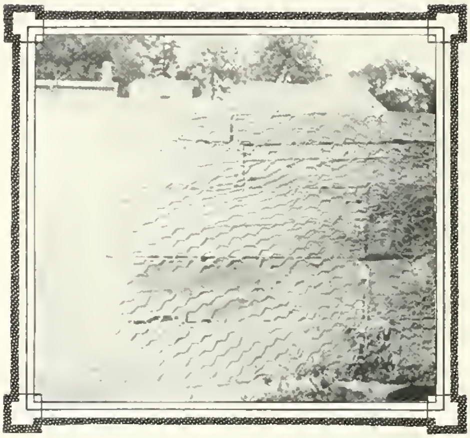
By Robert H. Moulton

If you should happen to run across a group of men pointing what apparently is the nozzle of a garden hose at the side of a house, don't jump to the conclusion that they are trying to put out a fire. And if you fail to see any indications of smoke or flame, don't imagine that they are simply directing a stream of water against the side of the building in order to remove its coating of dust and grime. By observing a little closer you will notice that what issues from the hose is not water at all, but something more nearly resembling whitewash—and as a rule buildings don't need immunity baths. Then if you follow with your eye the line of hose you will discover that the other end is attached, not to a fire-engine, but to something that looks like a combination of locomotive and auto truck. Also, you will see gathered about it another group of men who are busily engaged with shovels, as if feeding fuel to the engine. But even at a distance you can tell that the substance they are handling is not coal. The mystery deepens. What in the world can it be? The answer is—a cement gun.

As this may not make the matter much clearer, it may be well to state at once that the cement gun is an invention designed to do away with the whitewash and kalsomine brush, the cement and plaster trowel and a few other things of a similar nature. It is the very latest method of applying coatings of cement, lime, gypsum and other plastic materials to structures in need of repair, and of putting up the original walls of such structures entire if need be. In other words, the cement coated or concrete house of the future seems destined to be literally "shot" from a gun. The idea of shooting a house, not to pieces, but together may sound absurd, but it is well to remember that this is an age of scientific miracles, which come almost as fast and as thick as the flowers that spring up after an April shower, and we really should not be surprised at anything that happens.

A few years ago Thomas A. Edison made public announcement of a plan worked out in his factory to pour or cast concrete houses, which, he believed, would revolutionize the cost of building dwellings. And not only the cost was to be affected, but the time necessary to erect such a dwelling reduced to a fraction of what was formerly required. Mr. Edison claimed that by his process the exterior portions of a concrete house of moderate size could be put up in forty-eight hours. That, to use a popular phrase, was certainly going some. Is it too much to expect, then, that by the use of the cement gun even this rapidity of construction will be considerably increased?

Reference is here made to concrete construction in connection with the cement gun for the reason that concrete is simply cement mixed with gravel, stone, or some other coarse substance, and what is applicable to the one prod-



Showing How Improvement in Fence-Building May Be Brought About by the Use of the Cement Gun.

Building Up a Section of Cement Pipe on a Wire Mesh Skeleton or Reinforcement.
A cement-gun-made fence is shown in the background.

uct may also be applied to the other, so far as building matters are concerned. It should also be noted that when speaking of these two products as building materials it is intended to refer to the application of the product itself and not to the erection of the framework or skeleton of a building. In vertical construction both cement and concrete must, of course, have some sort of backing or mold to hold them together until they set or harden.

In the case of the poured concrete house a single giant mold would be required, which is equivalent to the older method of first building forms of heavy planks and then filling them with wet concrete. A disadvantage of this method, however, at least with our present knowledge of concrete construction, is, that if the concrete is made thin enough to pour, gravitation will carry all the heavier matter to the bottom before the mixture has time to set; and if not made thin it would not properly fill all the spaces in the mold, which is necessary in order to insure a smooth and reliable finish.

For years much time and money has been spent in the attempt to devise apparatus for the mechanical and pneumatic handling of cement and other plastic mixtures, but with very little success until the development of the cement gun. This method was first suggested by the pneumatic vacuum cleaner. It was argued that if a machine could be built that would remove dust, dirt and even heavier particles of matter by the power of suction, it ought to be possible to reverse this principle and make it work successfully in the application of cement.

The cement gun consists essentially of a hopper into which the dry cement and sand, or other materials, are placed, a hose connected to the bottom of the hopper through which the dry mixture is forced by air pressure, and a nozzle at the other end of the hose to which another hose supplying water is attached for hydrating the cement. The hydration takes place while the materials are all in motion, and, leaving the nozzle, the mixture is "shot" upon surfaces, or into interspaces of any aggregate. As the combination of the elements necessary to produce a plastic product takes place in transit, it will be seen what an advantage this is in connection with quick-setting materials. It not only obviates the use of a retardant, thereby increasing the quality of the product, but materially lessens its cost.

Heretofore the most serious criticism that has been made concerning plastic products has been their lack of uniformity, due to the human element in mixing them and in the methods of application. It is a well-known engineering fact that the instant moisture is brought into contact with plastic materials the initial set, or crystallization, begins, and that any

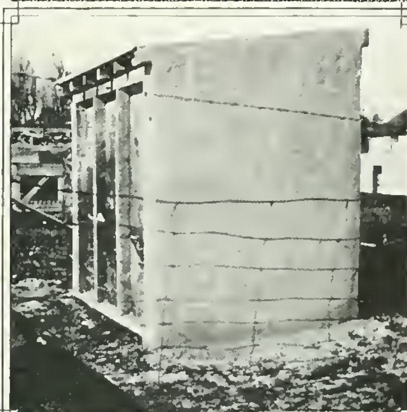
Before Application of Cement-Sand Mortar.

The Same Tree After Being "Treated" by Cement Gun. The work was accomplished in a few minutes.

subsequent manipulation or handling tends to disturb this initial crystallization, thereby weakening the entire product. The only way by which this fault could be corrected would be to have the hydration take place in such a manner that crystallization would begin only at the moment of the actual emplacement of the material on the place where it belongs. This is what the cement gun actually accomplishes.

Another advantage claimed for the gun is that only the amount of water actually necessary for hydration is used, the materials being projected with sufficient force to expel all surplus water and air, and the resulting product is denser, more homogeneous, and, consequently, more water-proof than anything yet attained by hand or machine processes. The labor involved is also said to be considerably less, while the saving in time is so great that the total cost of making and applying any plastic mixture by means of the gun is reduced to a minimum.

There would seem to be an almost unlimited field for the practical use of the cement gun. Foundation work and waterproofing below grade should be well adapted to this process. As a means of coating steel to prevent rust and corrosion it should prove superior to the or-



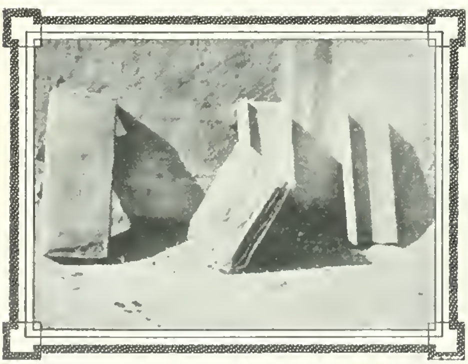
A Scientifically Built Fire, After Burning for Fifteen Minutes, Had No Effect Upon This Structure Built with the Cement Gun.

dinary method of painting, for a cement coating will wear much better than one of paint. The pipe line of the New York aqueduct from the Catskill mountains is now being lined with a two-inch coating of cement and sand in this manner. The inside diameter of the pipe is eight feet, eleven inches, so that a man can easily walk through it and perform the spraying process. Smaller pipes can be similarly treated in sections.

Suppose you have old and crumbling walls, fences, sidewalks or leaky roofs that need repairing, or a wooden building that you want made fireproof in anticipation of a visit from the fire insurance examiner. There will be no need of having one's premises littered up for a week or more with a lot of mortar boards and mixers, scaffoldings and similar eye-sores, as in times past. You simply send out a hurry-up call for the cement-gun man, who comes around with his little renovator, and—presto, everything is made spick and span "while you wait." It is something like sending one's clothes to the cleaner, only in this case the cleaner comes to you.


APPLYING CEMENT STUCCO TO AN OLD BUILDING AFTER COVERING IT WITH WIRE MESH.

It is probable that a great many people have noticed small railroad stations which had been sprinkled with sand, while newly painted, and then given the matter no further thought except perhaps to note that the buildings formed a convenient place upon which to strike matches. This is an idea that has long been employed to make such structures fireproof and to protect them from wear and tear. But


PIECES OF STEEL-BEAMS COATED WITH CEMENT-SAND MORTAR FOR PROTECTION AGAINST RUST OR CORROSION.


WHAT MAY BE DONE IN BUILDING OUT WITH ONE APPLICATION OF THE CEMENT GUN.

EXAMPLES OF TREE SURGERY.
Filling holes in trees with cement and mortar by means of the cement gun.

the process is slow and laborious. Imagine turning a garden hose on the same building, and imagine further that instead of water a stream of liquid cement issues from it, and it will be seen how quickly the same job might be finished.

Tree surgery is another thing that seems destined to undergo a revolution if all that is claimed for the cement gun proves practical. There are hundreds of torn, cracked and decaying trees in the private yards, on the streets, and in the public parks of every city that could have their years of usefulness and ornament doubled if they were given proper attention. The trouble is that it doesn't pay to go around and patch them up with hand-made cement or plaster, as it might be termed. Besides, this is an instance wherein it is especially necessary that the plastic product should be applied with the least possible delay after mixing on account of its subsequent constant exposure to the elements. With the cement gun this work can be done so quickly and cheaply that its use in this connection should become very general.

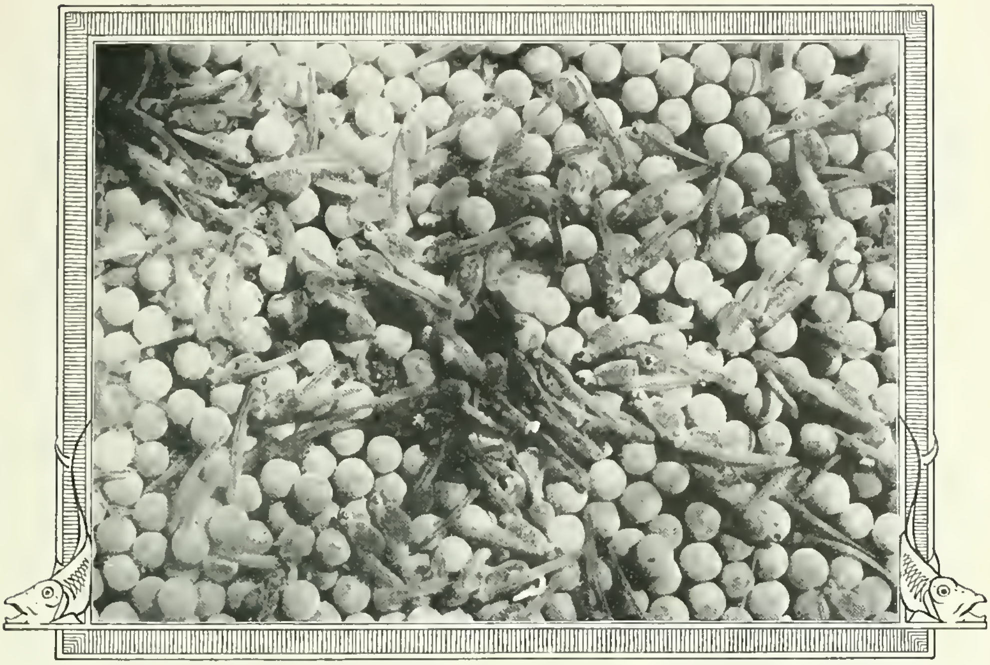
In the case of fences and other similar structures, and the interior and exterior walls of entire buildings, a special design of frame work is required. This consists of a wire mesh of the required size, with a wooden backing. The cement is shot upon this and after it has hardened the wooden backing is removed, leaving what is practically a reinforced cement wall. Such walls are claimed to be as fire-proof as they can be made by any known method.

In order to demonstrate this, a small building of two-inch by four-inch wood was constructed. Both the inside and outside were covered with building paper and over this was placed a wire mesh reinforcement with one inch of cement-sand stucco, leaving a four-inch air space between the walls. A scientifically built fire was then allowed to burn in it for fifteen minutes, after which buckets of water were thrown on the inside hot walls, with the result that only a little of the surface scaled off and not a single crack developed. The outer coating of the rear wall was left off in order to determine whether or not the wooden studding would be affected by the heat, and it was found to be not even charred.

A comparative test to determine the respective breaking strengths of hand-made and cement-gun made bricks, the latter composed of one part cement to three parts sand, was made after both had been exposed to moist air for one day and immersed in water for twelve days. The hand-made brick broke at 303 pounds, and the cement-gun-made brick at 533 pounds.

The cement gun is, of course, not adapted to the use of concrete or other mixtures in which coarse gravel or stone forms one of the ingredients. But a solution of this problem may be found in the construction of a "concrete cannon," and future generations may witness the spectacle of whole towns being literally "bombarded" into existence in the same time that it now takes to erect one building of moderate proportions.

For my part, people who do anything finely always inspire me to try. I don't mean that they make me believe that I can do as well as they . . . But they make the things seem worthy to be done. —*George Eliot.*



TROUT EGGS HATCHING.

THE STORY ON A FISH SCALE

By

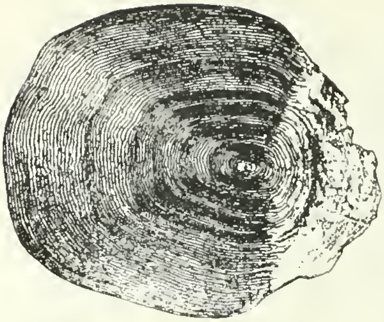
RENÉ BACHE

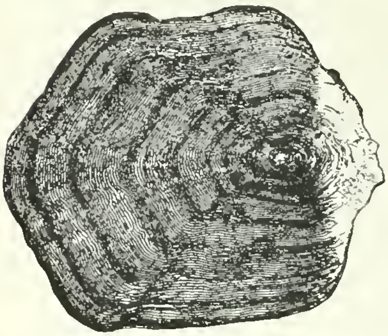
DR. HUGH M. SMITH, biologist and Deputy Fisheries Commissioner, sat at his desk in Washington, holding in his hand a small rectangular piece of glass, upon which was fastened a single scale of one of this year's run of Potomac shad. He was examining it with a magnifying lens.

"From this scale," he said, "I have learned more in fifteen minutes about the life history and habits of shad in general than all that I previously knew on the subject put together."

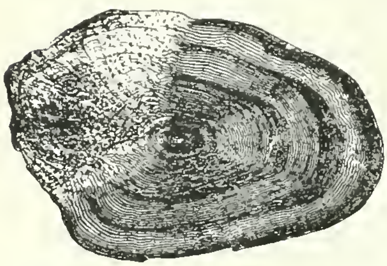
It seemed a remarkable statement. But Dr. Smith went on to explain that back of his remark there lay a most important new discovery, in the light of which it will henceforth be possible to ascertain with exactness and certainty the history of any individual fish. For, as has now come to be known, each fish carries on its body the story of its life, told in cipher, as one might say, and this story is repeated word for word, so to speak, on every one of its scales.

The language of the fish scale is entirely new to science, but now that biologists have found out how to read it, there is no further difficulty, inasmuch as it is practically the same for all kinds of fishes. Revealing as it does the details of the life history of various species, the discovery has a most vital bearing upon the interests of the commercial fisheries, to which in the long run it will be worth

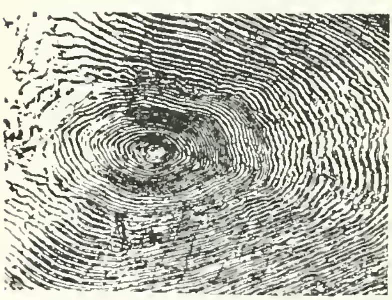




Trout Scales Showing the "Winter Rings" by Which the Number of Years of the Fish's Life Are Reckoned.



Scale of Salmon Showing "Winter Rings."



Middle Part of the Same Scale (Greatly Enlarged) Representing the First Three Years of the Fish's Life and Growth.

untold millions of dollars. Take the shad for example. It has been known hitherto only as a river fish. But, of course, it is really a sea fish, merely running up the rivers to spawn. What are its haunts, and what its wanderings, while in the ocean? Science, on this subject, has been obliged to confess an almost total ignorance.

Yet it is evident that a thorough acquaintance with the marine haunts and migrations of the shad would be of utmost practical value to the fishery. And it is of special importance to find out how fast they grow, how old they are when of different sizes, at what age they spawn for the first time, and how many batches of eggs the average female lays during her lifetime.

All of these facts, and others in addition, are ascertainable by a study of the scales of the shad. And the language is so extremely simple that anybody can learn to read it in a few minutes. Inasmuch as the story for each individual fish is repeated on every one of its scales, it is necessary only to select a single scale for observation. The scales all over the creature's body tell exactly the same story, and there are no contradictions.

If a shad scale be examined under a magnifying glass, it will be found to be covered with ever so many ripple-like marks, arranged as if the ripples all proceeded outward from a common center—the latter, obviously, being the point from which the scale originally began to develop. What are these marks? The answer is that they merely represent successive stages in the progress of growth. But their more important significance lies in the fact that they mark equivalent stages in the development of the fish; for, as the scale grows, so does the fish itself.

A shad, like any other animal, or any plant, does not develop steadily, but by a series of jumps and pauses. Thus a boy, if measured at frequent intervals, will be found to grow by jerks, as it were, remaining at the same height for a while, and then gaining half an inch in stature, perhaps, within a few days. This is the secret of the ripple-marks on the fish scale, each one of which represents a jump in the growth of the fish.

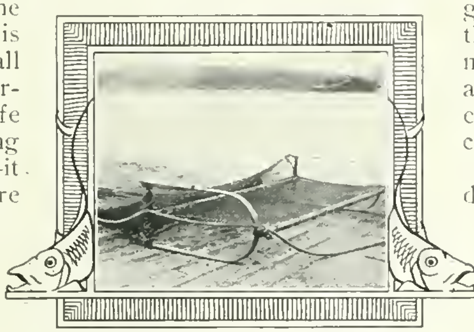
So far, so good. But this does not go on with absolute regularity, for in the winter time the shad becomes sluggish, and eats comparatively little, so that its rate of growth is retarded. Record of the fact, indeed, is made on its scales, the growth-ripples being much closer together, for the reason that the fish for the time being is gaining size more slowly.

Hence it comes about that each winter of the shad's life is clearly marked on every one of its scales; and thus, by examining a scale, it is easily possible to find out the age of the fish. Let a

DRAWING A SEINE FOR SHAD.
An expert, by examining the scales of any one of the catch, can tell its age and facts about its life.

shad be caught in the Delaware or the Potomac tomorrow, and an expert, by a mere glance at one of its scales, with the help of a magnifying glass, can tell just when the animal was hatched, how many years it has spent in the sea, and many other details of its life history—all of which will presently be made clear by further explanation. He can even determine where the little fish first saw the light, and, if a female, how many times it spawned before being finally captured in the fisherman's net.

Understanding clearly that what is true of the shad in this regard is likewise true of all other kinds of commercial fishes—the life story of each one being told by its scales—it seems best, before going further, to explain that what originally led up to this new knowledge was the discovery by a German scientist, Dr. Reibisch, a few years ago, of the fact that the ear-bones of the flounder showed age-rings similar to those found in the trunks of trees or the horns of cattle. Thenceforth it was possible to tell correctly the age of any individual flounder.

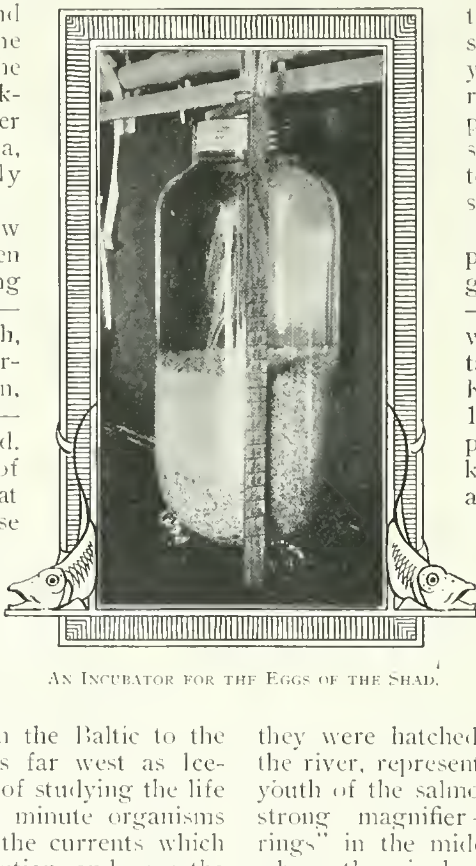


A Beam Trawl for Taking Fish.

Recently, however, it was ascertained that exactly the same story was told by the scales of any fish. For the scales, one should realize, are a permanent part of the body structure. They are a sort of natural armor, for protective purposes, arranged in a definite pattern, and remain through life. Their growth keeps pace with that of the fish, and the marks on them give, as already explained, a complete picture of the creature's development.

Scales from the middle of the upper part of the back are chosen by preference for examination because they are the oldest, and, as a preparation for study, they are carefully cleaned with alcohol. But—and here is a very interesting addendum—the fact now comes to light that the scale story is told in the same language, and so as to be more easily read, by the fish's cheek bones. Its gills on either side are covered by a large and flat bone, quite thin, which, when the skin has been removed from it, is found to have exactly the same markings as the scales; but the markings, being spread over a much greater area, are proportionately more legible.

During the last few years no fewer than ten steamers, representing as many countries—Belgian, Danish, Dutch, English, Finnish, German, Norse, Russian, Scotch and Swedish—have been engaged, with a large staff of scientists, in a great coöperative enterprise of oceanic research in the waters of northern Europe. In the interest of the commercial fisheries, they have made voyages all over those seas, from the Baltic to the Arctic Ocean, and as far west as Iceland, for the purpose of studying the life history of fishes, the minute organisms on which they feed, the currents which influence their distribution, and even the chemical composition of the water at various depths.



An Incubator for the Eggs of the Shad.

In this work the study of fish scales is proving enormously helpful, enabling the experts not only to tell the age of every cod, haddock, herring, or sprat, but also to ascertain many other details about their life history as individuals. Thus, for instance, it has been learned that the female cod, as a rule, spawns for the first time in her fourth year, and, if her activities are not cut short by capture, may be expected to lay eggs eleven or twelve times before she dies.

One of the most interesting studies has had reference to the salmon which run up from the sea into the rivers of Norway. It was supposed hitherto that the young, after being hatched on the spawning grounds at the headwaters of those streams, sought the ocean when they were yearlings. But the scales of the full-grown adults have shown, by the "winter rings" on them, that this species spends the first three years of its life in the rivers, during which period it grows very slowly. Then, on going to sea, it increases in size with great rapidity.

Shown herewith is a picture—from a photograph, much enlarged—of a scale of a Norway salmon which was taken in the river at Kristianso, May 21, 1909. The date and place of capture being known, its story reads as follows:

Hatched in March, 1900, and spent three winters in the river—the same river, of course, because these fish always return to the stream in which they were hatched. The time spent in the river, representing the slow-growing youth of the salmon, is shown—under a strong magnifier—by three "winter rings" in the middle part of the scale, where the ripple-marks are very close together.

This salmon left the river in the spring of 1903, spent the next two winters in the ocean, and in the summer of 1905 came back to the river to spawn. Meanwhile, as shown by the scale, it grew with great rapidity. The fact of its spawning is indicated by the raggedness of the ripple-marks corresponding to this stage in its career. For, when the fish runs up the river, it ceases to feed, and there is an absorption of all of its tissues, to furnish energy for the making of its eggs—or milt, in the case of a male. This absorption affects even the scales, rendering their edges ragged, and the scars remain permanently.

This particular salmon, after spawning, went back to the sea in the spring of 1906, spent one winter there, and in the summer of 1907 returned to spawn again. As further indicated by the record of the scale, it again sought the ocean in the spring of 1908, and, returning once more in the summer of 1909, was caught.

STORY TOLD BY THIS SALMON SCALE.

Hatched, March, 1900; left river in spring, 1903; spent two winters in sea; in 1905 came back to river to spawn; returned to sea in 1906; spent one winter there, and went back in 1907 to spawn again; returned to the ocean in 1908, back in 1909, and was caught.

Thus, one observes, the complete story of the life of this fish is ascertained by reading one of its scales—the approximate date when it was hatched, the stages of its growth in detail, the time when it made its first visit to the ocean, the periods it spent there, the dates of its successive returns to the river, the number and dates of its spawnings, and its almost exact age when captured. Practically nothing is omitted.

Nothing, that is to say, except some rather desirable information about what the fish was doing while it was in the sea. It is practically certain, however, that it did not go far from the mouth of the river of its birth—such being the habit of salmon. And, by the way, our own Alaskan salmon, which furnish so important a commercial fishery, are believed to spend only one year in fresh water before seeking the ocean. The government Fisheries Bureau proposes to obtain exact information on the subject by a study of their scales.

Much picturesqueness attaches to the haunts and wanderings of the various species of food fishes. Information on this subject is also of utmost value to the commercial fisheries. For example, it would be worth millions to know what has become of the mackerel.

Make the Best that in you Lies——	Good Work 's a thing that never Dies.

A. H. McQuilkin.

The HANDY MAN

By Berton Braley

Said Uncle Sam, "I've got a job for some good man to do,"
And so he hired an engineer who'd done a thing or two;
He gave him money, tools and men and told him, "Go ahead!
You cut the continent in two, that's all I ask," he said.
That engineer he fussed and fumed and finally he quit,
And then there came another man who took a whack at it;
But still the job was mighty slow—and slower every year,
Till Uncle Sam he went and got an Army Engineer.

Now *he* didn't start in crying
  Of the handicaps he met,
He just set the dirt to flying
  And the dirt is flying yet!
Handled money by the million
  (But each dollar counted clear)
For he wasn't a civilian
  But an Army Engineer!

Said Uncle Sam, "I reckon that the boys I teach myself
Are something more than ornaments upon the parlor shelf,
They may be fond of uniforms when showing on parade
But when they've got a job to do they're worth the wages paid.
I show an army man the work and let it go at that
And when I think of it again the job is finished—pat!
He never asks me questions and he doesn't sniff and sneer
But he knows his business proper, does the Army Engineer!"

For he isn't playing double,
    And he isn't full of tricks,
And he keeps himself from trouble
    And from peanut politics!
There is neither man nor devil
    That can throw him out of gear,
He is strictly on the level
    Is the Army Engineer!

Said Uncle Sam, "I reckon if I told him he should try
He would build a bridge of moonbeams from the ocean to the sky,
He would tie the worlds together in a harness made of light
And he wouldn't advertise it—but the job would be all right!
I don't want to be a boaster, but this army lad of mine
Is about the finest ever in his own peculiar line,
He's the kind that you can swear by, he's the kind that you can cheer,
He's a quiet peacherino, is the Army Engineer!"

He is keen and he is canny
    (Grafters call him quite a snob)
But there's no one's got his nanny
    'Cause he's always on the job!
When the others, all defeated,
    Say the thing's a failure sheer,
Why, we get the job completed
    By the Army Engineer!

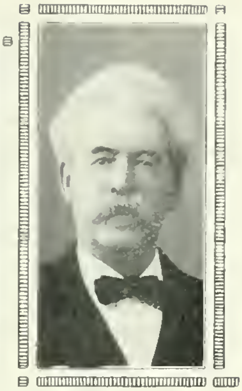
Free Dentistry for Poor Children

By Ralph Bergengren

NOT long ago there died in Boston a gentleman who, during his last illness, needed the services of a dentist and learned in conversation that many of the troubles with which humanity suffers from its teeth would be obviated if the teeth had been given proper scientific attention during early youth. He learned also that of the approximately two hundred thousand children in the public schools of Boston, seventy per cent needed such treatment and fully fifty per cent were children of parents who were too poor to pay for it. He learned that children of well-to-do parents are nowadays more and more likely to be sent early to the dentist, but that to the parents of the great majority dentistry is still a luxury and the first teeth generally but wrongly considered too unimportant to be given much attention. Actually, however, these first teeth determine the character and condition of those that come afterward. Thousands and thousands of children therefore start life handicapped by imperfect teeth, and the unfortunate result of lack of early treatment may range all the way from digestive disorders that produce various forms of illness to actual malformations of the jaw that make the innocent victim look like the possessor of criminal tendencies. Nor was there any visible signs of an improvement in this condition. Such free clinics as those of the Harvard and of the Tufts Dental Schools did indeed take care of a small proportion of children, but the average child was necessarily left uncared for.

The result of this knowledge, coming to a sympathetic and wealthy man in almost the last hour of his life, will soon be seen in the actual erection of the first building in the world designed to provide free dentistry for all the poor children of a large city. Before he died Mr. James Bennett Forsyth had worked out the broad idea of the institution, and his two surviving brothers, John Hamilton and Thomas Alexander Forsyth, are giving his last wishes tangible expression in a beautiful structure which will soon stand in the Back Bay region of Boston, conveniently accessible to the children of the city, and provided with a million dollar endowment in order that its good work may go on indefinitely. The Forsyth Dental Infirmary for Children, recently incorporated by special act of the Massachusetts Legislature, will thus set an example that other public-spirited men in other cities will be almost certain sooner or later to follow. Coming at almost the moment when the attention of thoughtful people was centered on the "Child Welfare Exhibition" in New York, and its appeal to the public to save the children from the evils of heredity and environment to which they are necessarily exposed in our congested cities, the announcement of the first institution for free dentistry for the children of the poor seems like a practical answer to a need that every student of modern civilization is coming more and more to realize.

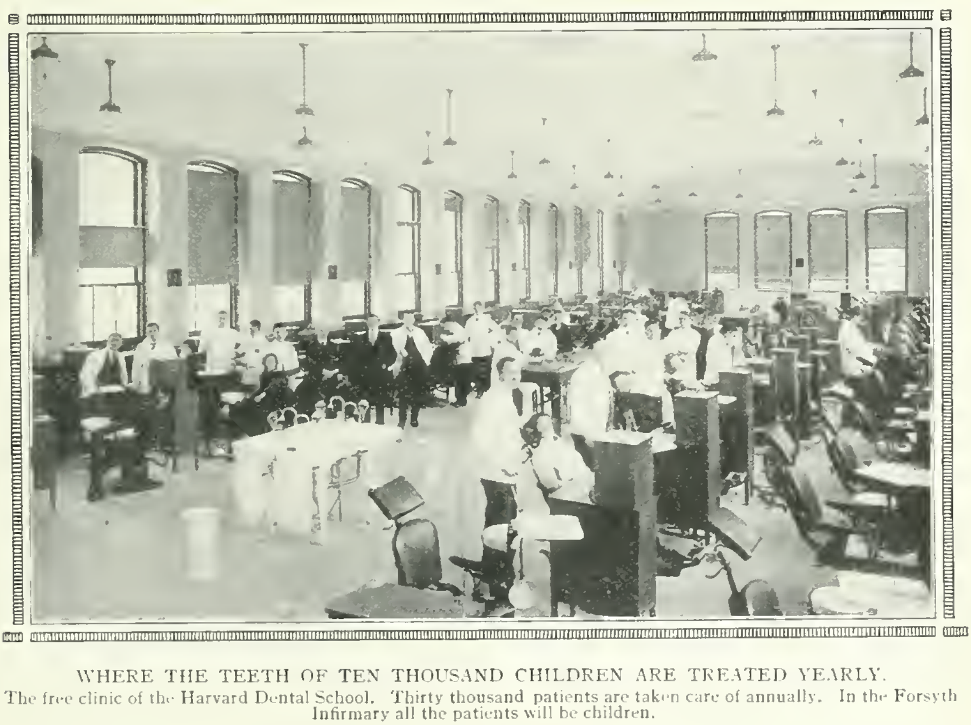
This new foundation, moreover, is not regarded by the founders in the light of a charity. Consecrated to the memory of two brothers, James Bennett and George Henry Forsyth, the monumental marble structure which will soon add a new beauty to the architecture of Boston's famous Back Bay simply carries a bit further the "right of every child to develop mentally at the public expense." Granting the right of every



Thos. A. Forsyth. John H. Forsyth.
Founders of the first institution in the world established to provide exclusively free dental treatment for children.

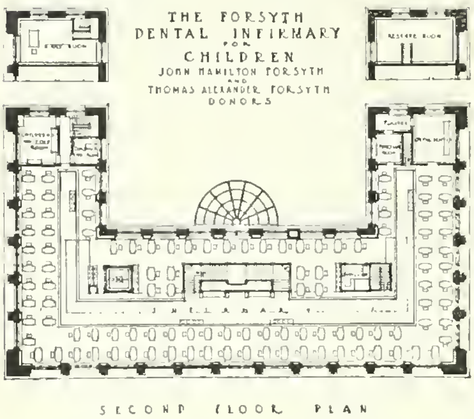
Geo. H. Forsyth. James B. Forsyth.
In whose memory the Forsyth Dental Infirmary for children is being erected.

child to a public school education, it is a logical amendment to add that every child has an equal right to be started in life in proper physical condition. The Forsyth Infirmary hopes not only to relieve individual suffering and prevent future individual suffering, but it hopes to exercise an important influence in "making for a better looking, more perfectly developed human race." The physical betterment of the individual child, when such betterment is freely offered to all the children of a large city, must, in short, make for the social betterment of the community. What the child becomes is no less important to the community than to the child himself, and whatever removes the handicap of



WHERE THE TEETH OF TEN THOUSAND CHILDREN ARE TREATED YEARLY.
The free clinic of the Harvard Dental School. Thirty thousand patients are taken care of annually. In the Forsyth Infirmary all the patients will be children.

THE FORSYTH DENTAL INFIRMARY FOR CHILDREN, BOSTON, AS IT WILL APPEAR.



THIS PLAN SHOWS THE MAIN OPERATING ROOM WITH THE ARRANGEMENT OF CHAIRS.

ill health from a great body of children is held to be a public benefit more than a private charity.

In appearance the Forsyth Dental Infirmary for Children will be a three-story structure of white marble, built in the Roman Classic style of architecture, and further beautified by ornamental fountains and a small park where in pleasant weather the children may play while awaiting treatment. It is significant of the spirit in which the institution is planned, and will be conducted, that it combines every latest facility for the scientific side of its work with every possible consideration for the state of mind of its juvenile patients. Some of these patients, indeed, will be too young to have any very definite state of mind as regards dentistry. They will come in perambulators, or in their mothers' arms, long before they are old enough to go to school, in order that their first teeth may be examined and the development of their little jaws started in the right way. The older children, brought from the public schools in charge of the school nurses, will better appreciate Forsyth park. With some 51,000 square feet of land to stand on, the infirmary will be so situated that excellent lighting from all sides will be permanently provided for the operators in the various departments, and at the same time a considerable amount of outdoor space reserved for park purposes. Operations, however, that are likely to inspire dread or nervousness in other patients will be taken care of in rooms apart from the great main hall of the infirmary, and the children who have been treated will then leave the building without coming in contact with any of the youngsters who are still waiting to be examined. Most of the cases are unlikely to be of this painful nature, for the work of the institution will be largely along the lines of prevention of future disorders by stopping them in infancy. In the main hall of the infirmary, where the great majority of the cases will come for treatment, there will be sixty-four chairs when the institution opens, and forty-four chairs can be added without in any way crowding the operators.

All this, of course, will require a large infirmary staff, especially since dentistry, as here considered, will include expert treatment of all incipient disorders of the throat and nose as well as the teeth. The institution will be under the guidance of a consulting staff of experts together with a permanent staff of dental graduates who will devote their entire time to the children. In addition there will be a visiting staff of dentists who volunteer their services, and the permanent operators will be aided by students of duly authorized Dental Schools under the immediate supervision of competent instructors. There will be provision for post-graduate study as well as for the special research and X-ray work with which no dental institution of the first rank is nowadays unprovided.

WHAT CHANCE HAS THE HORSE?

By M.M. Hunting

"AUTOS rush in where horses fear to tread," remarked a New York business man as he stood one slippery morning in front of the Flat Iron building and watched one horse after another fall heavily to the pavement while on every side motor trucks and pleasure cars rolled smoothly by. The toiling teams that managed to keep their feet tugged at their heavy loads and their drivers looked after the passing trucks with an expression of envy while the business man turned slowly away pondering the object lesson.

For a number of years it has been apparent to thinking men who have made a study of transportation methods that horse drawn vehicles were totally inadequate as a medium of freight transportation and that its logical successor would be the commercial car with its ability to do more and better work for less money. This fact, accepted at first only by a few, has been forced upon the general public so that today every up-to-date business man admits that the commercial car is here to stay.

Nothing could more strikingly demonstrate the attitude of the business world toward this innovation in our methods of transportation than the fact that practically within a period of five years New York has acquired 2,000 auto trucks, Chicago 900, Boston 450, Philadelphia 400 and Pittsburg 300. Other cities follow in proportion to the number and importance of their industries.

Almost every branch of the world's business that has heretofore used horses for hauling is now represented by from one to fifty trucks in the great procession of commercial cars. One manufacturer claims to have sold from five to forty trucks to each of sixty-one different lines of business while the number of small delivery cars in use by city stores is astonishing. A New York department store recently purchased one hundred light delivery cars in a single order, replacing their entire horse equipment.

That skepticism has been common among business men as to the success of the power wagon is not to be wondered at for the salesman has had little but theory to back his assertions until recently. Only a few had faith enough in its future to invest their money but fortunately today examples of the superiority of the gasoline wagon to old Dobbin are without number and are far more interesting and convincing than any amount of figures.

A well known safe manufacturer of New York employing a 5 ton truck made an interesting comparison recently. A large safe was loaded upon a wagon and delivered in the usual way by means of horses. Another safe of equal size and weight was hoisted upon a truck by means of a windlass operated by the truck's engine. The watch was held by impartial judges and the result announced that the safe handled by the truck was loaded, delivered and set up in less than ¼ the time required by the

A ROAD TRAIN—THE ONLY ONE IN THE UNITED STATES—TURNED OUT BY A DETROIT AUTOMOBILE MANUFACTURER.

horse drawn wagon for the same operation.

Another instance even more astonishing is the performance of a gasoline car employed by a stone quarry near Quincy, Mass. In one day of ten hours the machine delivered 12 loads of stone aggregating 106,410 pounds. The smallest load being 7,900 pounds, the largest 11,000 pounds. Approximately 60 miles were traveled, part of the way over rough and steep roads where at least 8 horses would have been required to haul the load and yet the expense of the day's work including gasoline, lubricating oil and driver's salary was but $5.00. Lest these figures should completely discourage the competitive teamster the owners added $8.50 to cover general depreciation and interest upon the investment, but a tremendous balance in favor of the truck still remains.

An interesting example of speed and economy is furnished in the case of the family who engaged a motor truck to transport their household goods from Ypsilanti to Detroit, Mich., a distance of 32 miles. The truck made the journey over sandy roads in 3 hours and 5 minutes, the total expense being $7.50 divided as follows: driver's salary, $2.75; helper, $2.00; gasoline and lubri-

FIVE-TON TRUCK, LOADED TO CAPACITY, CLIMBING A ROCKY HILL NEAR LEEDS, MISSOURI.

HAULING EIGHT TONS OF COAL IN NEW YORK CITY

eating oil, $1.25; depreciation and interest upon the investment, $1.50. By team it would have taken not less than two days, and the expense would have been three times as great. By freight the cost would have been double, and would have required from 5 to 6 days time, not to mention the four handlings of the goods.

In Kansas City, Mo., a motor wagon recently delivered two loads of alfalfa aggregating 11,240 pounds a distance of 21 miles, while a 4 horse team made a trip of 10 miles with 7,700 pounds.

Trailers are sometimes attached to motor trucks thus multiplying their capacity. A manufacturer in a Western city recently hauled 17,214 pounds of castings, the load being divided between the truck and trailer. With this unusual load a distance of 7 miles was covered over city streets in 55 minutes.

Portland, Oregon, is taking hold of the truck idea with enthusiasm far beyond that shown by many larger cities, and several unusual tests have been made within the past year. The local gas company experimented with a truck for a period of 8 months keeping a careful record of its performance during that time. To their surprise they discovered that this 2 ton car was handling double the load of their heaviest wagon in half the time, thus exceeding the capacity of the wagon four fold. Forty-two horses and 20 wagons have been banished in consequence and replaced by eight steel monsters that do not tire out or have to take days off on account of sickness.

An instance of quick delivery that is enough to discourage any horse if he were able to read it is the story told by the President of a large packing house of Portland. "Delay in the delivery of our Portland car from our packing house in North Portland necessitated some quick work and we hired a big auto truck to make a special trip for us. The truck left Portland at 10 o'clock A. M. covered 7 miles to the packing house, took on 9,500 pounds of meat and had the load back in Portland at 1 o'clock, having covered 14 miles, loaded and unloaded 4½ tons in a period of 3 hours." Compare this with what the best team of draft horses could do and you will readily understand why this company has decided to adopt gasoline instead of horse flesh in the future.

As an example of what may be accomplished with the light delivery car such as can be used by almost any retail store, the experience of a milling concern in the East is interesting. A record was kept of the performance of one car and a horse and wagon used side by side for eighteen days, the truck made 418 deliveries in 114 hours, 560 miles, at a cost of $8.76 cents or an average of 2 cents per delivery; the horse made the sad showing of 132 deliveries in 133 hours.

TRANSPORTING MILK IN LOS ANGELES.
In four trips to the depot, this vehicle carries daily 11,200 quarts.

covering 110 miles at a cost of $7.49 or nearly 6 cents per delivery. This is a demonstration of superiority and economy in light delivery trucks that admits of no argument, and shows that even our corner grocery can dispense with the services of its horse and wagon with profit.

It is plain that almost any auto truck can do the work of 2 or 3 wagons and there are many cases on record as some of the foregoing anecdotes demonstrate where they have done much more, but resorting to figures for a moment let us see what the actual cost of the motor truck is.

It is obvious, in order to give the truck a fair showing, we must assume that the entire delivery equipment is composed of motor vehicles as any item entering into the total expense must be considered. If, therefore, any part of the equipment is composed of horse-drawn vehicles the truck's record must suffer in consequence.

Very carefully compiled figures show that 10 gasoline trucks taken as an average equipment all covering 40 miles per day and operating 300 days each year can be maintained at a cost for each machine of $9.75. The items contributing to this average are as follows:

FIXED CHARGES PER YEAR ON ONE TRUCK.

Interest at 6% on $3,000.00 cost price	$ 180.00
Depreciation at 20%	600.00
Insurance, at ½%	15.00
Storage, 200 square feet, at 50 cts.	100.00
	$ 895.00
Add 20% for two spare machines	179.00
Total	$1,074.00

Dividing by 300 the number of working days in the year, this gives $3.58 per day.

RUNNING EXPENSES PER DAY FOR TEN TRUCKS.

Wages of 10 drivers, at $2.50 for ten hours	$25.00
Wages of repairman, helper and washer	7.00
Gasoline, 80 gallons at 12 cts.	9.60
Lubricants, at 1 cent per mile	4.00
Maintenance, at 10% a year	10.00
Superintendence	3.20
Incidentals, light, heat, tools, waste, etc.	2.87
	$61.67

A MOTOR TRUCK EQUIPPED WITH WINDLASS FOR RAISING AND LOWERING SAFES.

Average running expense per truck	$ 6.17
Fixed charges per truck per day	3.58
Total maintenance and operating cost	$ 9.75

As compared with this it is claimed that the electric truck of practically the same capacity may be operated at a cost of $8.76 per day, the items entering into the cost being the same as that of the gasoline truck except of course that storage batteries are considered instead of gasoline and a somewhat smaller consumption of lubricating oil. This comparison favors the electric truck but it would be unjust to state positively that either is the most efficient, as the results depend upon local conditions largely such as facilities for charging the storage batteries of the electric vehicles, the character of the work to which the trucks are subjected and the quality of the road over which they have to travel.

Probably the most marked improvement in service as well as the greatest saving to the public has been affected by the adoption of motor fire apparatus, and the fact of its being largely adopted proves that its advantages have not been overlooked.

It is estimated by the National Board of Fire Underwriters, that our yearly loss by fire amounts to half a billion dollars. The same source of information is responsible for the statement that this would be reduced 4/5 could the extinguishing apparatus reach the conflagration in half the time usually required. Since this sum, $400,000,000, amounts to $5.00 for each man, woman and child in the United States any statement regarding the value of seconds in getting action on the flames is likely to be too conservative.

The ability of the motor fire department to start quickly and maintain their speed indefinitely is a point of superiority which cannot be overestimated. They travel at nearly the same speed in all kinds of weather and require practically no more care than the common apparatus, while the space to house them is considerably less.

It is interesting to note the varied uses of the motor truck, and one is often surprised if not almost shocked, at times to see to what extent the horse has been

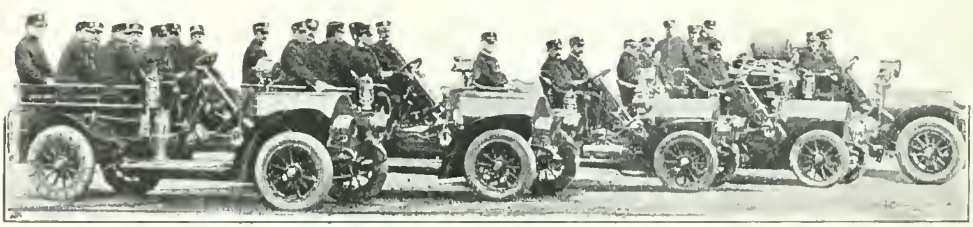
THE ROUGH ROAD HAS NO TERRORS FOR THE MOTOR TRUCK.

thrust aside to let in his modern rival. The motor patrol and ambulance are now common, but think of a motor street cleaner, a motor sprinkling wagon, a motor oil tank, and even a motor scissor grinder's outfit.

If the horse is capable of embarrassment he surely must be nearly overcome when after falling upon the pavement and receiving a serious injury he is carried away in a motor ambulance for disabled animals. Such is the practice in New York.

Those of us who are accustomed to seeing the dignified black team drawing the hearse experience a peculiar sensation as the motor hearse rolls by, yet in spite of prejudice Eastern undertakers are rapidly adopting it.

The saving in dollars very naturally appeals most strongly to the commercial world but there are other advantages in dispensing with the services of our common beast of burden of equal if not greater importance. He is a spreader of disease. The presence of the stable, especially in the city, is one of the most prolific sources of infection. Fully 90 per cent of the flies that infest our homes are bred there and carry thousands of germs upon their bodies to be deposited upon everything with which they come in contact. If in banishing the horse we can also dispose of this pest and spreader of disease, the automobile will have accomplished a great mission even if it proves no more efficient than its flesh and blood rival.



THE AUTO FIRE DEPARTMENT.

EFFICIENCY ON THE FARM

By F. G. Moorhead

WHEN David Rankin, the world's largest farmer, was asked to tell the secret of his success (he began by borrowing $6 and died worth $5,000,000, all made in farming) he answered promptly: "Success in farming consists in making every minute, every cent and every seed count. A good workman is cheap at most any price and a shiftless, careless man is dear if he works for nothing."

Not long before he died Mr. Rankin amplified his views. "To make a profit the farmer, just as any other manufacturer, must reduce the cost of production," he said. "I saw this long ago and when I saved a hand's wages by the use of a new piece of machinery I felt pretty good; that was making money for me. We farmers must not only keep eternally at reducing the cost of production but plan a way to get the most out of our product. Use your head as well as your hands, for it is the little savings that make up the profits at the end of the year. It takes sharpening of wits all the time."

Mr. Rankin's life was a constant practicing of what he preached. Almost sixty years ago he conceived the idea of putting together two of his double shovel plows so as to plow on both sides of the row at once. He explained his ideas to the village blacksmith and it was not long before he was using a straddle-row cultivator, the first one so far as any records go. That day he did away with one hired man. He was learning to make every effort count. "Whenever I can buy an implement that will reduce the labor or perform the work better than the old style machine, it pays me to throw the old one away and get the new one," he explained. "Let me prove this to you. Now, a good steel plow will turn two to three acres of sod per day. Say you use it only thirty days in the year and it lasts fifteen years, then it has turned 1,350 acres and cost about $13.50, which was about one cent per acre. A stalk cutter will cut ten to twelve acres of stalks per day and while it costs about $30, still you wouldn't try the job nowadays with a hoe. I use three and four row stalk cutters, also stalkbreaks thirty-two feet long. A self binder will handle from twelve to fifteen acres of grain in a day and requires an outlay of about ten to fifteen cents per acre, still how much would it require in additional labor to handle the crop? With the single shovel, a man could do a fair piece of scratching and cover about four acres per day, while with the common single row cultivator he can do a much better job and do eight acres and with the modern two-row cultivator he can as easily do fourteen to sixteen acres. I am telling you this to impress you with the fact that the cost of machinery doesn't amount to anything. The two-row cultivator will do better work and cut the cost, too, by lessening the amount of labor, of both men and horses."

It may be urged, however, that Mr.

Rankin farmed on a wholesale plan, he was indeed a manufacturer; how is it possible for the average farmer, the man with a quarter section or less, to do away with useless labor and dispense with unnecessary hands; in other words, to reduce the cost of production and increase the output? Listen to the testimony of an Illinois farmer—one of the ordinary, garden - variety sort of every-day farmers — who quickly learned that one of the first things to do was to abandon the ways of his father, install labor-saving machinery and let George, in the form of a gasoline engine, do it.

The Dairymaid Did All the Milking Yesterday.

"My father used to feed cattle and he always shelled all the corn he fed, using self-feeders for the cattle. The cobs were used for fuel and they were very nice to start fires with. He used a two-hole corn sheller and an old eight-horse power, but used only two and four horses on it. On account of old age and not longer being able to run the farm, he retired from farm life and moved to town. The corn sheller and power were left on the old homestead, and I moved onto it and used them. Often when I wished to shell corn the track would be very muddy for the horses and the old power would run hard, as it was getting all out of line, and I decided to investigate gasoline engines.

"I was expecting to get about a three or four-horse power, but I secured prices on different sizes and ordered a seven-horse power. The factory sent a man to install and start it. I have been running the engine ever since, and have never had an expert or anyone else to examine it and it runs just fine. I run a four-hole corn sheller, feed grinder and two pumps; one is sixty rods and the other is 150 feet from the engine, and I can have water for my stock whenever I want it, wind or no wind. I grind a great deal of chicken feed in the spring for my neighbors and at the same time pump water for the stock, and what I charge for grinding helps pay for the gasoline, and a very small quantity of gasoline is required to do all the work. I would not do without the engine for almost any price if I could not get another.

"In 1905 I had a room built near the dwelling, secured a small two-horse power engine, and this runs the churn, washing machine, and the house pump from the well, which is forty-four feet deep, while I have a double-cylinder force pump and have hose handy, which in case of fire can be attached to the engine. My two smaller girls, eight and fourteen years of age, can start the engine, and Monday morning, while the engine is running the washing machine, my wife can sit and talk over the telephone, or in the rocking chair and read the news."

What this man accomplished with his gasoline engine, thousands upon thousands of other farmers are duplicating. The gasoline engine has proved itself one of the greatest factors in making every penny and minute and stroke count. Nor is it a hired man who eats his head off, for the fuel cost of running one is small, being only about one and one-half cents per horse power per hour,

MACHINERY IS SUPERSEDING THE FAIR MAID WITH THE PAIL.

when gasoline is bought for fifteen cents a gallon.

The gasoline engine has proved its utility; tomorrow bids fair to see the electric motor the farmer's best hired man. Already it is being hitched to a vast number of farm machines, such as feed grinders, root cutters, fodder cutters, fanning mills, grindstones, circular saws, corn shellers, drill presses, silage cutters and elevators, horse clippers, milking machines, grain separators, churns, vacuum cleaners, ice cream freezers, dough mixers, feed mixers and chicken hatchers.

A good idea of the amount of work a small motor will do on the farm is gained from the following: Six horse-power will drive a grain separator and thresh 2,500 bushels of oats in ten hours. Three horse-power furnishes all power needed to make 6,000 pounds of milk into cheese in one day. Six horse-power will run a feed mill grinding twenty bushels of corn an hour. Five horse-power grinds twenty-five to forty bushels of feed, or ten to twelve bushels of ear corn an hour. Seven horse-power drives an 18-inch separator, burr mill and corn cob crusher and corn sheller, grinding from twelve to fifteen bushels of good fine meal. Six horse-power will drive a 30-inch circular saw, sawing from fifty to seventy-five cords of stove wood from hard oak in ten hours. Six horse-power saws all the wood four men can pile in cords. Twelve horse-power will run a 16-inch cutter and blower, and elevate the ensilage into silo thirty feet high at the rate of seven tons per hour. One horse-power will pump water from a well of ordinary depth in sufficient quantity to supply an ordinary farmhouse and all the buildings with water for all the ordinary uses.

But the highest efficiency on the farm neither begins nor ends with the gasoline engine or the electric motor. There is also the spreader which takes the refuse of the barnyard out to the fields and scatters it about like so many gold dollars. The fertilizer problem is one of the most serious confronting the farmer today. Shall he open up his fields to the commercial article or shall he husband his own resources and maintain the fertility of the soil by returning to it the elements of which it was robbed in producing a crop? The answer is simple. A ton of average fresh manure contains ten pounds of nitrogen, five pounds of phosphoric acid, and ten pounds of potash. At the prices which these elements of plant food would cost in commercial fer-

WHERE AN EFFICIENT SYSTEM TREBLES THE CORN AVERAGE.

tilizers the value of manure would be $2.50 a ton. This does not take into account the value of the organic matter furnished, which may be greater than that of the plant food. That this theoretical valuation is very conservative is shown by the result of many field experiments, by various experiment stations and by practical farmers. The value as shown by the increased crops has equaled and often exceeded this theoretical valuation.

The Pennsylvania station conducted a series of experiments with manure for twenty-five years. A four year rotation of corn, oats, wheat and clover was used and manure applied at the rate of six tons an acre every two years. Its value in the increased yield was $2.50 a ton. The Illinois station found the value of manure applied six tons to the acre once in a three year rotation of corn, oats and clover to be $2.70 a ton. The Ohio station in a series of experiments extending over thirteen years found the value of manure to be from $3 to $4 a ton. Values, of course, as every one understands, vary with the character of the soil.

None of these experiments mentioned, however, indicate the full value of the manure since they do not take into consideration its cumulative effect. The importance of this is shown by experiments at the Rothemstead Station in England. At this station one plot was given regular application of manure for twenty years and then the manuring discontinued for an equal length of time. At the end of the time the plot still gave nearly double the yields obtained from another plot similar in every way except that it had never been manured.

An experiment conducted in Jasper county, Missouri, resulted in an acre which had been treated with eight tons of manure yielding sixty-five bushels of corn, while an acre immediately adjoining—which had not been treated with natural fertilizer—yielding only twenty-nine and a half bushels. Experiments conducted at Columbia, in the same state, resulted as follows: A tract on which corn had been grown continuously for twenty years yielded only three bushels to the acre. Immediately adjoining, a tract planted to corn for twenty years, but which had been liberally manured, yielded thirty bushels to the acre. Another tract, likewise adjoining, on which corn had been rotated with oats and clover yielded forty-nine bushels to the acre. Still a fourth tract, immediately adjoining, on which scientific management had been practiced to the extent of both rotating crops and manuring the field, yielded sixty bushels to the acre. Even more striking proof of the value of fertilizers and rotation of crops comes from Illinois. Sixty years ago a man bought a farm of 120 acres in that state. It has remained in his possession continuously. He has farmed it without plan or purpose other than to eke out a precarious livelihood. The land formerly yielded thirty-five bushels of wheat to the acre. It has been planted to wheat, year after year, for half a century. Last year it yielded two bushels to the acre. The last corn crop on that land ran ten bushels to the acre, while in the neighbor's field the yield averaged forty bushels to the acre. That Illinois farmer is a pitiable reminder of the days when farming was not a science, but was simply an "In God we trust" way of getting from the cradle to the grave. That man never heard or heeded the doctrine preached by James J. Hill: "You can no more take wheat from the soil continuously than you can take money out of a bank without making deposits."

Fertilizer Is Spread with Improved Machinery.

The farmer who makes use of the barnyard manure must learn first of all to use this fertilizer when it is of the greatest value. Manure exposed for three months in an open barnyard during the winter and early spring loses nearly one-third of its fertilizing value. Such manure in field experiments produced increase to the value of \$2.15 a ton on a ten-year average, while the fresh manure gave an average increase of \$2.96 for the same period, showing a loss in effectiveness of 81 cents per ton or 27 per cent. There are seasons of the year, however, when it is impossible or impractical to haul direct to the field. In such times it is the farmer who most effectively conserves this important fertilizer who finds his income and net profits the largest. A Nebraska farmer thus tells how he proceeds: "I have on my farm a building especially constructed for the storing of manure during the winter when I am compelled to hold it for some months. This building is large enough to hold the accumulations for several months, which amount to several tons. It is built a reasonable distance from the barn, so as not to be unhandy. I haul manure to

No More of This.

PICTURESQUE, BUT SENTIMENT CANNOT MEET MODERN COMPETITIVE METHODS.

the field where I think it is most needed until the ground gets soft, so I am bound to stop, and then I have a carrier track running from the barn to my manure house, to save the labor of handling. I run the manure every few days from the stables to the storage house, which is covered with a good roof to keep the rain and snow out. In hauling direct from the barn I also mix some other fertilizing material, such as rich dirt, hen manure or anything I can gather up around my farm, so as to have a well balanced fertilizer for all crops. I have the storage house built on a slightly rolling place with a reservoir dug in the ground on the lower side to catch all the liquid manure that runs out, to keep it from being wasted in washing away. This liquid is pumped directly back into the heap, thus keeping the heap moist, and in case the liquid is not sufficient to keep the heap moist, I sprinkle a little water on to keep it so. It is very important that this manure be kept packed firmly all of the time to exclude the air, and in order to do this I have it so arranged that I can turn a bunch of heavy hogs in when I so desire, to gather up any waste grains that may be in the manure and in so doing they pack it very firmly and nicely."

Such labor and thoroughness pay well. Take the state of Iowa, for instance, with its annual approximate production of 340,000,000 bushels of corn, 140,000,000 bushels of oats and 6,000,000 bushels of wheat. Until the past few years the Iowa farmer did not stop to consider that in the production of these crops the soil had given up approximately 650,000,000 pounds of nitrogen, 10,000,000 pounds of phosphorus and 345,000,000 pounds of potassium, which if purchased in the commercial form at the current prices would cost about $130,000,000, or in other words practically the annual value of the entire crop of the state. It is since the Iowa farmer has figured this out—sometimes, it must be admitted, after a personal loss—that he has taken more extensively to live stock farming, rather than grain farming, and the silo has come to dot the hills and valleys. "If I had to take my choice between a corn crib, a barn or a silo and could have only the one, I would choose the silo," preached the experts on the dairy trains which traversed Iowa and the Missouri Ozarks last spring. When they went on to show that to husk corn and bring it into the crib results in only sixty per cent of the feeding value of the corn being secured, leaving forty per

Mowing by Machinery Is the Rule Today.

the center of the driveway answering for a turn around. The drive and the road in front were made of crushed limestone with a sifted dust finish, suggesting good roads and the importance of a driveway, which, by the way, should be the foundation of any lawn. The driveway connected with the steps from the front porch and also the side porch, the barn and the sheds, cellar door and engine house, suggesting convenience for chores and the saving of time and steps in the day's round on the farm.

In the vegetable garden south of the barn were located the hot-bed and cold frame; west of the barn, the barn lot with water trough and north of the barn the pig pen and the pig trough. Both poultry yard and pig pen connected with the barn lot and the pasture. North of the pasture and extending across the farm was a field, suggesting a combination of field crops, planting first corn with cowpeas in the middle of corn rows when the corn is laid by and after cutting the corn, the cowpeas to be pulled or used as pasture. East of the pasture and next to this field was located the apple orchard and a patch of alfalfa. The peach orchard was placed north of the poultry yard, and on the east side of the apple orchard were placed consecutively the blackberries, raspberries, Irish potatoes and sweet corn, sweet potatoes, watermelons, strawberries and asparagus, then blending the horse-radish with peonies, german iris, phlox, hollyhocks, etc., locating the currants and gooseberries in the border of the shrubs ornamenting the lawn.

cent in the field, while using ensilage saves all the feeding value, their logic became plain. As a result of those trips thousands of silos are being built.

There is every bit as important a lesson in the proper disposition of space so as to insure the maximum of crops at the minimum of labor and expense. It was to teach this lesson that a model farm was exhibited last fall at the Missouri land congress at Springfield, the Missouri state fair at Sedalia and the Industrial land congress at Little Rock, Arkansas. This model was constructed on a scale of three feet to the inch and was built on a table ten feet wide and twenty feet long. It was inspected by thousands of farmers who learned from it the lesson of conserving space and making every stroke count by minimizing waste of time in moving from one field to another.

On display, the model had a south front and the house was located to represent eight feet from the front and ninety feet from the east line; the barn one hundred feet from the front and on a line seventy-five feet west of the house. The drive was located to begin forty feet from the east line and was laid on easy curves, passing by the house and leading to the barn, a clump of lilacs in

Taken as a whole the model suggested to the farmer the importance of a plan for making his fields dovetail together. It was a vivid reminder to him that houses are too often merely stuck here and there and that other buildings are located more often than otherwise by chance or guesswork. It illustrated the advantage of using every foot of space to produce something for the comfort, convenience, and profit of the owners. The cherry and apricot trees on the lawn, plum trees in the poultry yard, pear trees at the end of the truck rows, horse-radish in a corner, a clump of sage tucked in here, a little bunch of mint there, dewberries along the fence, all of these features combined to impress the fact that it is not so much the size of the farm which counts at the end of the season as the proper cultivation of the land itself.


THESE HAPPY-GO-LUCKY PLOWING DAYS ARE NO MORE.

Second only to the importance of arranging the crops so as to minimize labor is the importance of securing the most efficient labor and getting maximum results. In many respects, the labor problem is the most serious one confronting the farmer today. The unemployed drift in large numbers to the harvest fields but few have the adaptability or the experience to make good farm hands. The task is to find men who will not merely do but who will prove efficient workers and will remain on the farm. Good wages are paid, varying according to the sections of the country. But even then the farmers are not getting the worth of their money. One of the largest grain growers of the Northwest, Mr. J. H. McCroskey, who has 2,000 acres of Palouse Valley land in wheat, has found this out by experience. His observations are well worth hearing:

"System is the secret of success and of a balance in black ink instead of red," says Mr. McCroskey. "It's the little things saved that make the big amounts earned. Just for example. When using a number of binders, it is better to keep all of them at work together in the same field, as one man can oversee it all. The same applies to plowing or other farm operations. When a binder is stopped for repairs, even if only for five minutes, it is better to take it to one side and let the others go on with their work. It may be only five minutes' stop for the disabled machine, but it is a loss of fifty minutes if the other nine operating are kept waiting. Moreover, the binder which has been stopped for a few minutes can generally catch up with the others.

"It is better to have a head binder who has the best team and the best machine. This foreman may not be on his own machine more than half the time. He is looking after the others, and if any hitch occurs with some of the other binders, he changes places until things are working smoothly again. In the same way a head shocker will keep a lookout over the field generally, seeing that the teams of three men are lined up and work well together.

"During threshing time, the grower should watch the work. This applies to the quarter section farmer as well as to the bonanza rancher. In this way he can look after and frequently check wastes in the field and at the machine and judge the quality of work. Poor threshing may reduce the price of grain from one to two cents a bushel.

"It is of as much importance as any other thing that the farmer should do his work at the right time, and hire additional horses when needed. It costs but little more to hire than to own, but it does make a big difference in the crops if they are not put in, harvested and cared for at the right time."

Mr. McCroskey is a firm believer in

Plowing Is Now a Science.

Frisco railroad system, in his address at the 1910 meeting of the Farmers Union in St. Louis, when he said: "The Florida farmer receives $2.50 for a bushel of green beans, the railroad gets fifty cents for the 800-mile haul to New York and the consumer pays $6.40 for this same bushel of beans. There is thirty-five per cent for the grower, eight per cent for the carrier and fifty-seven per cent for the dealer. This is not a fair division. Thirty cents a dozen was the average price of eggs in New York last year, while the farmers of Arkansas and Missouri received fifteen cents. The freight was two cents a dozen. The men who receive the eggs at a freight station in New York and deliver them to the consumer take fifteen cents a dozen profit. The rice farmer of Texas, Louisiana and Arkansas gets two and one-half cents a pound for the grain, and the consumer in New York pays ten cents a pound for this rice. The freight is one and one-half cents a pound. If the rice farmer were paid three and one-half cents—one cent more than he is now getting—and the dealer took one cent profit—which is twenty-five per cent—the New York consumer would get twenty pounds of rice for $1, instead of ten pounds, as now."

paying good wages and keeping the same gang of men year after year. He is making a striking success of his wheat land, which yields him an annual return of 10.6 per cent on a valuation of $170,000.

Having arranged his land to the best advantage, seen that it is fertilized and cultivated so that the largest possible crops will result and having harvested these crops in the most thorough manner, the problem confronting the farmer is that of marketing. Alone among the leading workers of the world he has no permanent, effective organization. He sells his goods at the prices made by the buyer. And yet this need not be, although most of the plans to prevent it have failed. There is no disputing that the farmer is not receiving his just share of the price which the ultimate consumer pays. This was strikingly illustrated by Mr. B. F. Yoakum, chairman of the

On the platform at that convention was a chart showing the division of profits on a five cent loaf of bread. According to this chart the wheat grower receives one and one-half cents out of each nickel, the baker two cents and the retail dealer one cent. Now what must the farmer do to make his receipts more nearly commensurate with his investment, his work and his risk? Up to date the most satisfactory plan has been co-operation. Yet the absolutely successful co-operative plan has never yet been worked out. The reason is found in the

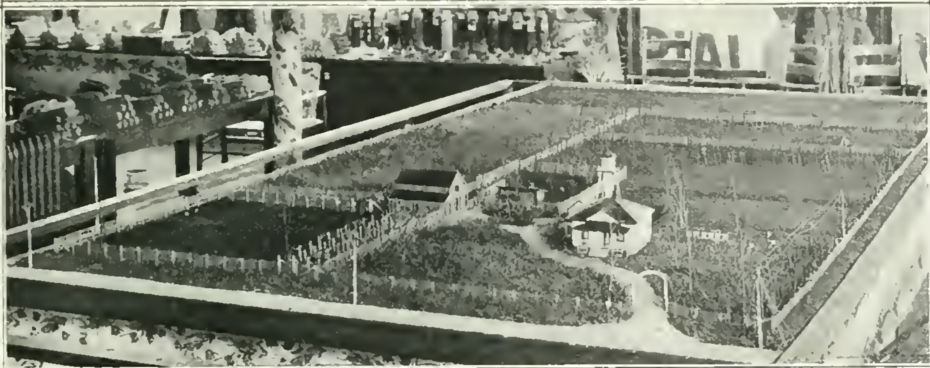
The Successful Farmer Lives in a Modern, "City-Looking" Dwelling.

Such Farm Homes as This Are Comparatively Rare Nowadays.

frailty of human nature. One of the most practical addresses delivered before the St. Louis convention of the Farmers Union was that of John A. Miller, president of the Missouri State Union, who narrated his experiences in organizing the farmers of his community. He stated that when corn was selling on the St. Louis market at fifty-two cents per bushel, the commission men in his home town offered but forty-three cents per bushel. Mr. Miller believed that if the farmers would co-operate, they could name their own price and materially benefit themselves. To this end he secured the agreement of half a dozen farmers to withhold from the market 10,000 bushels of corn until the local commission men paid approximately the St. Louis market price. Two days after this agreement was entered into, the commission men raised their offer from forty-three to fifty cents per bushel, within two cents of the St. Louis price, and Mr. Miller and his associates accepted the offer and disposed of their 10,000 bushels at an increase of $700 for this one instance of the organization.

Mr. Miller confessed, however, that his tentative efforts to better the farmers' condition and to raise the price of corn fell flat because of the farmers withdrawing from their agreement. It had been decided to pool their corn again and 15,000 bushels were put into the pool. Before a price for the entire lot could be arranged, however, several of the farmers who had agreed to stand together individually sold their corn for fifty and one-quarter cents per bushel, making an increased profit of only twenty-five cents per hundred bushels and disarranging the pool and violating their agreement. Mr. Miller admitted that all efforts to organize and co-operate would fail as this plan failed if the farmers would not resolve to stand by their contracts and to sink or swim together.

All these things, and more, too, are necessary if the highest efficiency possible on the farm is to be achieved. The farmer who fails to realize that he must discard the ways of his fathers, study day and night and adopt every system and scheme for making every penny, every stroke and every seed count is dropping behind in the procession. Mark Twain once declared that he was the only farmer in Connecticut who could make two blades of grass grow where three had grown before. Over against him is the efficient farmer who is mak-



TEACHING THE LESSON OF OBSERVING SPACE AND SYSTEMATIC ARRANGEMENT OF CROPS.
A model farm exhibited at the Missouri state fair.

ing three blades of grass, three ears of corn, grow where but one had grown before. Efficiency is the thing that is making the farmer the autombile buyer, modernizing his farm home, sending his son and daughter to college and increasing his bank account. Men may come and men may go but the efficient system will go on forever. David Rankin passed away, but other men are making fortunes carrying out his plans. These men are the prophets of agricultural efficiency whose works are opening the eyes of the world, with the result that system is supplanting luck and continued prosperity is taking the place of haphazard livelihood.

Dinner Pail Philosophy

¶ He means well—is an obituary.

¶ Greed is the mother of credulity.

¶ Timidity saves a lot of reputations.

¶ Most of what passes for morality is hypocrisy.

¶ No really honest man is vain about his honesty.

¶ Some friends are a lot harder to stand than prosperity.

¶ Nothing else inspires so much confidence as independence.

NEW PICK-UP FOR MAIL POUCHES

By H. M. MERTON

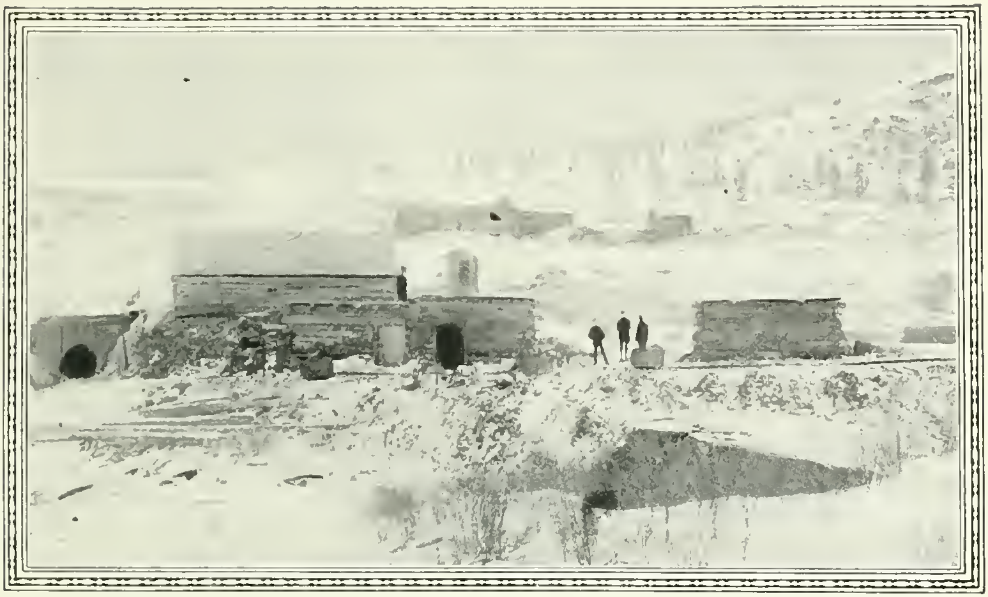
IF you have ever watched the process of catching the mail by the present method at a station in a small town you have probably noticed that the mail clerk on the train has an iron hook fastened to the side of the car with which he grasps the pouch in passing. If the hook fails to catch the pouch, as it often does, the pouch is ground to pieces beneath the wheels of the train. A traveling salesman by the name of Albert Hupp has found a better way. He was quite incredulous when the government officials told him that improvement was impossible, and has now demonstrated to their satisfaction that his mail exchange system is a success.

The Receiving Arm Taking the Pouches from the Cranes.

The following parts comprise the complete system: Two receiving arms, one on either side of the mail car attached to the side of the door through which the mail is received; a truck for carrying the mail, operating between the car doors, so as to deliver its contents on either side of the track; three tripping devices, which start the mechanism as the train approaches the station and leaves it; and station cranes provided with spring clamp arms to hold the pouches.

At the point where the mail is to be delivered a guard rail twelve inches high is placed along the track to prevent pouches, once dropped, being drawn by suction beneath the wheels of passing trains.

The mechanism upon the car operates as follows: A worm gear attached to the middle of the axle of the mail car runs a driving shaft which operates a counter shaft provided with a clutch. This clutch throws the mechanism into gear when the car comes into contact with one of the trips located at the track side. The mechanism makes one revolution and then throws itself out of gear automatically. The first quarter turn rings a gong in the car to notify the mail clerks that the exchange is about to be made, and opens the car door; the second quarter turn pushes out the delivery truck until it dumps the mail and opens the receiving arm; the third quarter holds the truck in position, while it dumps, and the receiving arm in position until the station cranes are passed and the mail upon them conducted into the car; the fourth quarter pulls the delivery truck back into the car, folds the receiving arms, and closes the door. This completes the operation and the mechanism remains out of gear until tripped at another station.



WINTER CAMP OF THE PIPE BUILDERS, SHOWING TUNNEL ENTRANCE.

THE STRONGEST PIPE IN THE WORLD

By

GLENN MARSTON

IF you ever go to Colorado Springs to see Pike's Peak, you will notice a long yellow scar running from top to bottom of one of the foot hills, and if you have any curiosity as to its cause, you will be told that it contains the strongest steel pipe ever made for the daily conveyance of water. Further inquiry will develop the information that this pipe contains city water for Colorado Springs, and that the water is used to light the city, operate the street railways, print the newspapers, and perform a hundred other duties before it is finally used to quench the thirst of tourists and common people.

This piece of pipe holds more world's records than any other pipe in the world, and is the property of the Pike's Peak Hydro Electric Company. It shows not only the great benefits which result from the development of a water power but also the dangers which attend such an undertaking. The history of the undertaking is a succession of misfortunes which were overcome only by endless perseverance and unlimited confidence in the final success of the enterprise on the part of George W. Taff, organizer of the company.

The project was conceived in failure and carried out only after overcoming uncounted legal and engineering obstacles. The fight made for its existence, the attempts to invalidate the franchise, the ludicrous effort on the part of Colorado Springs to force the company to replace its street lamps with obsolete arcs because the franchise specified the old style lamp—these are interesting phases of the company's development, but they pale into insignificance in comparison with the endless fight against Nature which demanded every resource of the most ingenious engineers of the country.

In the beginning—some eleven or twelve years ago—there was no thought of turning the water which tumbled down the sides of Pike's Peak into power. At that time Colorado Springs found its water supply—fed from the melting snows of the mountains—growing short. The water laws of Colorado are peculiar and are based on the theory of "first come, first served." For example, the great Roby Ranch, just below Colorado Springs, has the oldest water rights in the state, and has a right to its sixty cubic feet a second before the city can touch the water.

All the water rights on the east slope of the mountains were taken up, but on the west side untold quantities were going to waste. The city secured rights for this water, and then was confronted with the problem of getting it across the Peak. A tunnel had to be dug through the Peak, and the contract was let to George W. Jackson and associates, of Chicago.

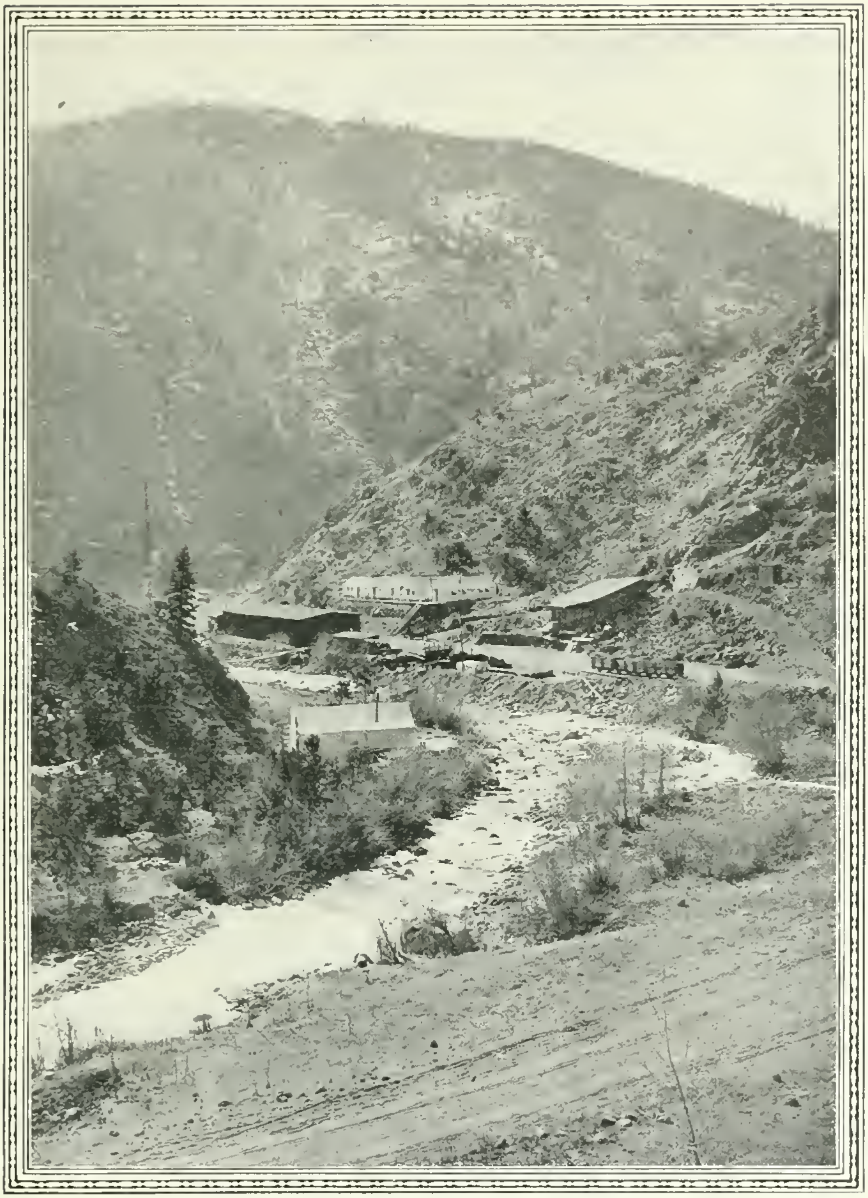
Then trouble began. Famous the world over as a tunnel builder, Jackson had not had his mettle tried as in this job. No tunnel had ever been built under such circumstances, and it is not surprising that the contract price failed to cover the cost of construction. Long before the tunnel was completed the money for the purpose was used up. Jackson could have thrown up his contract, and ended this story right here had he wished. But he was a man to see money in impossibilities. It seemed visionary, it might never amount to anything—the chances were that way, and he looked down upon a railroad right of way along the foothills which had never seen a rail, and never would, on account of over ambitious dreaming—but he agreed to complete the tunnel if the city would give him the right to use the water which came through the tunnel for the purpose of generating power.

There was much haggling, and the council dreamed impossibilities too, but finally gave Jackson the right for twenty-five years provided there should be no pollution or waste of water, the city to be the sole judge of both. And so the tunnel was finished.

Starting almost two and a half miles above sea level, the tunnel burrowed a mile and a third through solid granite. There were no roads, so roads—or more properly trails, for there was no room for roads—were built. The only means of transportation was by burro-back. A camp had to be established on the mountain top. The workmen had to be bundled up in fur lined clothes and ear muffs, and their labor thereby delayed. The average temperature was four degrees above zero. Water dripped from the tunnel roof and froze on the workmen's clothes. The alternation of hard and soft spots in the granite was to be expected and the broken drills and wrecked compressors which resulted were merely a part of the day's work.

Engineers and Some of the Workmen Who Were Instrumental in Constructing the "Strongest Pipe."

Then Jackson began to plan for the big power project he had in mind.



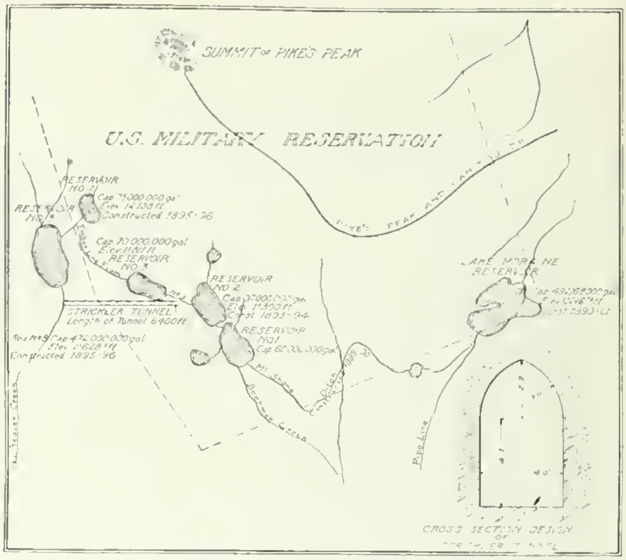
ONE OF THE CAMPS OF THE PIPE LAYERS.

He went to the bankers. "Show us" was all they said. He went back to his figuring. Pipe of sufficient strength could be manufactured, but could it be put up? The whole scheme was theoretically possible, but was it practical? Time went on, and Jackson got nowhere with his power scheme. "Let somebody else try it," said the bankers. And so the franchise was sold to the Pikes Peak Hydro-Electric Company, of which George W. Taff was President and Engineer.

Taff went through, the same heart-breaking experiences which had been suffered by Jackson. But he planned his project to the minutest detail. He began where Jackson stopped. Jackson had brought the water through the mountain.

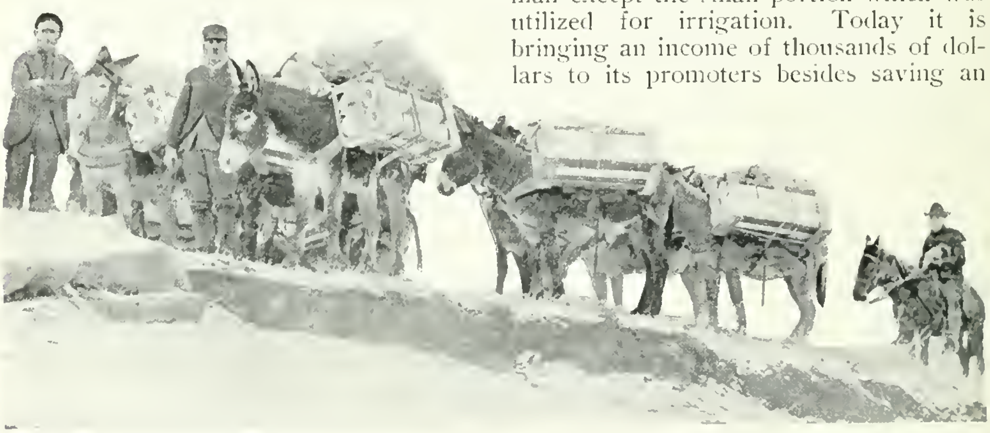
Taff's task was to get it down the mountain—to get it down harnessed and ready for work. Between Jackson's tunnel and Taff's pipe line were reservoirs with a capacity of twenty-three and a half billion gallons. Taff's problem was to drop this a straight half mile and not let it get away from him at the bottom.

He started at the top and worked down, contrary to the usual custom of the successful man. But Taff came so close to being unsuccessful so many times that his inverted plan of action may be forgiven. He devised a method of erecting his pipe line without roads or trails—by using the air instead. He put hand rails and cables where they could be grasped by workmen who could not find a footing on the precipitous mountain side. He showed how a pipe could be constructed that would not fail under twice the pressure to be put upon it, and designed relief valves which would open at 11,000, 12,000, and 13,000 pounds respectively. He planned a cushion against which this tremendous force could beat itself impotently and inexpensively when it was not needed to turn his wheels. After he had done all this, he went to the bankers again—and got the money. Six years after the franchise was granted, the power was turned on—one year of labor, five years of brains.



TOPOGRAPHICAL MAP OF PIKE'S PEAK AND THE STRICKLER TUNNEL.
This tunnel, constructed for Colorado Springs, is 6,400 feet in length. It was driven through close-grained granite rock.

The principal interest in the plant of the Pikes Peak Hydro-Electric Company centers around the high pressure pipe which conducts the water from the mountain top to the wheels below. The water which flows through this pipe was formerly of no use. Before the construction of the high level tunnel this water simply ran down the western slope of Pike's Peak and was of no benefit to man except the small portion which was utilized for irrigation. Today it is bringing an income of thousands of dollars to its promoters besides saving an



TRANSPORTING ENGINEERING SUPPLIES BY BURRO UP PIKE'S PEAK.

PIKE'S PEAK, FROM WHICH COLORADO SPRINGS DRAWS ITS WATER SUPPLY.

even greater sum to the users of electricity in Colorado Springs.

As before stated, the project came into being through the excessive cost of the tunnel, but the difficulties of boring the tunnel were only a beginning. The water in the pressure pipe has a head of 2,417 feet at the wheels, giving a pressure of 940 pounds to the square inch. Some idea of the tremendous force of this stream may be gained when it is borne in mind that the ordinary pressure in fire hose is around fifty pounds. A fire hose would easily knock a man down, but not so a stream from this pipe. It wouldn't stop for that. It would simply cut a hole through him. He wouldn't have time to fall down.

The pipe itself is 4,775 feet long and 21 inches in diameter, giving an effective diameter of about twenty inches after making deductions for the retardation caused by rivet heads. It is constructed of ¾ inch plates of steel, rolled into tubular form. Each section of pipe was tested to a pressure of 2,000 pounds to the inch before it left the factory. The rivets were driven by a 100 ton hydraulic press.

One of the greatest difficulties encountered in manufacturing the pipe was that of preventing leaky joints. The pressure is so great that a pin hole leak would soon wear away the edges of the break and wreck the pipe. It was necessary, therefore, to pack the joints so that leakage could not occur. It was originally intended to make the gaskets of lead, but it was found that the pressure was too great, the lead pressing out to a thin film which was of no value whatever. After weeks of experimentation an alloy of lead and tin was found which served the purpose.

But the factory problems did not end the company's troubles. The pipe had to be laid up a rough mountain side so steep that workmen could not stand on the slope without holding to something, while there was no road or other means of transporting the heavy sections of pipe to their final position. It was first necessary to prepare a bed for the pipe, which was done by smoothing the surface of the mountain side, removing obstructing boulders, and digging trenches through the more prominent ridges.

An aerial cableway was constructed along the right of way and section after section of the pipe carried through the air to their proper resting places. Not only were the sections of pipe carried upon this tramway but also the workmen themselves. Where the trench for the pipe was cut through rock it was imbedded in concrete made from the decomposed granite taken out of the excavations. Where the pipe is exposed on the mountain side it is guyed to adjacent boulders or rock formations.

Scarcely less interesting than the pipe line is the power house at its foot. Snuggling in a cleft hewn out of solid rock stands a little one story building which looks for all the world like a garage, save that the entrance is a foot or two above ground level. Within you will see three iron shells and hear a roaring and splashing under foot. At one side there is a switchboard on which the attendant occasionally pulls some handle or turns a button. It is the quietest, most peaceful place imaginable, yet you are watching the creation of three thousand horsepower every instant you stand there. Each of the three shapeless heaps on the floor, which look like automobile wheels caked solid with mud represents a thousand horsepower.

The water wheels are of the well-known Pelton type, which some tourist said looked like a platter garnished with oyster shells. The "oyster shells" are set at right angles to the disc of the wheel. The water, at 940 pounds pressure, leaps from a nozzle and strikes the oyster shell with tremendous force, which is turned into electricity by a direct connected generator. Here again the builders were confronted with a new problem, that of controlling this rush of water so that the wheels would be kept constantly at 450 revolutions per minute. In the old forms of impulse water wheels the nozzles were provided with needles which regulated the flow of water.

No such method could be used here, for if the load on the generator were suddenly reduced and the flow of water cut off to equalize the lessened power demanded, the shock would burst the pipe line and wreck the whole plant. It is true, the nozzles are fitted with needles, but they are so governed that a nozzle cannot be shut off in less than twenty-five minutes, this reduction being so gradual that it has no serious effect on the pipe line.

But it would be impossible to allow twenty-five minutes to care for the usual fluctuations in electrical load. The solution was absurdly simple. The nozzles themselves were so made that they could be moved up and down. If the load was heavy they were raised so that the full force of the jet was exerted on the "oyster shells," or buckets, on the circumference of the wheel. When the load lightens the nozzle drops so that only a part of the jet strikes the buckets, the remainder passing on unused.

And then came the problem of stopping, or "baffling" the gigantic force of the jets. Ordinary masonry or iron would wear out in almost no time. The jets discharge, therefore, into a tank where they strike a water cushion of over forty feet before reaching the specially designed baffles on which their energy is finally expended. The baffles are made of cast iron, having a sharp edge which splits the jet and curves each half around so that its final energy is expended on the water in the tank again. Even with the resistance provided by the forty feet of water the baffles wear out frequently and have to be replaced. The jets plow great furrows in the surface of the water which gradually grow deeper until they collapse and a new furrow is started. This cycle goes on continuously.

COURTESY U. S. FOREST SERVICE.

A MOUNTAIN TOP SMASHED TO FRAGMENTS BY MANY STROKES OF LIGHTNING.

WATCHING FOR MOUNTAIN FIRES

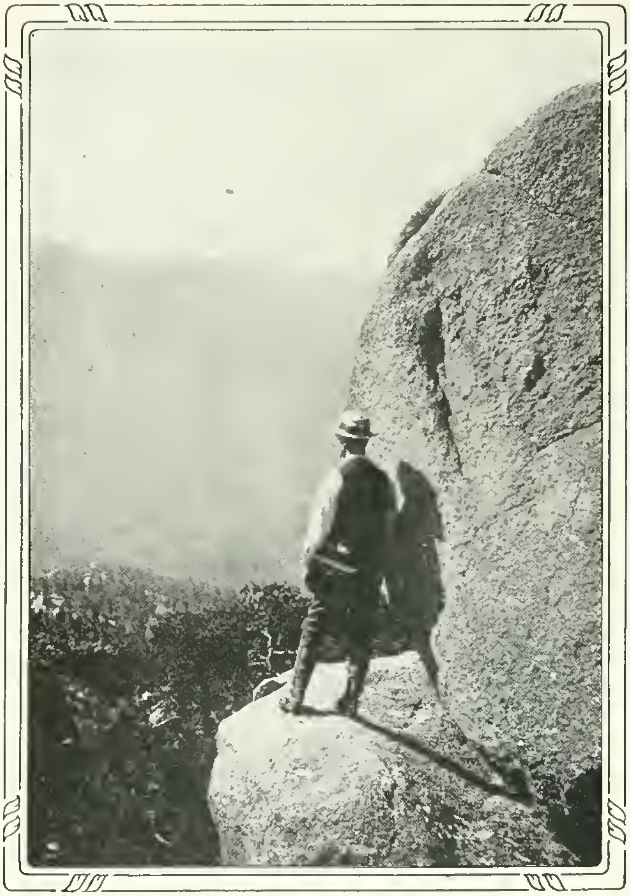
By

ROBERT FRANKLIN

IN the vast forest reserves of Montana and other parts of the Rocky Mountains, the most important duty of the Ranger is to watch for fires. Not very far from his cabin—where, very likely, he has a wife and children, with a stream close by to furnish water—there is a lofty eyrie, from which he is able to survey the country in all directions for hundreds of miles.

In that region fierce thunderstorms are frequent. They sweep over the mountains with great fuss and fury, discharging volleys of thunderbolts, which often set the woods in a flame. In fact, it is in this way that a great majority of the forest fires are started. Major Fenn, Supervisor of the Clearwater National Reserve, in eastern Idaho, while camping on a trail not many months ago, got up one morning after a storm, and saw five fires in as many different directions, which had been set by lightning. He escaped with his life only by riding as he says he never rode before, nor expects to ride again.

It is a very dry country, and the woods are like so much tinder, which a spark may ignite. The Ranger, from his post of outlook, on the top of a mountain that may be two miles high, locates the fires with the help of a field-glass, and "plots" them on a sketch chart of the surrounding region. Then, descending



COURTESY [illegible] FOREST SERVICE.

THE RANGER ON GUARD.

to his cabin, or to some other station of communication, he telephones to other guards of the forest—it may be over distances of fifty miles or more—and gives them warning of what he has observed. Of course, they likewise have been on the watch, and by such means the entire forest is covered by a complete fire alarm system.

The nerves of this intelligence system are the telephone wires which run in all directions through the forest—instruments, simply attached to trees, being so distributed that a Ranger can always put himself at brief notice in communication with other guards, to give information or to call for help. It is a matter of no little difficulty to keep the service always in first-rate running order, because falling trees, blown down by storms, are liable at any time to dislodge or break the wires.

When a fire has been located, the first thing requisite is to get as many men as possible to the spot, to fight it. But they must have food and other supplies, of course, which have to be fetched long distances over difficult trails. Formerly this was a very arduous matter, involving long delays, because a week might easily be consumed in transporting the provisions, etc., from the nearest source of supply to the scene of active operations; and meanwhile the fire burns on. The obstacle has been overcome to a great extent, however, by establishing, in various parts of the forest, depots, which are drawn upon in any emergency.

The method adopted in fighting a fire is usually not to attack it from the front, but to go at it from both ends, gradually narrowing in this way the width of its path until finally it is extinguished. For this purpose the most effective tool employed is the spade, by the help of which the flames, running through dry leaves and underbrush, are smothered to death. Sometimes the burning trees are felled. In a serious case, when practicable, resort is had to the expedient of "back-firing"—that is to say, starting a fire to burning in the direction of the conflagration that is already raging, and thus clearing a strip over which the flames are unable to pass. But it happens occasionally, when the thing is unskillfully done, that back-fires themselves spread with disastrous consequences.

The Forest Ranger who knows his business is a man of many aptitudes. He must be, to begin with, an experienced mountaineer and woodsman. It is a part of his work to control all grazing on the reservation, and so it is necessary that he shall be well acquainted with cattle and sheep, and also with forage plants. He must understand lumbering, and must be able to recognize the different species of trees. No tree is allowed to be cut until, with his axe, he has put his brand on it, below the point at which it is to be separated from the stump. The lumber buyer who, by accident or otherwise, cuts a tree that does not bear this brand, is obliged to pay double price for it.

COURTESY U. S. FOREST SERVICE.

THE RANGER KEEPS IN TOUCH WITH HEADQUARTERS BY MEANS OF THE FOREST TELEPHONE.

Immense quantities of lumber are sold annually from the national forests. Thus, for instance, a company may obtain permission to cut 50,000,000 board feet on one of the reserves. It is necessary that the cutting shall be done in such a way as to do no permanent harm to the forest. So many trees must be left for seed; young trees must not be touched, and enough large trees must be left to protect the smaller ones against destruction by wind. These and other matters must be considered by the Ranger when he marks the trees, and upon his skill and carefulness in this work depends the future of the forest—that is to say, the prospect of its reproducing and replacing what has been cut.

The forest trails were originally game trails. Naturally, these followed the lines of least resistance, avoiding the more inaccessible places, and the Indians of earlier days used them in lieu of roads, traveling in single file. They are still utilized for the same purpose by the guards of the forest—commonly running along the tops of mountains. But it is a part of the business of the Ranger to make other and better trails, in order that all parts of the forest may be easily reached, and in this laborious duty he is often obliged to employ the services of that formidable agent dynamite.

RESUSCITATING BY MEANS OF THE PULMOTOR.

NEW AID TO SAVE THE DYING

By

M. H. MUNGER

FOR the resuscitation of persons overcome by the inhalation of gases, drowning, or electric shock a device called the pulmotor, which enforces the act of breathing, has recently been invented.

A cylinder containing oxygen under a pressure of 125 atmospheres, a blowing and suction valve actuated by two accordion bellows, and a face mask, connected with the valve by rubber tubes, compose the apparatus.

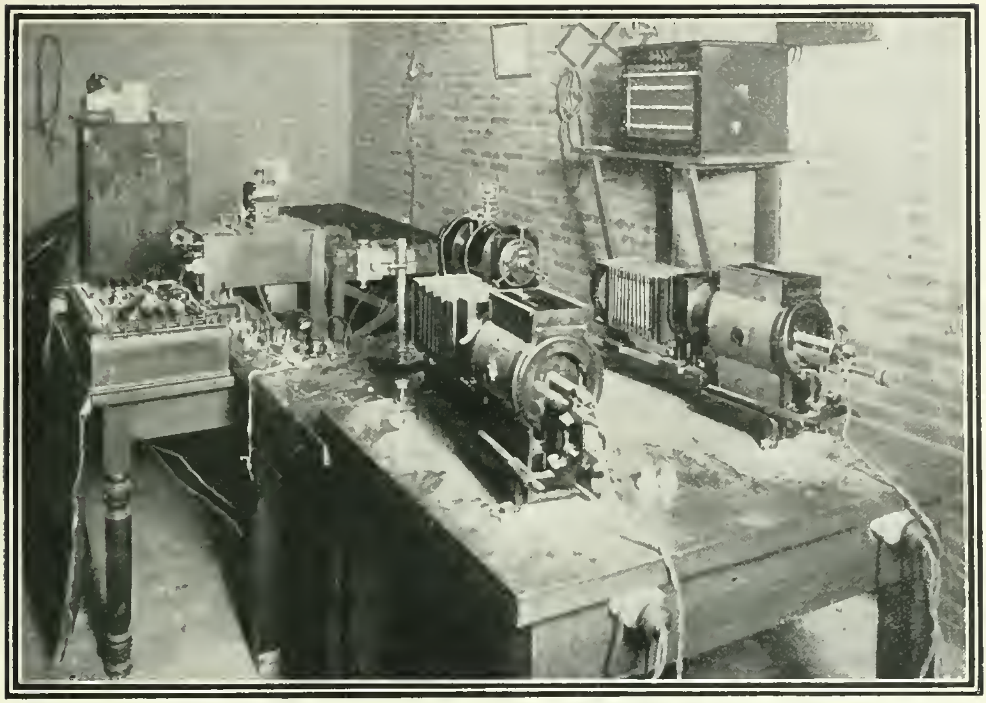
When the mask is made air-tight on the face, and the oxygen turned on the apparatus works automatically. Oxygen is forced into the lungs until a pressure of four inches, water gauge, is reached, which pressure is in connection with one of the accordion bellows, and, owing to its elongation, the pressure valve is turned and the oxygen in the lungs released. The suction valve immediately exhausts the lungs until a vacuum of four inches of water gauge is reached. This action elongates the second accordion bellows changing the position of the valve and allowing the oxygen again to be forced into the lungs. A lever is also provided to carry on this operation independently of the automatic device.

In the application of the pulmotor, the patient is placed upon his back and as the tongue naturally falls and with the soft palate closing the back of the throat it is necessary to grasp and hold the tongue forward with a pair of forceps in order to raise the soft palate and open the larynx.

As soon as the patient has sufficiently recovered to carry on breathing naturally an inhalation device is substituted for the mask and pulmotor. This contains about two liters of oxygen and is operated by hand.

The suction valve is so arranged that it indicates whether inhalation or exhalation is taking place, and a rubber bag may be attached which is filled or emptied according as the patient is inhaling or exhaling.

This apparatus is being used in connection with the mine rescue cars recently placed in service by the Federal government.



DETAILS OF A HEART STATION, SHOWING GALVANOMETER AND APPARATUS FOR MAKING ELECTROCARDIAGRAMS.

FINDING DISEASES BY TELEPHONE

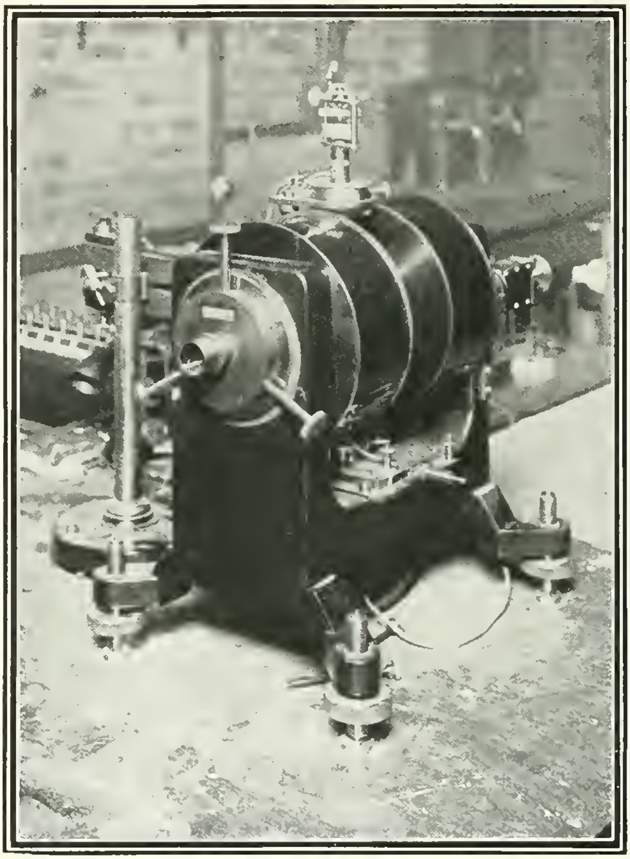
By

HENRY HALE

OUR hearts are the most vital portions of our bodies—that is why any suspicion that this organ is ailing causes more alarm than trouble with any other organ. Disease of the heart has so often caused death that this is why we fear any quickening or weakening of the pulse which is caused by the heart action literally pumping the blood through the tiny canals in the body called the arteries.

The physician examines the heart of a patient more often and more carefully than any other part of the body because he wants to make sure if it is healthy or diseased. Usually he makes his "diagnosis," as it is called in medical terms, by holding his ear closely to the part of the chest over the heart and listening to the heart action while he feels it. An instrument called a stethoscope is also used. It has an opening somewhat like a mouth piece of the telephone which is placed firmly upon the chest. From the upper end or neck of the mouthpiece extend two insulated rubber tubes which the doctor pushes into his ears. In this way he can get a better idea of heart condition as the movements are noted more plainly than by the ear unaided.

But an invention has at last been perfected by which the ear is no longer needed. This mechanism is so wonder-



DETAILED VIEW OF THE GALVANOMETER.

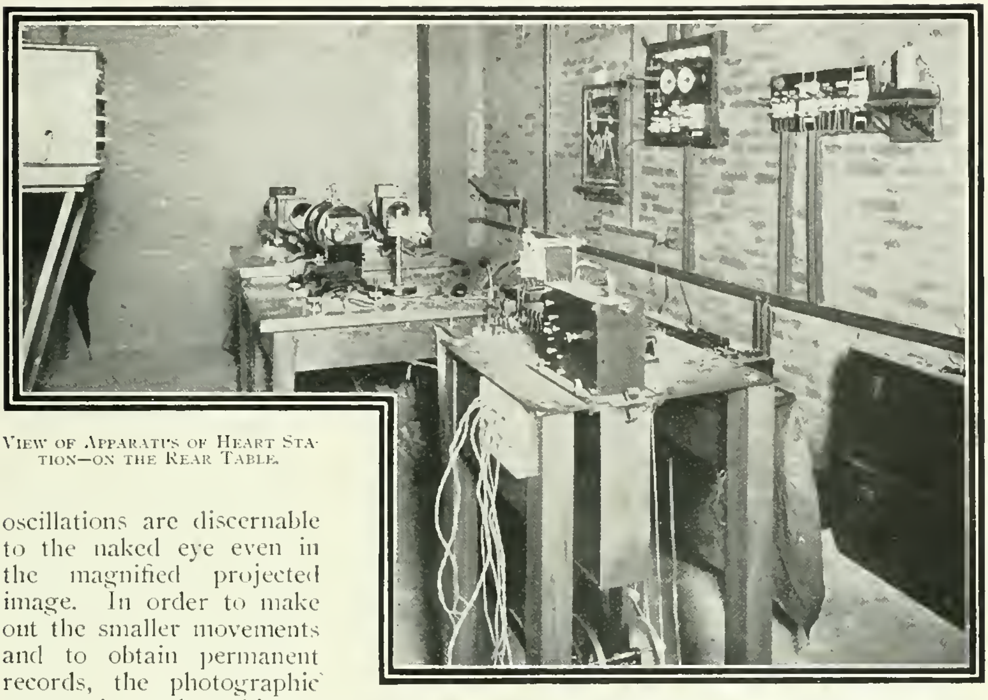
In the center space is suspended the delicate string or wire which oscillates by means of the current from the body. Projecting from the galvanometer is a powerful lens which transmits the vibrations of the string to the camera film, which revolves in a box to the right—not shown in the photograph.

the instrument in common use—the stethoscope.

The perfection of the "heart station" is clearly shown by the methods employed. The electric current—animal as well as artificial—comes into use in diagnosing and determining diseases in unseen organs and especially the heart. Credit should be given Einthoven, the noted Dutch physiologist who in 1903 at his Leyden laboratory devised the "string" galvanometer which is the most notable of the instruments installed, in the latest type of this instrument that has been placed in the Baltimore station. In most galvanometers the magnet is the movable part and the current to be measured passes through the stationary coils. In Einthoven's instrument an opposite arrangement has been made; the magnet is stationary and the current swings through a tiny thread or string — really fine wire. This movable conductor of the current is so minute that it is only 1/1250 of an inch in thickness. Two kinds of threads are used—either one of quartz, strange to say, coated with silver to make it conductive, or one of platinum. Through his microscopic lens the physician can actually see with the naked eye the oscillations which the thread receives from the heart of the patient actuated by the electric current generated in the human body. The rapidity of the string or thread movements and their extent as well as regularity or irregularity reveal the muscular action of the heart, although the patient as stated may be in a distant room.

Such is merely one of many scientific achievements of the heart station. But the manner in which pulsations are verified and recorded is as remarkable. When the string is oscillating to the currents of the human heart, only the larger

fully accurate that a physician may clearly hear the heart pulsations of a patient though he may be in the hospital ward or in a sick room a mile away. These "heart stations" are now in operation in two cities of the United States—New York and Baltimore. The instruments at Johns Hopkins Hospital in Baltimore are of the very latest design and differ in several features from the New York installation. Such thorough tests have been made of these "heart stations" that it is believed they will revolutionize the ordinary methods of examining patients to learn the condition of the heart. The system is far more thorough and gives extremely accurate results as compared with the tests of the human ear unaided or aided only by



View of Apparatus of Heart Station—on the Rear Table.

oscillations are discernable to the naked eye even in the magnified projected image. In order to make out the smaller movements and to obtain permanent records, the photographic camera is used, making a moving picture. The magnified image of the string is projected by means of a powerful electric light upon a slit in a dark box which contains a moving photographic film. The slit opens and shuts when required by electric signal, and the movement of the film can be begun or stopped at will. Ordinarily a film half the length of an ordinary kodak film will suffice for one observation, but a recording apparatus which will permit a photograph 250 feet in length to be taken without intermission, may be installed. Smaller portions of this long film may be used and clipped off for development if desired. On this film is actually a picture of the movement by a line that extends across it in a zigzag direction. It is like the series of the letter "M" made in angular form. This means that by the galvanometer and its auxiliaries, the heart conditions can be investigated in three different ways—by the eye, the ear, by the moving camera film, which makes an exact image of the motions, yet as stated the patient may be at a distance. In the examinations thus made the electricity in the body of a patient actually three miles away has revealed his condition to the physicians. These pictures are called by the scientist "electrocardiagrams."

In operation, the connection of the patient with the heart station is naturally of much importance so that the current he generates from the heart movement may be transmitted without loss if possible. The patient places left arm, left foot and right arm in three electrodes, which consist of zinc pans filled with normal salt solution eight

How the Patient Is Connected with the Heart Station.

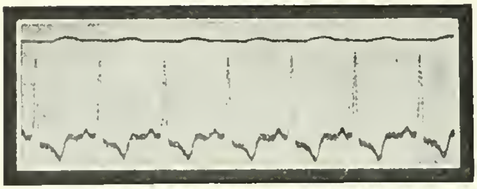
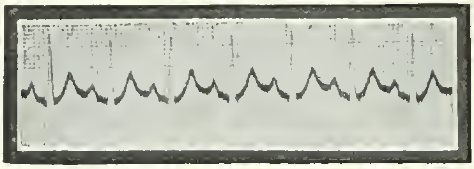
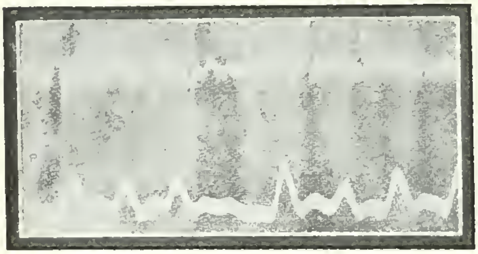


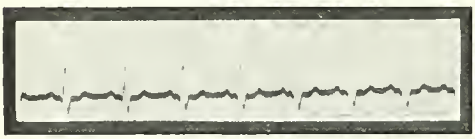
Diagram Showing Disease of the Ventricle of the Heart.



Curve with the Patient at Rest



Heart Pulsations of a Patient Suffering from Tachycardia.



Electrocardiagram Taken of a Patient During an Attack of Dyspnoea—Difficulty in Breathing.

grams to liter. From each of these, wires are conducted to three switches, by means of which any two of the electrodes can be connected to the main circuit. They are connected with a wire which is attached to the station galvanometer.

As to the distance that heart observations may be taken, at the present time it can be calculated but such is the delicacy of the apparatus that eventually a patient twenty miles or more away may thus be examined by the physician. This is not considered impossible by the experts. Here is where more advantages of the system are to be noted. Many patients are too ill to be removed from a hospital ward to the heart station Again in many instances apparatus can be set up in a physiological laboratory when one is not available in a hospital in the same town. To meet these requirements wires may be laid connecting various wards of the hospital with the heart station which is situated either in the hospital itself or in a physiological laboratory in the same town. Einthoven laid wires between the Leyden Hospital and his laboratory, a distance of one and a half miles, and took tracings in his laboratory from patients in the hospital wards. The main difficulty lies in the prevention of induced currents en route, but that such telecardiagrams—heart pulsation pictures—are feasible has been fully demonstrated.

What this instrumental investigation signifies in not only discovering disease but in determining the nature of the disease, is of the utmost importance as an aid to the medical profession. While the galvanometer, the photographic recorder and the auxiliary instruments in this country have given much information in connection with animals as well as human beings, the work in Germany has been far more extensive since more stations have been established. But the film, in America, has revealed the existence of such diseases as neurasthenia, tachycardia, hemorrhage, poisoning by such compounds as digital, strophantine, even the toxin which is a symptom of diphtheria. These are merely some of the causes which affect the heart current, each producing a different movement depicted on the film, has given a visible proof of disease, possibly unknown before. By filing the electrocardiagrams made of each patient also of animals which have been utilized for experiment, as comparison of the shapes of the zigzag lines or waves produced by the heart electric current has resulted in the discovery made that certain diseases produce certain heart pulsations. Thus a new way of locating and correctly defining physical ailment is opened by these mechanical recorders of the human body.

TWELVE ACRES PER DAY HARVESTED AT A COST OF LESS THAN ONE DOLLAR AN ACRE.

THE NEW IDAHO HARVESTER

By

J. W. LIEUALLEN

WHEN it is remembered that there are millions of acres of grain harvested each year throughout the world and that it costs from four to six dollars an acre to harvest it with binders, headers and threshers, it is at once apparent what an enormous saving there would be to the grain growing countries of the world, if this cost was reduced to less than one dollar an acre.

Out in Idaho a new machine has been invented for which is claimed the power to accomplish this wonderful revolution. It is neither a binder nor a header, nor a combination of header and threshing machine, but it is distinctly a new harvester, invented and built on principles which have not heretofore been applied, but which are now protected by patents.

The inventors, Cornelius Quesnell, a blacksmith, and Andrew M. Anderson, a wagon maker of Moscow, Idaho, within the past five years have perfected eleven distinct inventions which are combined in the construction of this wonderful machine called the "Idaho Harvester," the patents for which are owned by the manufacturing company.

This machine enables a farmer to take six horses and his sixteen-year-old son into his field and with one operation cut, thresh and sack his grain, with no more expense than it has ordinarily cost heretofore for binder twine, under the old methods of harvesting.

The inventors had the same experience

THE NEW HARVESTER AT WORK ON A HILLSIDE.
One of the wonders of this machine is that it does as perfect work on slanting as on level ground.

that many other inventors of great improvements have had to interest people. When their resources became exhausted in building models for experimental work, they interested Gainford P. Mix, a young farmer who had just graduated from the University of Idaho and who is the present manager of the manufacturing company. State Senator Jerome J. Day, a millionaire and one of the owners of the famous Hercules mine in the Coeur d'Alenes of Idaho and who owns extensive tracts of wheat lands in the Palouse country, also devoted much time and money to the perfecting of the Idaho Harvester.

Last year twenty-five machines were used all season and were distributed throughout Idaho, Oregon and Washington, for testing under most trying conditions, with the result that the most skeptical experts pronounced them to be a success in every way.

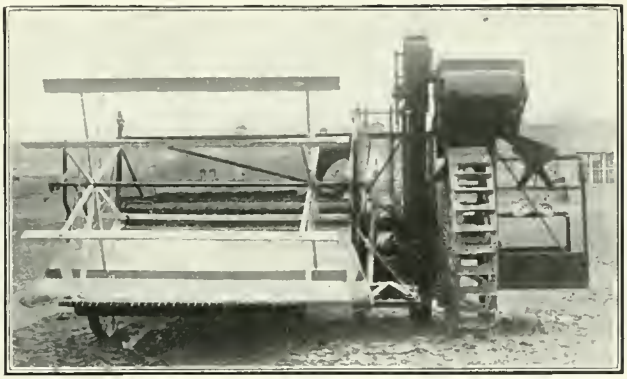
The Agriculture College Department of the University of Idaho gave the "Idaho Harvester" a tryout last fall for not only threshing wheat, oats and barley but also for threshing field peas and beans and pronounced it a success.

The scarcity and high price of labor at harvest time has always been a serious matter in the great grain producing sections of the West. Much of the trouble about help in harvest time and the enormous expense of threshing crews, twine bills, threshing bills, and the worry over many other expensive things are done away with by the use of the new machine.

The farmer will be as independent in harvest time as at any other period because he can reap what he sows with no increase of his usual force, saving, on an average, four dollars an acre in the cost of harvesting.

A farmer who has six head of horses with which to do his plowing, seeding and other farm work, can afterwards put his grain in the sack with the same help, and no more, unless perhaps an extra boy to sew the sacks as they are filled. One man and a boy can go into the field with an "Idaho" and cut, thresh and sack twelve to sixteen acres per day.

Numerous farmers who used an "Idaho" for the season 1910, say they saved the cost of a machine in the harvesting of two hundred and fifty acres of wheat, figuring forty bushels to the acre. Besides this they claim to have saved from two to four bushels more grain per acre than it has been possible for them to save by the methods commonly employed.



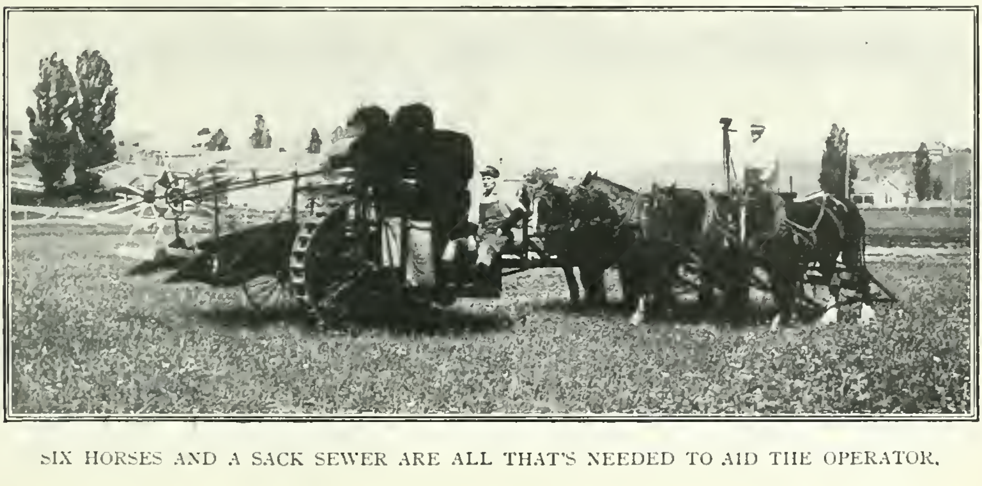
FRONT VIEW OF THE NEW HARVESTER.
The reel, sickle, sickle-drive, bull wheel, the elevator which carries the grain to the re-cleaner over the bull wheel, and the sack-sewer's platform to the right of the bull wheel and discharge pipes are shown.

It will be observed also that, in a cost of from seventy-five cents to one dollar per acre to put grain in the sack with an "Idaho," are figured good harvest wages for man, boy and six head of horses; otherwise all expense would be for oil and occasional repairs.

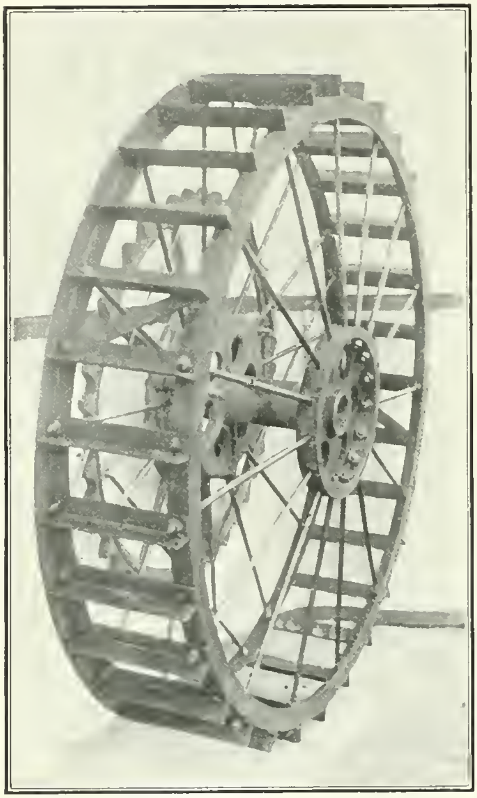
The aggregate of the possible saving, at an average of $5 per acre each year throughout the grain growing countries of the world, will amount to many millions of dollars.

The machine in action weighs 3,200 pounds and is constructed almost entirely of steel and iron castings with ball and roller bearings throughout.

The most important of the eleven patented devices, essential to the "Idaho" are: the "bull-wheel," the cylinder and concave, the corrugated teeth, the corrugated device preventing grain settling to one side of separator on hill sides, the automatic leveling device of the sickle bar and reel and the sickle drive. The bull-wheel is stoutly built of angle iron with open face, about five feet and ten inches in diameter and 18 inches across the face. It has iron rod spokes bolted into a heavy cast hub, on which is also bolted a large sprocket wheel, the chain on which operates the entire machinery for cutting and cleaning the grain. The outer rim of the bull-wheel has the angle turned outward so as to cut into the ground and prevent slipping on hillsides. The climbing bars of angle iron are bolted across the face of the wheel from rim to rim about ten inches apart. These cut into the ground and prevent



SIX HORSES AND A SACK SEWER ARE ALL THAT'S NEEDED TO AID THE OPERATOR.



The Open "Bull Wheel" of the Harvester.

slipping but do not injure the ground by packing as some other heavy solid surface wheels do.

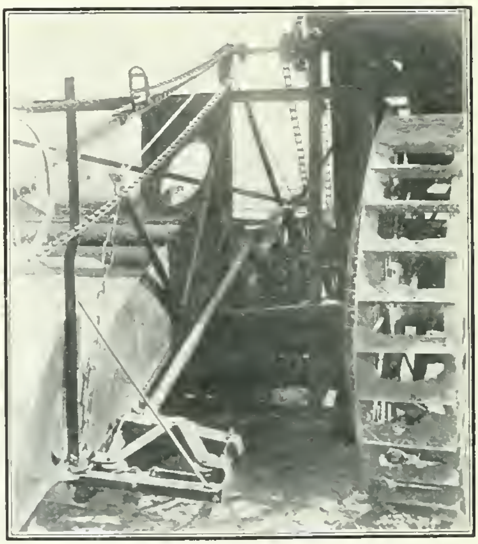
The cylinder and concave are the full length of the sickle bar—a feature never before patented. The cylinder is about nine inches in diameter, because of the corrugated teeth, with which it is studded. It does good threshing at six hundred revolutions and when run at twelve hundred does not crack the grain, making it more desirable for milling purposes as the flour is whiter.

The corrugated teeth are considered indispensable because they enable threshing to be successfully done whether the cylinder is geared to a high or low speed, so that the operation of the entire machine produces the same result at all times. These teeth in the cylinder have four corrugations on each side, giving somewhat the appearance of a washboard, except that the corrugations are deeper than in the humble household device. There are three corrugations on each tooth in the concave.

The grain pan and sieve are each corrugated like a washboard which prevents the grain from going to the lower side when operating on steep hillsides. The rattle-rake drags down over the pan and delivers the grain equally on the sieve. The sieve being also corrugated the grain is carried straight back, there being no chance for it to flush sidewise. The machine does excellent work on one-fourth pitch.

The sickle bar is always level, due to a patent device which operates automatically when the same is raised or lowered according to the height of the grain being cut. This is done with one movement of a lever by the driver without stopping the machine. The reel at all times is kept in its same relative position with the sickle bar, whether cutting high or low grain. Every head of grain too short to be bound with ordinary binders is saved by the "Idaho," even if the cutting apparatus has to be tipped down to the ground. The sickle bar remains level and no grain can drop off in front after being cut.

The sickle drive device is a walking-beam operated from an off center sprocket-wheel. It is so arranged that there is produced a steady pull both



View of the Walking Beam Sickle-Drive—in Lower Left-Hand Corner.

FACTORY AT MOSCOW, IDAHO, WHERE THE NEW HARVESTER IS MANUFACTURED.
The buildings are of concrete, stone and glass.

ways on the sickle. A ball-and-socket connection of the walking-beam and the driving-shaft operates to let the sickle bar be raised or lowered automatically.

This machine has a seven foot sickle, a seven foot cylinder and concave, a seven foot rattle-rake and a seven foot sieve. This being the width of the harvester. From sickle to cylinder is four feet six inches; from cylinder to rear of rattle-rake is also four feet and six inches. There are twelve and one-fourth square feet of sieve in the separator. The grain is then carried up to the recleaner where it passes through two sieves twenty by twenty-four inches each, making six and two-thirds square feet more of sieve, which gives a total of eighteen and eleven-twelfths square feet of sieve surface in the machine. The discharge pipe from which the grain runs into the sack hangs on the platform beside the separator where the sack-sewer sits. When one sack is filled the spout is automatically moved to another sack which fills while the first one is being sewed and rolled off the platform where it is out of the way of the machine.

Engineers have figured out that, with one revolution of the cylinder in the "Idaho," there are eight times as many threshing surfaces as in one revolution of the spiked tooth cylinder in an ordinary threshing machine and hence successful threshing at lower speed. The narrow surfaces of the corrugated teeth secure more effective threshing without the necessity of cracking grains as the flat sides of an ordinary spike tooth.

As the grain is cut it falls back onto the draper and is carried back to the cylinder just as evenly as it grows upon the ground. The cylinder being the same length as the sickle, the threshing is accomplished with but slight additional power over what it takes to operate the machine without the grain passing through it. A very different rule obtains in other styles of machines where large quantities of grain and straw must be fed through short cylinders which have to be keyed to high speed to separate the grain from the straw.

LOWERING A CONCRETE GIRDER.
A slip in work of this sort may precipitate the great weight upon pedestrians in the street below.

WRECKING A MODERN BUILDING

By

JOSEPH A. MASSAL

UNABLE to withstand the merciless blows of irresistible pneumatic hammers and drills and powerfully wielded sledges, the old home of The Baltimore News, a modern fireproof structure, built entirely of steel and concrete, recently crumbled and was demolished. Out of the ruins will rise a fine office building twenty stories high.

The destruction of the old home of The News was of great significance to the engineering and architectural world, because of its being the first building of concrete and steel to be torn down since the present-day methods of construction were adopted. Experts have watched closely the wrecking process, and observations were taken constantly upon the progress of the work.

The solid concrete parts, reinforced with steel and structural iron were cut by pneumatic drills as easily as though they were made of papier mache, and derricks lifted the huge crumbled and twisted portions of iron and concrete and lowered them to wagons which rapidly hauled them away to the scrapheap. For several weeks during the demolition of The News' old home thousands of interested spectators lined the sidewalks on News Square, and so congested the streets that time and again all traffic had to be abandoned. They gathered there to watch the wreckers—veritable daredevils—and marvel at the ingenuity displayed in rendering into junk what appeared to be an invulnerable structure.

And, had ordinary methods been employed to destroy it, it would have been invulnerable, for the walls, columns and girders were as if carved from solid rock. The whole mass was filled, too, with great sinews of steel—heavy rods linked by apparently inseparable bonds.

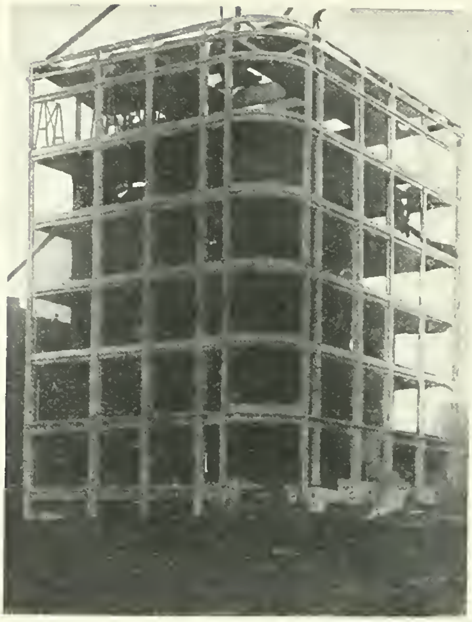
Experts as well as novices who learned that the structure was to be destroyed scouted the idea that it would be leveled to the ground within weeks.

The pneumatic drill and the blowpipe were called into service, and it was these that triumphed over the intermingled concrete and steel, and attracted the attention and wonder of the big crowds that gathered in the streets below and gazed up at the workers as they steadily mastered the tough old building.

The contract allowed ninety days for the work but after sixty days' work the big job was completed. Between seventy-five and one hundred men were engaged in tearing down the structure. Every day it was possible for greater speed to be made, although the beams and supports of the lower floors were heavier than those near the top. Closer to the ground the men relaxed the rigid precautions necessary near the top, where the slip of a rope or a misstep would have meant death or serious injury. Although everyone in the building trade recognizes that wrecking work is much more hazardous than even the highest kind of building construction, the work progressed without a single accident.

The new building is actually growing up under the wreck of the old. As a matter of fact the most interesting part of the work was the construction of the new building's foundation piers under the old building's foundation grill, which was partly removed by dynamite blasts.

CUTTING A GIRDER IN TWO WITH A BLOW PIPE.
The workman has a most limited space for footing.



SKELETON OF THE OLD NEWS BUILDING, BALTIMORE.
This photo was taken ten days after the work of demolition was begun. The reinforced girders, uprights and floors can be clearly seen.

The new foundations will be distinct from those of the old building and will go much deeper. Tons and tons of steel and concrete base were blasted out. Many men worked all day long preparing for the blasting, which was done between five and seven o'clock in the morning, and between the same hours in the evening. The old building extended two floors underground, with foundations going down still further. The lowest sub-basement of the new building will be thirty-six feet below, the superstructure twenty stories above, the street.

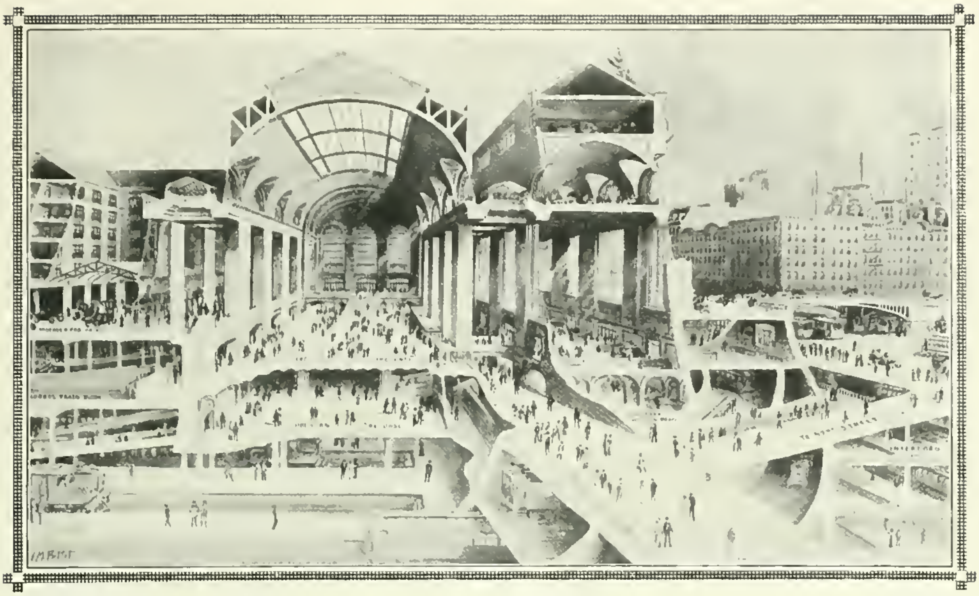
Many things were going on at once above ground. Every now and then a huge 2,000-pound pile driver was lifted six feet by the derrick and by means of a "snare" in the cable was dropped, with a sound like the crack of doom, on the concrete floors. When it struck it gave the whole building a jolt and made more noise than the dynamite. It was lifted again and again, smashing the crust of the floor at every drop.

A grating of iron reinforcing bars held together the floors that were broken up by the pile driver. Men then got at them with hammers and chisels and smashed the concrete through, leaving only the iron grating. Other methods were used in dealing with the heavy reinforced upright supports and horizontal beams. These were marked off into sections as big as the wagons could carry, and cut up.

A compressed air drill battered away the concrete, leaving the beams to rest on the iron reinforcing bars. Two electric air compressors were kept at work all the time supplying the air-power for these drills. After the concrete had been drilled away, men with "fire machines" got to work on the iron bars. To do this there was brought into operation the blowpipe, a highly developed form of the sometimes crude affair of the same name that youths become acquainted with in the high school laboratories. The wreckers' type of the blowpipe consists of a rather ordinary looking pipe connected by tubes with tanks of coal gas and oxygen. The gas is constantly flowing from the mouth of the pipe, and, being ignited, the flame, fanned by a high pressure of air, generates an intense heat.

First a part of the iron bar is heated with the coal-gas blast, and then, when the rod reaches the red heat stage the operator presses a button and, presto! there pours through the pipe and against the heated steel a strong current of oxygen. The effect of oxygen upon red-hot metal is to instantaneously burn it, and in almost the twinkling of an eye the stubborn metallic rod that would have defied almost any other means of destruction is worn clear through.

Two huge derricks were at work all the time, one in the corridor of the new building and one in the basement of the old building. The engineer never sees the movements of the derricks. All communication with him is by means of bells of two tones and by five different rings on each bell. In other words, he can be told several different things—start, stop, faster, slower, a little faster, a little slower, on each bell. These derricks have lifted as much as twenty-five tons. It is tremendously important to place a burden of this magnitude in the right place. Mixing signals might land twenty-five tons in the bed of a street with force enough to grind up the car tracks or anything else that might be hit.



SECTIONAL VIEW OF THE NEW GRAND CENTRAL TERMINAL STATION, NEW YORK CITY.

STATION WITHOUT STAIRWAYS

By

RICHARD H. MORRISON

IN building its new terminal station, which is to be the largest in the world, the New York Central Railroad is spending millions of dollars to save minutes of time for travelers moving to and from its trains. It is to be a station without stairways—the first building of its kind ever erected. In place of stairways there will be "ramps"—broad, gently sloping ways along which the rivers of human traffic will flow quickly and safely. These ramps were decided upon after months of study and the most severely practical tests, in which scores of experimental inclines were built and torn down, and in which all sorts of people, fat and lean, tall and short, old and young, all carrying a maximum of hand baggage, participated. The reports gathered from these experiments showed that a grade of eight feet in every hundred was scarcely noticeable. Whenever possible the grades are to be only three or four feet. When the new station is completed a passenger can get off a train at the lowest level and reach the street without mounting a single step.

The new terminal will have four levels where the old one had one. The gallery on the grade of Forty-second Street will be the top level. The next will be a concourse, which is on the level of the forty-two tracks that will handle the through trains. This will connect with the subway lines. On the third level will be the twenty-five tracks for the suburban trains, and underneath these will be subways for handling the inbound and outbound baggage. The terminal, which is to cover seventy acres, will be able to take care of 70,000 people in an hour, and will have a capacity of 1,150 cars. If necessary, as many as 200 trains an hour, all handled by electricity, can be sent out. The station building proper will be 600 feet on the street level, 300 feet wide and 105 feet high. Below the street level it will be 745 feet long, 480 feet wide and 45 feet deep.

The station will possess many other novel features never before incorporated in a building of this kind. For instance, there will be a great many small rooms, to be rented for a nominal sum, in which a man can change his clothes without hiring a room in a hotel. For women the same facilities are to be offered. Passengers will never need to go to the baggage rooms. When a person buys his ticket he passes on to the next counter, from which check and tickets are sent by pneumatic tube to the baggage room and returned, after checking, by the same means. Another innovation will be the "kissing gallery," a balcony in the incoming station, specially arranged for people who come to meet friends or relatives. It will have a sufficient elevation to give a perfect view of the doors through which travelers arrive. There are to be separate waiting rooms, ticket offices, entrances and exits for suburban and long-distance passengers so that they need never see each other or mix in coming and going. When trains come in and discharge their passengers, they will not back out, as they do now, but after being emptied will continue on around a loop and run over to the yards at one side below the street level, where they will be made ready for another trip. Thus all of the main tracks will be given over entirely to incoming and outgoing trains filled with passengers.

Instead of a single structure this new gateway to New York will be a group of magnificent buildings, for it is proposed to improve all of the space now occupied by the road's open yards. The cost of these improvements will approximate $180,000,000. All the machinery of the terminal, the signals, tracks and hundreds of trains, will never be seen from the streets. Perhaps the most wonderful thing about all this is that this work is being carried on without stopping or delaying for a moment the movement of nearly 2,000,000 passengers a month.

Ode to the Fly

Most injurious typhoid fly,
Drink with you no more will I.
When you settle on my cup,
I perchance bacteria sup;
After what I've seen today,
I would have you chased away.
I dislike those feet of thine,
What they've touched I shall decline.
Carrier of germ and spore,
Get thee hence! Return no more!
Spreader of disease, begone!
Kindly leave my food alone.

SHIP GAME FOR HOME PLAY

By

P. J. PRESTON

"DECK BILLIARDS" is a game that has been peculiar to ocean travel, but it may be made a diversion on land also.

The game can be played by two or more persons and is very simple to learn. The players take their stand at either end of a course, which can be the length of any space that is suitable for the purpose. At sea the available deck space usually settles the question of the length of the course.

The "court," at either end, is marked in squares, the squares being numbered from one to ten, with four spaces for ciphers. The game is played with flat wooden disks and the "cues" are used to push these disks along the course, the object being to place them on the highest numbers, carefully avoiding the spaces marked with the ciphers. If one player has left his disk snugly ensconced on a high number the opposing player who follows him tries so to shoot as to knock the preceding player's disk from

COUNTING THE SCORE.
The outcome of the game is computed from the figures on which the disks rest.

"Shooting" a Disk in a Home Game of Deck Billiards.

the space, at the same time doing it so skillfully as to leave his own disk in its place.

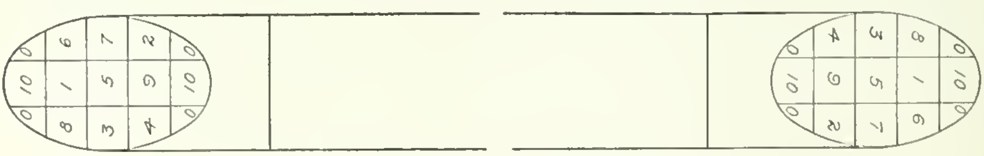
It will be found very easy to make the entire outfit for this game and the course can be marked out on any level place, a side path of the house, provided the path is paved, or a room that is long enough to give room for a satisfactory shot. The wooden disks, two for each player, can be made from the lumber of a soap box, or can be cut from any piece of wood that is smooth and firm enough to serve the purpose. It should not be too light or it will not "carry" when shot down the course, and the disks must be of about the same size and weight to make the contest fair to all the players. If no better tools are available the disks can be fashioned by drawing a circle with a pair of compasses and cutting out the circle with a small saw. After it has been cut to shape, the disk should be sandpapered perfectly smooth on both sides so that it will slide easily and any rough edges left by the saw should be smoothed out by the same means, so that on sides and edge the disk is quite smooth to the touch.

When the disks are finished the "cues" must be fashioned. They are made in various ways. The handle is a long pole which is taken in both hands, or in one, as the player prefers, and used to shoot the wooden disk along the course.

It is easy to make a set of "cues." The handles can be fashioned from old brooms, and if the forked ends are too complicated a piece of carpentry for the novice the forks can be omitted altogether and the wooden block that engages the disk when making a shot can be fastened to the handle by boring a hole and fitting the two together, as the handle of a hammer is fastened to the head.

It will probably be found just as much trouble to do this, however, as to make a forked end to the broom handle by nailing two pieces of wood to the end and fastening the wooden block between the forked ends. It can be seen from the photographs what a very simple matter the outfit is.

There is a deal of exercise in this game, the bending and shoulder movements necessary to the shooting being most beneficial, and as both sexes can play "deck billiards" it will be found



HOW THE COURSE FOR DECK BILLIARDS IS LAID OUT.
Disks are used, which must be shot so as to stop on one of the figures.

well worth the trouble of making an outfit and marking out a course.

The player's disk in the game of deck billiards is placed on a line three feet from the figure squares, and inside these, as shown in the photos where the player is about to "shoot."

The game can be played by four persons or two. When four are playing two are partners, opposing the other two. The partners do not take their places side by side at opposite ends, but one at either end, facing each other, so that opposing players shoot from the same side alternately until all the disks have been shot over the course. The opposing players at the other end then count the disks for their own partners and announce the result to the other side, it not being possible to tell accurately where the disks have landed when looking at them from the side from which they were shot.

When the count has been made and announced the disks are removed from the squares and the same disks returned to the opposite side by the shooting process. The number of disks used is eight, four to each of the two players who do the shooting. The first man to shoot sends one of his four disks over the course. Then the opponent who, as explained, is playing at the same end, sends his disk along, striving to knock the other man's disk off if it has been placed on a high number. The first player then shoots again and again his competitor, by his side, tries his luck and so on until all the eight disks have been sent over the course.

The partners of the two players, at the other end, watch the progress of the disks and count the total score, announcing it to the others. Then they gather up the disks and repeat the shooting from the opposite direction. The side first scoring fifty points wins the game.

There is no penalty if the disks are driven out of bounds. On shipboard the penalty is sometimes the loss of the disk, for the reason that a disk will occasionally turn on its side, assume the shape of a wheel and climb over the rail into the ocean. On land such a thing would not be possible and a bad shot simply brings its own penalty of no score.

There is nothing to correspond to "putting" on the golf green. The width of the course is the width of the checkered board on which the scoring figures are placed. If the disks are not kept within this space they will of course fail to score. The disks must be shot so as to stop on one of the figures. If they are shot so as to overshoot the figures or are sent wide so as not to pass over the scoring squares at all, obviously it is a bad shot and does not score.

An interesting complication is introduced into the game by the marking of one of the squares ten plus and the other ten minus. As both these squares are in line the player who tries to get on the coveted ten plus, which adds ten to the score is more than likely to shoot short and have his disk stop on ten minus, which causes him to lose ten from the score already made; so that when the total score is almost reached the player who accidentally gets on the ten minus square may be put back so far the other side wins.

ONE HUNDRED MILLIONS FOR CITY ROADS

By

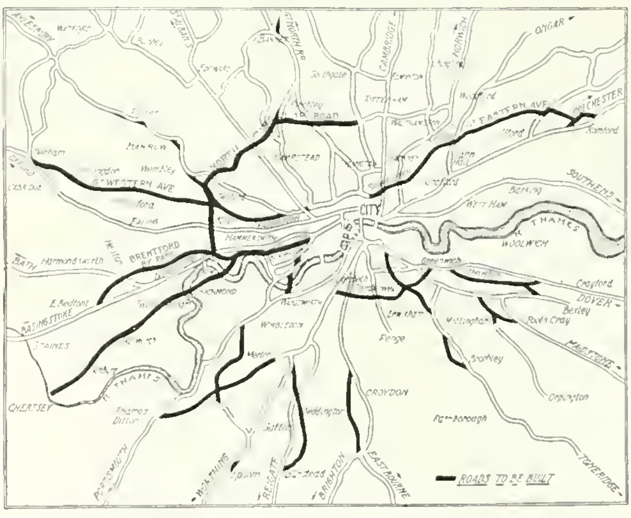
ARTHUR JOHNSON

THE vast problem of dealing with the ever growing traffic of London—the need of great transverse and circular arteries, the demand for access to existing and future "garden suburbs," the changes due to the motor vehicle and the tramway—is at last receiving the attention of the London Board of Trade authorities.

Sir Herbert Jekyll, Assistant Secretary of the Board, has prepared remarkable records and plans, which show that the demand for traveling facilities will sooner or later overtake the supply. Accordingly, it is urged, now is the time to start a great scheme of road improvement in and near London, so that town-planning schemes may be allied with it and the whole work be unified.

It is proposed to at once proceed with the building of over 100 miles of new roads, and also to improve over twenty-five miles of existing thoroughfares. In speaking of the expense, Sir Herbert Jekyll says: "It is difficult to see how the cost can be avoided if congestion is to be relieved and proper provision made for the future. Large as the expense may be, the cost of inaction is also heavy. The time lost daily by millions of people through insufficient road accommodation is alone equivalent to a very large loss of money.

"Every million spent at the present time would be a good investment." In fact, the report goes on to set forth in emphatic language how the cost, if the plan is put off for eight years, will be probably double what it is now. It is suggested that a central authority will have to be empowered to carry out the scheme.



Proposed New Roads Which Will Relieve the Heart of London of Its Congestion

There is a covert but powerful appeal to London patriotism. The example of Liverpool, London's greatest rival, is quoted to show both what a great city has done in the way of new roads and how the taxpayers have profited by forethought and central control.

The report anticipates that the great new roads will have a double track of tramway, and that there must be room for three lines of moving traffic on either side of the tramway, with further room for standing vehicles if there are shops in the road.

Therefore, main arterial roads must be from 100 to

WHAT THE NEW CIRCULAR BOUNDARY—OR "RING" ROAD—WOULD BE LIKE.

125 feet wide, first-class county roads 75 to 100, and second-class 50 to 75. It recommends, too, ornamental planting along parts of the roads and the selection of good sites for public monuments.

On the whole, the report shows conclusively that London is now tackling her traffic problems, so far as conveyances go, with energy and good sense. Twenty-three main roads radiate from Greater London into the surrounding country, including the Dover, the Brighton, the Bath, and the Great North roads. The scheme would provide means for making direct-approach roads into London, besides linking up the main routes, both old and new, with subsidiary ones. At the same time there is an official suggestion of a great circular road around London, a quarter of a mile in width and a ten-mile radius from Charing Cross, which would link up these radial roads.

GASOLINE FROM NATURAL GAS

By

F. M. LESTER

A NEW method of producing gasoline has been perfected with results that promise to increase greatly the supply of that indispensable fluid in this automobile age. The process involves the production of gasoline from natural gas. The list of valuable commodities that were discovered by accident is a long one and to it must be added this kind of gasoline, for the possibilities of natural gas in this direction were learned by chance.

Two or three years ago it began to be noticed that mysterious explosions occurred in ranges and stoves fed by natural gas, particularly in cold weather. It was conjectured that the cause was due to some rapid chemical change in the water often in the line. One day an inquisitive pumper in blowing off a Pennsylvania gas line noticed that the fluid blown out did not look exactly like water. He managed to gather some of it and discovered that it was a high-grade gasoline.

News of this interesting discovery in two or three days reached the headquarters of natural gas sharps in Pittsburg and gas chemists were sent to the scene to investigate. They found that the regular attendant on the lease had become ill suddenly and departed leaving a couple of high pressure wells flowing into the line. It in turn was cut off from the trunk line by a valve a mile further. The weather had been bitterly cold for a week. The gas line ran part of the way through a marsh, the water in which was frozen, so the line was incased in ice. Here then was gas confined under heavy pressure in a low temperature and these the experts saw were the only conditions nature required to turn out with great rapidity gasoline of a higher grade than is distilled off in the ordinary refining process.

A Gas Well Before Being Shut in.
Where the flow is very strong, the gas usually yields but little gasoline.

Natural gas is known in oil country vernacular as "dry" gas and "casing head" gas. The first means gas from a well that produces no oil and it is this kind of natural gas that supplies fuel to hundreds of cities and towns. Nearly all oil wells produce gas in association with oil. Such of it as is necessary is used to operate gas engines for pumping or to furnish fuel for the boiler. The rest is allowed to escape through the casing heads of the wells. In some cases this waste is very large. As before intimated news travels fast in the oil country. Within two months after that Pennsylvania pumper blew off his gasoline, oil operators from Pennsylvania to Oklahoma knew that the gas they were throwing in the air was capable of being turned into gasoline and money.

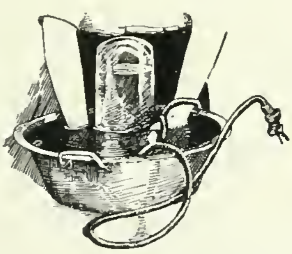
Jack Used in Pumping Oil from a Well.
The two longest braces of the jack terminate at the casing head, through holes in which gas traveling upward between the tubing and casing is allowed to escape.

Several of the larger manufacturing companies that build machinery for the oil fields took up the subject. They devised apparatus to produce the low temperature, high pressure and confinement that nature demanded for her condensing process. In the first plants the gas was run from the well through a compressor which contributed the necessary pressure, into a coil of pipe in a tank of cold water where the other conditions were realized. That with a few frills was about all. The early plants have been improved on but the principle remains the same and so much simplicity has been introduced that an ordinary pumper can operate the ordinary plant in addition to his regular work.

These little gasoline plants are going up in all the oil fields. They involve the investment of a few thousand dollars only and for the most part are of the capacity of a few barrels of gasoline daily. But some are of pretentious size and more are being added to this list. In the Oklahoma field a few weeks ago a company heavily backed by wealthy men was formed to thus utilize waste gas and in the same field the special process man has made his appearance.

The characteristics of two wells on the same farm are often entirely different. In fact there is as much dissimilarity between oil and gas wells as there is between individuals and this makes it necessary for a lease owner to have his gas tested before putting in a gasoline plant because its content in gasoline may be less or more than that of gas produced from wells a comparatively short distance away. At the beginning of this industry just how to test a volatile invisible fluid on a farm without elaborate scientific apparatus was considerable of a problem. But the old text books of the preparatory schools provided the manufacturing companies a way to do it and they now send out directions to any lease owner telling him how to collect samples of gas for testing.

The operation is a simple one but very interesting. An empty quart bottle is secured and a piece of rubber tubing with a suitable reducing attachment to be fitted on the source of the gas to be tested. Then the bottle is filled with water and immersed neck downward in a pail of water. The rubber tubing is inserted in the neck of the bottle. Immediately the gas forces the water out of it. A cork is put in and, after dipping it in liquid paraffine, the bottle of gas is ready for shipment to a laboratory. Hundreds of bottles are received weekly in the testing rooms around Pittsburg and the chemists are able to tell exactly just what quantity of gasoline per thousand feet a particular gas will produce. It is found that dry gas



Obtaining a Sample of Gas.
Gas displacing water in bottle. Gas blown from bottle before corking.

yields little or no gasoline but that casing head gas coming from oil saturated sands carries a content of from two to two and one-half gallons per thousand feet of gas. This means that a great many lease owners are garnering very handsome profits. The oil papers which perhaps of all trade papers follow their subject closest, report numerous little plants that bring the owners as high as $50.00 a day clear profit from a product that for years has been allowed to mix with the atmosphere.

The "gasoline scheme" as oil men call it has already advanced sufficiently to develop problems of transportation and storage. Of course, gasoline cannot be kept in the ordinary wooden tank. Nor will the customary iron tank hold the volatile fluid. A specially built steel tank is required. For shipment it has been found necessary to use steel drums. There is really no difficulty yet in finding quick markets for the demand for gasoline is worldwide and immense.

Burning Gas Well with Flame 125 Feet High.
Photograph taken at night.

Last year the production of oil in the United States reached the stupendous figures of 213,000,000 barrels—the largest in the history of the industry. This means that every day 600,000 barrels of that fluid came out of the ground. Though exact statistics are lacking it is known that the production of the Asiatic and Eastern European fields was also enormous although, of course, nothing like that of the United States, which maintains, without danger of loss, the supremacy it assumed fifty years ago.

The prodigious production of oil has developed a peculiar condition in the market for oil products. There is practically no end to the consumption of the lubricating oils produced from petroleum and, as said, gasoline moves out as rapidly as it is made. These two products represent the two extremes of crude oil, and the space between is made up of burning oils which, owing to the great production, have accumulated enormously. It is this fact which has enabled the Standard to attack successfully on their own ground the European manufacturers, for the latter cannot sell kerosene at the price made by the Standard. A vast proportion of American petroleum does not yield much gasoline. This is the fact as to the California oils and also as to the oil of the Gulf Coast. Every ounce of gasoline that the other oils can be made to yield is secured in the refining process.

The manufacturing companies most concerned concede that transportation problems will increase as the business increases. But they believe these will solve themselves. They examine in their laboratories thousands of samples of gas from the different fields and express their belief that these are the early stages of an industry which bids fair to become second in importance to the production of crude petroleum.

UP THE ALPS BY AERIAL TROLLEY.
A new way to ascend the Aiguille du Midi, a peak of the Mont Blanc Range.

AERIAL RAILWAY TO MONT BLANC RANGE

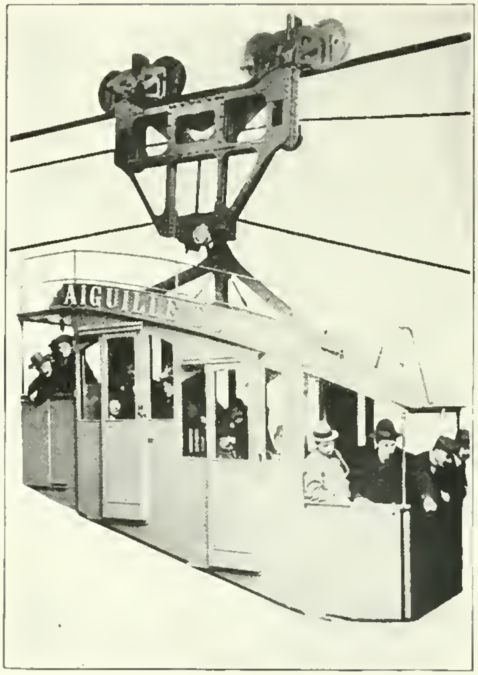
By

DR. ALFRED GRADENWITZ

WE are fast approaching a time when all local obstacles having been removed, even the remotest places will have been brought within the reach of modern civilization. In fact, man in his struggle with natural drawbacks has long been intent on encircling the whole surface of the earth in a continuous network of railways and steamship lines, thus reducing distance to ever more subordinate importance. The last refuge left to lovers of solitude was on the snow-clad peaks of the Alps, which could be conquered only by the chosen few able to vanquish their terrors. However, the iron horse is now invading even these last ramparts of virgin nature, spreading everywhere on its way, the hustle of modern life.

It is true that from a less selfish point of view this triumph of human skill is to be welcomed. Though the noisy products of civilization necessarily impair to some extent the beauty of Alpine scenery, it is doubtless a boon to humanity that common mortals should have been allowed their share in so many unknown treasures. Moreover, the very advance of engineering allows these means of conveyance to be designed on lines more and more in keeping with the majesty of Alpine scenery. The noisy steam engine with its clouds of smoke has already been superseded by silent and snug electric locomotives and the latest progress in this direction is the advent of suspended cableways, aerial railways as it were, which convey their passengers with the smoothness almost of air travel and hardly any earthly contact, up to the most giddy heights.

This novel means of conveyance, after a few short lines of minor importance, has been put to an interesting applica-



THE ZEST OF AERIAL, WITH THE SAFETY OF LAND TRAVEL.
Swinging a carload of passengers to Alpine heights.

tion in connecting the Aiguille du Midi, a peak of the Mont Blanc range, with the world-renowned village of Chamonix situated at its foot. In describing this remarkable installation, it should be understood that the suspended railway is identical in principle with the cable-way employed from times immemorial in mines and elsewhere for the transport of coal, ore, timber, etc., and that such cableways seem to have been known in China for thousands of years.

All the latest advances of modern engineering had to be resorted to in substituting for the tiny trucks used in the transport of goods, comfortable passenger cars propelled at a convenient speed. Moreover, in case of rupture of a cable or other disturbances, a safety at least equivalent to that of ordinary railways had to be warranted.

Being more independent of the configuration of the soil and adapting themselves more easily than ordinary railways to any caprices of the ground, these cableways show obvious advantages over track railways, the more so as they are incomparably cheaper in installation.

MEASURING THE SNOWFALL

By

ARTHUR CHAPMAN

ONE of the most interesting lines of work taken up by the government in recent years is the measurement of the snow-fall in the Rocky Mountains. It is the intention of the weather bureau, with the co-operation of the forestry service, to establish snow boxes and gauges at innumerable points on the Great Divide. Weather bureau employes, and forest rangers, will visit these stations as often as conditions will permit, and will file daily or monthly reports showing the amount of snowfall on the great watershed of the United States—reports that will be most valuable as indicating the likelihood of floods at the sources of the most important streams in the country.

Through the efforts of Frederick H. Brandenburg, district forecaster of the United States Weather Bureau in charge of the Rocky Mountain district, and director of the Colorado weather service, an encouraging start has been made in this new and important work in Colorado. Mr. Brandenburg has established forty-three snow bins and 225 snow scales in Colorado in the last year. These stations are evenly distributed over the mountains and foothills, so that this winter's snowfall in Colorado will be accurately estimated from day to day.

The snow boxes, which have been spe-

MEASUREMENTS OF SNOWFALL ARE MADE DAILY IN THIS SPECIALLY CONSTRUCTED BOX.
United States government station at Steamboat Springs, Routt County, Colorado.

cially designed for this work, are wooden boxes five feet square, and are set five feet above the ground. The bottom is a trap door, and each day's snowfall is cleaned out, after being measured at a stated time.

"It took considerable experimenting to evolve just the right kind of a box," said Mr. Brandenburg, "but we think we have the correct sort now. We soon found that an ordinary box would not do, for the reason that the high winds which usually prevail during a Rocky Mountain snow storm caused the snow to drift, making it almost impossible to get a correct measurement of the fall. What we wanted was to get a box that would overcome this tendency to drift, and in which the snow would fall in a normal way. After various experiments we have evolved a box which answers these requirements. Around the upper edge of the box, projecting several inches above it, we have placed a coarse wire screen. Then, on the inner walls of the box we fasten boards which slant downward and inward. There are several rows of these boards. The combined effect is to break the air currents above and inside the box, and the snow falls to the bottom so evenly that, even when a high wind prevails, there is little variation in the deposit in the receptacle. This simplifies the work of measurement, even at such places as Corona, on the very top of the continental divide, 11,000 feet above sea level, where sixty mile winds often prevail in snow storms."

The snowfall at these measuring stations is measured every twenty-four hours, when storms prevail, the boxes being cleaned out every night. The snow gauges, which have been posted at points in the mountains inaccessible to the average person, are not visited so often, but, through the co-operation of the forestry service, they are read at least once a month by forest rangers.

In establishing these snow gauges, Mr. Brandenburg first called upon the forestry and geological survey departments and secured their promise of co-operation. There are seventeen national forests in Colorado, most of which extend on both sides of the great divide, covering the very field in which a snowfall measurement is most desired. The snow gauges, which are simply scales, six feet in length and marked in feet and

WEATHER STATION AT CORONA, COLORADO, ON THE GREAT DIVIDE ELEVEN THOUSAND FEET ABOVE SEA LEVEL.

half feet, have been placed mostly on these reserves. In establishing these measuring stations, Mr. Brandenburg usually selected glades in the forests, where an average snow fall would be secured. The scales are affixed to trees in most cases, though a number are set up on wooden braces.

PHOTOGRAPHING THE AURORA BOREALIS

By

ALBERT GRANDE

MYSTERY has always surrounded the Aurora Borealis, but recent investigations of invisible rays have afforded a novel and interesting theory.

It is known that certain invisible rays are given out from an electrical discharge bulb such as is used with X-ray machines. While experimenting on these rays, in 1896, Professor Birkeland, of Christiania, noticed the peculiar suction effects exerted upon them by a magnet. When arranging a very strong magnet below the discharge bulb these rays were seen to converge towards this magnet in the same manner as light rays will converge towards the focus of a lens. The similarity between the light thus obtained and the Aurora Borealis suggested the idea that auroras are due to rays given out from the sun, which, on their way through space, converge towards the magnetic pole of the earth, thus producing a particularly bright light at certain places in the surrounding air. Nature thus organizes on a huge scale the same phenomenon observed in a small compass in the electrical discharge bulb.

Birkeland afterwards undertook three voyages of discovery to polar regions with a view of investigating the Aurora Borealis and any attending magnetic disturbances. He confirmed his theory by a number of laboratory experiments. Professor Carl Störmer of Christiania, in a memoir recently submitted to the international congress of mathematicians, established a theory of the phenomenon,

PHOTOGRAPHS OF THE AURORA BOREALIS—THE GLORY OF NORTHERN NIGHTS.

showing it to be excellently accounted for on the above supposition. He also took photographs of aurora displays.

It had so far been considered practically impossible, on account of the faint light and great motion of auroras, to fix the phenomenon on a photographic plate and only once did Professor Brendel succeed in obtaining an aurora photograph with an exposure of seven seconds.

Professor Störmer first endeavored to choose such combinations of objectives and photographic plates as would insure the sensitiveness required for rendering so feeble and fleeting a light. He eventually adopted an objective one inch in diameter and two inches in focal length and used special photographic plates. With this outfit he was successful on a voyage to Bossekop, in February and March, 1910, in obtaining a series of 800 aurora photographs, of which one-half can be considered satisfactory, exposures varying, according to the brightness of the phenomenon, between a fraction of a second and about twenty seconds.

These photographic views incidentally afforded an excellent means of measuring the altitude of auroras and ascertaining their accurate position in space by photographing simultaneously from two stations connected by telephone and comparing the position of the aurora relatively to the surrounding stars. The method of calculating, after the data are found, is practically the same as that employed by the surveyor, using the transit, to calculate the height of any object such as a church-spire or high chimney.

A systematic application of this theory, recently submitted to the French Academy of Sciences, would undoubtedly give most interesting results.

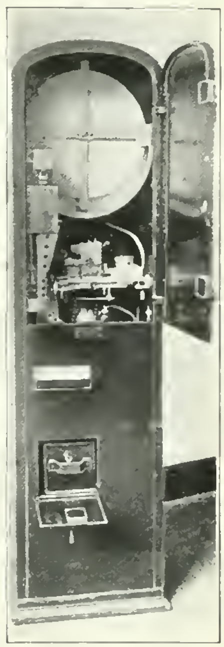
ELECTRIC AUTOMATIC MACHINES

By

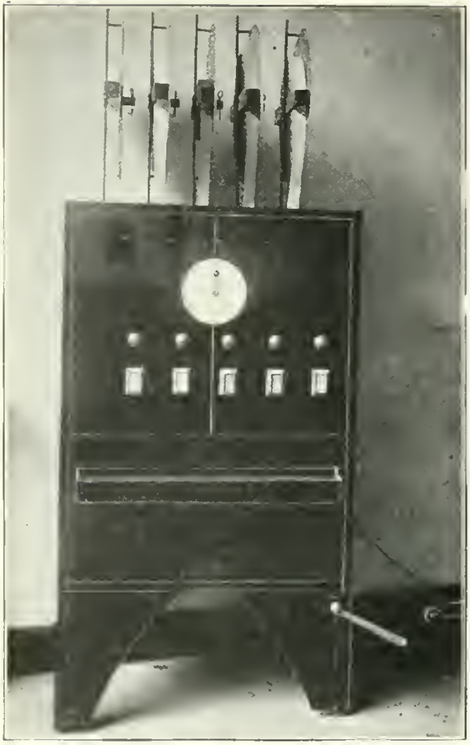
ARTHUR JOHNSON

Ticket Vender Operated by Electricity.

ALTHOUGH America stands foremost in any output of automatic machinery, we hear from time to time of devices from England which are not without merit. Such an idea shows an ingenious electric automatic ticket-sender, which, the makers claim, is destined to revolutionize the present troublesome and costly process of printing, issuing, and checking railway tickets. The machine is to substitute the ticket-shelves in booking offices where there is a great and continuous demand for tickets to suburban and seaside places. It claims to reduce the cost of tickets to about four cents per thousand, and to consume one-fourth cent's worth of electricity for printing and issuing a thousand tickets. It contains 10,000 tickets ready for sale, and can print and issue up to fifty tickets by pressing a button once, and setting the indicator according to the number of tickets required. At



The Interior Mechanism of the Ticket Vender.



Automatic Ticket Printing Machine.

the same time it registers all tickets issued automatically, the register being visible from the outside and the cash takings ascertained at a glance. It also dates tickets automatically, and does away with all counting and storing of tickets.

Another novel English idea, this time an electric-automatic ticket vendor, will commend itself to the notice of those to whom time is the essence of all things. This machine is a marvel of mechanical ingenuity. It not only issues tickets on receipt of the proper coin, but it prints, dates and registers them as well; moreover, it reduces the printing of tickets to a third of its present cost. Its principal points and advantages are that it saves time. Being driven by electricity, consequently it does not need to be wound up, and at the same time it does away with all preparatory printing, counting, delivery and storing of tickets. The machine contains 5,000 tickets ready for sale, and effects sales up to ninety a minute. It dates the ticket and registers all sales automatically, the register being visible on the outside, and the cash takings ascertained at a glance.

Ben Franklin Maxims

¶ Three little strokes fell great oaks.

¶ Plough deep while sluggards sleep.

¶ Three removes are as bad as a fire.

¶ There never was a good war nor a bad peace.

¶ Do not squander time, for that is the stuff life is made of.

ELECTRIC FOUNTAIN AT SAN DIEGO THAT IS ATTRACTIVE BY DAY AS WELL AS BY NIGHT.

BEAUTIFUL FOUNTAIN AT SAN DIEGO

By

C. L. EDHOLM

TO build an electric fountain which should be an ornament to the San Diego plaza by day as well as by night was the problem which an architect of that city was recently called upon to solve. It is a well known fact that the ordinary electric fountain, beautiful as it may be while illuminated, is exceedingly unattractive until nightfall, being of a purely mechanical appearance, iron pipes and nozzles showing above the surface of a basin. That is because no architect has heretofore thought of combining beauty of line and surface with the device that produces these artistic fireworks.

In the designing of the San Diego fountain, however, the problem was unusual. The tiny plaza in the center of the city is laid out as a formal square and is directly opposite one of the finest hotels in the world, an architectural triumph. Therefore it was necessary to preserve a harmony between the appearance of the fountain and its surroundings, and the architect was compelled to create something totally different. How well he succeeded is shown in this photograph of the fountain which is almost as beautiful by day as by night.

The general design of it is taken from classic Greek models, and even when the water is not flowing the little monument of granite, marble and bronze is a thing of beauty. The unique features are found in the arrangement of the jets of water and the placing of the lights and reflectors. At first sight the dome of the little temple-like structure appears to be formed of spray, seemingly thrown skyward by the needles of water shooting up between the marble columns. This is an illusion, though, as in reality the water which forms the dome is forced by a pump through the cores of the columns and allowed to gush out from under the bronze lantern on the dome, which is constructed of prismatic glass and a metal grille. The water flowing violently over the projections of the grille develops countless miniature cascades so that the roof is covered with a foaming mantle. The water between the columns is in reality not thrown upward but is a shower. The flow from above is allowed to drop straight down through a perforated sheet of metal under the dome. The arrangement of the other jets is harmonious but not unusual.

By night, of course, the fountain is at its best. All of the jets and cascades are illuminated in various colors, red, green, yellow and purple lights, automatically operated by a flasher. In addition to that, clusters of tungsten lights are placed under the prismatic glass of the dome causing a diffused glow to shine through the foam.

An electric motor of fifteen horsepower was installed below the fountain and all the mechanical devices are completely hidden. It is estimated that five dollars a day covers the full cost of upkeep, including lights, water, and salary of one man, which seems an exceedingly small outlay.

A San Diego capitalist gave this fountain to the city and also co-operated with the architect in perfecting some of the original details of the mechanism. It was erected at a cost of $15,000.

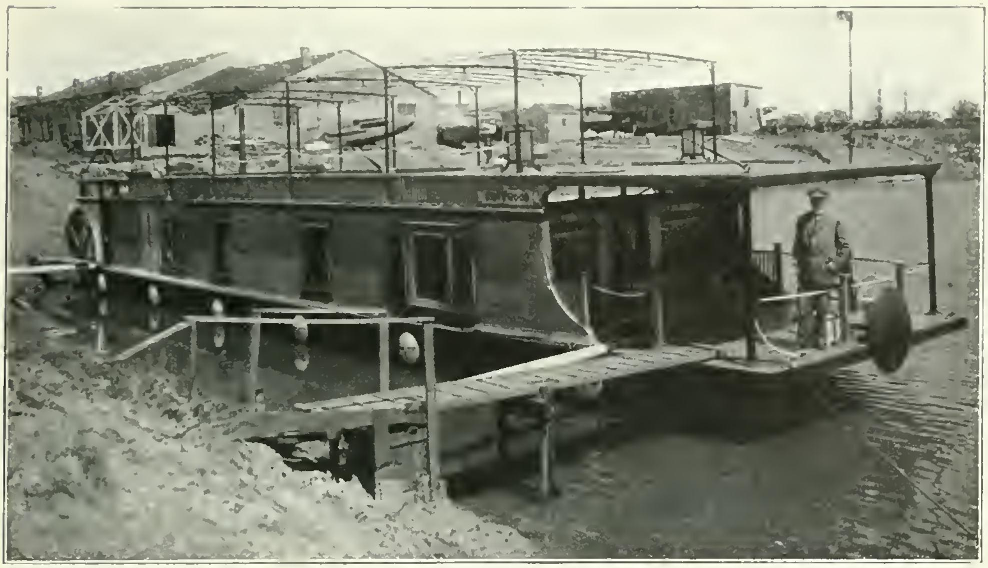
RUNNING A HOUSEBOAT BY AUTO POWER

By

ROGER MASSINGER

A CHICAGO banker has discovered a way to make his automobile do double duty. Instead of leaving his car at home when he goes on a houseboating cruise he takes it along and makes it serve as a power plant to run the boat. This is accomplished by fitting spurred sprocket wheels to the hubs of the car's rear wheels, and keying similar but larger ones to the paddle wheels of the boat, connection between them being made by means of link chain belts. Then when the auto is jacked up so that rear wheels are clear of the deck, and the engine started, the boat majestically glides away. The automobile is guided on board by means of a couple of grooved runways which run from the shore to the gangplank, and stopped at a place on the aft deck just between the paddle wheels.

The boat has two rudders, but it may also be steered by means of the paddle wheels if desired. The paddles are constructed so as to be independent of each other, and when they are connected with the automobile, the emergency brake of the car is disconnected from one driving wheel and the foot brake from the other.

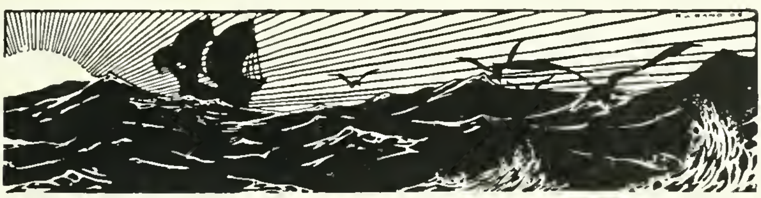


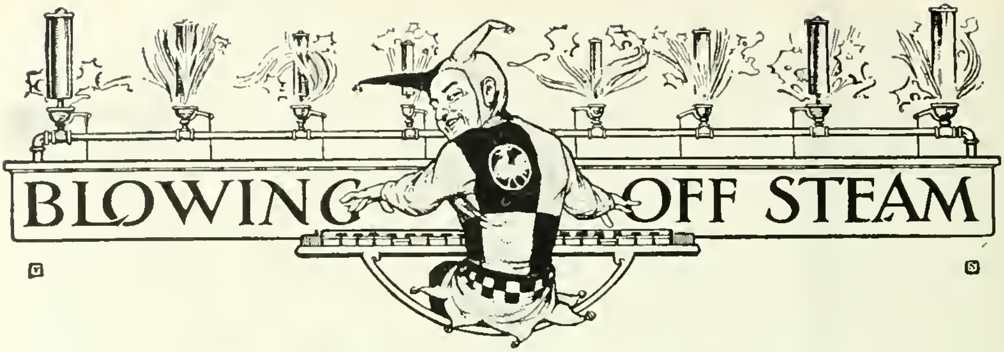
THE HOUSEBOAT *DRIFTWOOD*, OPERATED BY AUTOMOBILE POWER.

In this way one of the paddles can be revolved while its opposite remains stationary. If the port paddle is turned, while the starboard is held still, the bow of the houseboat is shoved around to starboard, and vice versa.

The *Driftwood*, which is the name of this remarkable craft, has all the conveniences of a modern steam heated apartment, including hot and cold water, refrigerator, gas stove, roof garden, sun parlor, private back porch, hardwood floors, laundry, clothes drier and janitor service. It also carries a gasmaking machine which supplies gas for illumination and cooking, and a complete water filtering system.

The houseboat measures seventy-five feet over all, with a width of sixteen feet, five inches. It weighs thirty-six tons and draws sixteen inches of water. The house proper is fifty feet long and the full width of the boat, and contains three sleeping rooms, a bath room, kitchen and combined living and dining room. Its owner lived on it during the entire past winter, while moored in a boat yard, and proposes to automobile the craft down the Illinois and Mississippi rivers some time during the summer.





The Motorist at Home

"You have a fine lot of children, Binks," said Hawkins, as after a spin through the country they returned to the house for dinner. "How many are there?"

"Seven," said Binks, proudly.

"I've often wondered," said Hawkins, "whether you people with so many children have any favorites among them."

"Oh, no," returned Binks, hesitatingly; "that is to say, not consciously, but of course we are more interested in a 1911 model than in the earlier ones."—*To-Day's Magazine.*

Especially if He's an Editor

"What a poor man needs is a thrifty, economical wife."

"That sounds like magazine advice. What a poor man really needs is a rich, liberal wife."

Modern Politics

"Who are they recalling today?"

"Oh, it's the mayor again. Some of the women folks complain that he squints and is bowlegged."—*Cleveland Plain Dealer.*

Deterrents

"George," said her husband's wife, "I don't believe you have smoked one of those cigars I gave you on your birthday."

"That's right, my dear," replied his wife's husband; I'm going to keep them until our Willie wants to learn to smoke."—*Chicago News.*

A Solitude

Here is an extract from a hotel prospectus in Switzerland:

"Veissbach is the favorite place of resort for those who are fond of solitude. Persons in search of it are in fact constantly flocking here from the four quarters of the globe."

An Act of Kindness

Weary Voice from Doorway—"My dear sir, I have absolutely no objection to your coming here and sitting up half the night with my daughter, nor to you standing on the doorstep for three hours saying good night. But in consideration for the rest of the household who wish to get to sleep, will you kindly take your elbow off the bell push?"—*London Opinion.*

Of Course

Teacher—"Willie, if you had five eggs in the basket and laid three on the table, how many would you then have?"

Willie—"Eight."

The Quick and the Dead

Rufe Johnson was heard telling this story:

"Yessur, it sure was er ghost, an' I run some. De fust mile I made in nuffin', den I burnt de wind for two or free more, an' den I sot down on er rail fence to rest, an' when I'd 'bout caught my breff I done looked over mah shoulder, an' dare was dat ghost again an' it said:

"'We sure did run, Rufe, didn't we?' An' dhen I say: 'Yes, Mr. Ghost, we sure did; but we didn't run noffin' to what we's gwine to run.'"

Couldn't Stand the Insult

A Scottish boy and an English boy who had been fighting were separated by their respective mothers, the Scottish boy, although the smaller of the two, being by far the more pugnacious.

"Whit garred ye fecht a big laddie like that?" asked his mother, as she wiped the blood from his nose.

"And I'll fecht him again," exclaimed the lad, "if he says Scotsmen hiv tae wear kilts because their feet are too big tae get into their troosers!"—*The Continent.*

He Missed It

A small boy from town was spending a few days in the country. One morning he heard the grown folks complaining of having been kept awake the night before by a skunk.

Willie burst into tears. "Why, Willie, what's the matter?" the fond mother inquired.

"Why didn't someone wake me up?" he blubbered. "I never smelled a skunk in all my life!"—*Metropolitan Magazine.*

Premature

The Fair Purchaser—"Your eggs are very small today, Mr. Jones."

Mr. Jones—"Yes'm, they are; but I'm sure I don't know the reason."

The Fair Purchaser—"Oh, I expect you took them out of the nests too soon."—*London Sketch.*

She Knew Them

Dentist (to old lady who wants tooth pulled): "Do you want gas, madam?"

Old Lady—"Well, I should say so. I don't propose to stay in the dark with you or any other man."

Au Revoir

If you are feeling downhearted, tell your story to a fat man and get him to crying about it. If the tears rolling down his vast expanse of cheek fail to make you laugh, you know where the river is.—*Atchison Globe.*

Worse Yet

Blobbs—"Well, poor old Bjones has joined the silent majority."

Slobbs—"Gracious! When did he die?"

Blobbs—"He isn't dead. He's married."
—*Philadelphia Record.*

As Usual

"Bronson has gone to Europe for his health." "How did he lose his health?" "Earning the money to go to Europe."—*Boston Transcript.*

The Feminine "Touch"

Wife—"Wretch! Show me that letter."

Husband—"What letter?"

Wife—"That one in your hand. It's from a woman, I can see by the writing, and you turned pale when you saw it."

Husband—"Yes. Here it is. It's your dressmaker's bill."—*New York Evening* Mail.

Altitude Records

Butcher—"Twenty-eight cents a pound."

Mrs. Murphy—"That's awful high. I guess that's the aviation meat Oi've been reading so mooch about."—*Judge.*

Would Do Her Duty

Mistress (after the quarrel)—"Norah, you must stay until I get another girl."

Norah—"I intend to. It's only roight some wan should tell her the kind of a woman ye are."—*Boston Transcript.*

POPULAR · SCIENCE & MECHANICS SUPPLEMENT ·

LARGEST EGG IN THE WORLD

THE largest egg in the world was recently exhibited in the Museum of Natural History, New York. It is the egg of the gigantic extinct bird called aepyornis, which formerly lived in considerable numbers on the Island of Madagascar. This was a huge wingless creature the largest and most formidable bird of prey that ever trod the earth. In life it has been variously estimated to have stood from seven to twelve feet in height, possessing massive and powerful limbs. This great bird surpassed the ostrich, the king of modern birds, both in size, herculean strength and build. The enormous size of the aepyornis egg may be imagined from the accompanying photograph. By way of realistic comparison on the right is seen an ordinary hen's egg, on the left is the egg of an ostrich. The aepyornis egg is six times larger than that of the ostrich, having a capacity of two gallons, or the capacity of 150 hen eggs. Here are some of the astonishing dimensions of the big egg. The shell is about ⅛ of an inch thick,

HUGE EGG LAID BY THE GIGANTIC EXTINCT BIRD, AEPYORNIS, OF MADAGASCAR.
The capacity of the shell is two gallons. On the right is shown a hen's egg; on the left, an ostrich's egg.

PUSH BALL PLAYED ON HORSEBACK BY THE OUT WEST RIDING CLUB OF LOS ANGELES, CALIFORNIA.

The ball itself is a huge sphere measuring six feet in diameter, but comparatively light for its size; and the opposing teams of players mounted on little western bronchos endeavor to drive the ball through the opposite goal, their horses doing the actual pushing. The scrimmages are very exciting and the horses are often thrown, but still it does not seem to be as dangerous as football and at the same time is far more picturesque.

the lengthways circumference is two feet eight inches, and two feet two inches round the middle. Though termed a fossil egg it is not petrified nor turned to hard stone as in the case of dinosaur bones.

MOUNDS OF CRUDE SALT THAT HAVE FORMED IN THE GREAT SALT LAKE, UTAH.

Residents of Utah, especially those commercially interested, are growing alarmed at the persistency with which the waters of Great Salt Lake are gradually dwindling away. If they continue at the rate at which they have decreased during the past ten or twelve years, the term "Great" will be a misnomer. This seems to be but bearing out the theory of many scientists, that the lake is but a "shrunken remnant" of a vastly larger body of acrid water that at one time reached out to the northern and western borders of Utah and doubtless beyond—a veritable inland sea. In time, it will entirely disappear, it is believed.

Only two or three of these eggs have been obtained by Europeans. These were found in the sand beds of torrents.

MOST ANCIENT MAN ON RECORD

THE Ethnological Museum of Berlin has recently been fortunate enough to secure the skeleton found by the Swiss professor Hansee in the valley of the river Vezere, near Perigord, in southern France. This skeleton has created con-

BONES OF MAN WHO LIVED FROM ONE THOUSAND TO FOUR THOUSAND YEARS AGO.

siderable discussion among scientists as it represents the oldest remains of prehistoric man that have been discovered so far.

The skeleton was found about thirty feet under a projecting rocky ledge called "Le Moustier" and the species to which it belongs received the name of "Homo Moustiesis Houseri." The skeleton is that of a man about five feet six inches high, with crooked legs and an imperfectly developed lower jaw. Sea shells were grouped around it, from which fact the professor concluded that the man either wore ornaments of shells or that the corpse was decorated with them after death. The skull and the stratum in which the bones were found belong to the middle "Palaeolithic" form.

The discoverer concluded therefore that the owner of the skeleton had lived and died at least one thousand years ago. Professor Klaatach of Breshaw, the well known archaeologist, goes even farther than Professor Hansee and claims that the skeleton is fully four thousand years old.

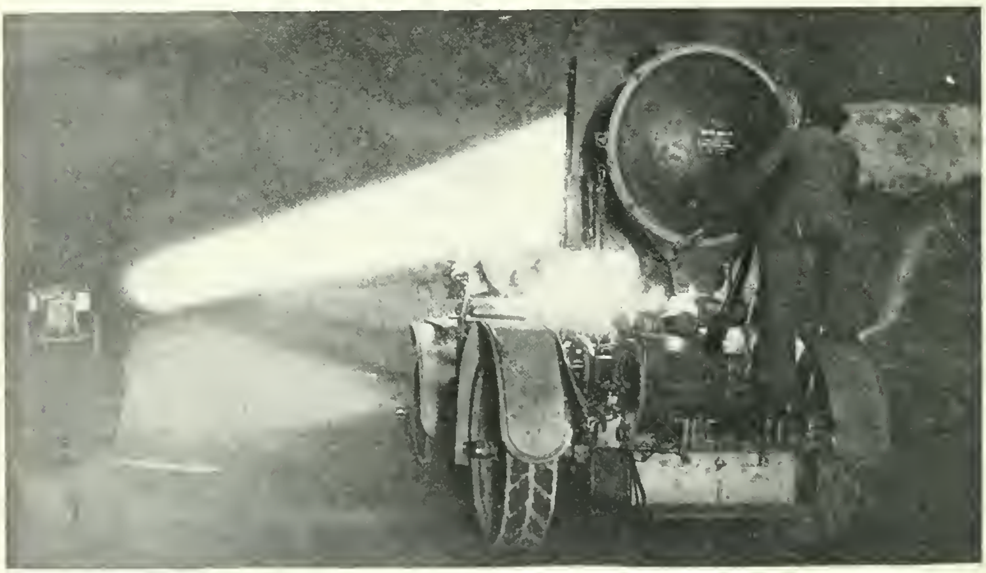
NEW FRENCH MILITARY SEARCHLIGHT

IN future wars the army as well as the navy will prosecute its grim business both day and night. There will be little sleeping at night as in wars of the past. Automobile searchlights like that shown in one of the photographs reproduced herewith will illuminate the highways for the motor wagon transports, throw light across streams for the placing of pontoon bridges, and greatly facilitate the movement and disposition of artillery.

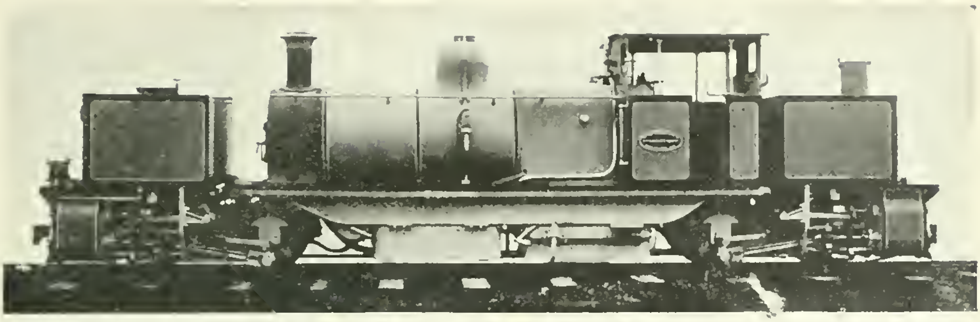
IN THE FOCUS OF A POWERFUL SEARCHLIGHT.

This machine has recently been delivered to the French army. The photographs are not "doctored" in any way but are just as the negatives were taken. The one of the machine itself shows the high-powered beam of light thrown while the effect of the light at different ranges is seen by the other.

With each addition to the equipment of modern armies, war becomes more horrible. Fighting in the glare of powerful electric lights seems particularly awful and repellant.



POWERFUL SEARCHLIGHT ON AUTOMOBILE FOR USE IN THE FRENCH ARMY.



LOCOMOTIVE OF ODD DESIGN FOR NARROW GAUGE RAILWAY IN THE HIMALAYAS.

LOCOMOTIVE FOR THE HIMALAYAS

THE unique locomotive illustrated in the photograph has recently been constructed in England, for service on the Darjeeling Himalaya Railway, which is a narrow gauge line starting from Siliguri, 398 feet above mean sea level, rising to a height of 7,407 feet at Ghoom Station, 47 miles distant, and then descending to Darjeeling, another four miles, which terminus is 6,812 feet above sea level. The average ascent for the 40 miles between Sookna and Ghoom is 170 feet per mile, and in this section the gradients vary from one in 129 to one in 137, while there are many curves of only 70 feet radius. From the foregoing, it will be seen that a very special locomotive was called for. Instead of the boiler being placed over the wheels, as has hitherto been the practice, it is carried upon a girder frame which is pivoted and supported at its extreme ends on bogies, each of which may be likened to a locomotive without a boiler. These steam bogies with their water tanks and coal bunker together constitute the greater part of the weight of the locomotive and give stability to the running. Furthermore, the center line of the boiler portion connecting the two bogies forms a chord of the curve on which the engine may be traveling, and the sharper the curve, the greater will be the projection of the boiler towards the center of the curve. Comparing this with other forms of articulated locomotives, it will be seen that its novelty lies in the fact that the boiler is placed completely between the two main connecting points of the boiler frame, without the boiler frame materially overhanging the connecting points. By this means, a locomotive is obtained possessing perfect pliability and stability combined with perfect freedom from restrictions which have hitherto governed locomotive construction.

NEW MOTOR HYDROPLANE.
Coach Ward of the University of Pennsylvania built this boat to help him train his crews. The craft is capable of making 25 miles an hour. With this new craft the coach can get much nearer the shells without making a swell than he can with any other sort of boat.

MAGNET TAKES STEEL FROM EYE

A VERY unusual operation was recently performed in Los Angeles, when a steel sliver more than an eighth of an inch long was removed from a boy's eye with a huge magnet, probably saving him from blindness. The lad was hammering a steel bar when a fragment broke off and struck him in the eye, entering through the pupil. The boy's

REDUCED PHOTO OF THE HERCULES BEETLE.
This is one of the biggest "bugs" in existence, being seven inches long.

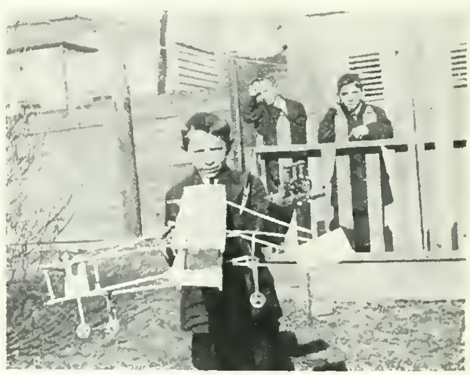
sight from that optic was temporarily destroyed, and his parents consulted a regular physician, who could find no trace of the sliver but a small scar, the metal having gone into the eyeball. A specialist made an X-ray examination and located the bit of steel, and an operation was decided upon. A small T shaped cut was made in the eyeball, and a powerful magnet was used to draw out the fragment of metal. Since that time improvement has been rapid, and it is hoped that after the wound has healed there will be no bad effects.

GIANT AMONG BUGS

WHILE the study of entomology (science of insects) will lead you to observe many minute and microscopical objects, all "bugs" are not small, as you will see from the photograph, which is of the Hercules beetle.

In size he is probably one of the largest bugs in existence, being about seven inches long, including its snout. The metallic-like wing covers are a delicate gray, edged and dotted with black. The snout-like weapon is also black, decorated with a row of tan-colored hairs along the edge of the largest projection. He is a native of the West Indies, where he must look a most formidable foe to the insect world, though his prominent proboscis seems to be used chiefly to "lock horns" with the male adversaries of his own order only.

Among insects are found many instances of structures present in males and wanting in the female of the same species, many of them have enlarged jaws, some with horns, and some antler-like projections with which to combat their foe, and probably many a desperate battle has been fought in insect life that would be worthy of record by some Homeric bard.



AIR CRAFT BUILT BY BROOKLYN BOYS.
Solomon Wolfe and two other lads—ranging in age from ten to twelve—show what modern, wide-awake youngsters can accomplish.

How Wireless Telegraphy Simplifies Defense.

This shows three British men-of-war and their wireless apparatus. Every vessel is in wireless communication with the Admiralty and commander-in-chief, and would be able by this means to intercept any fleet of transports that might descend on England.

Hygienics in a Berlin Day Nursery.

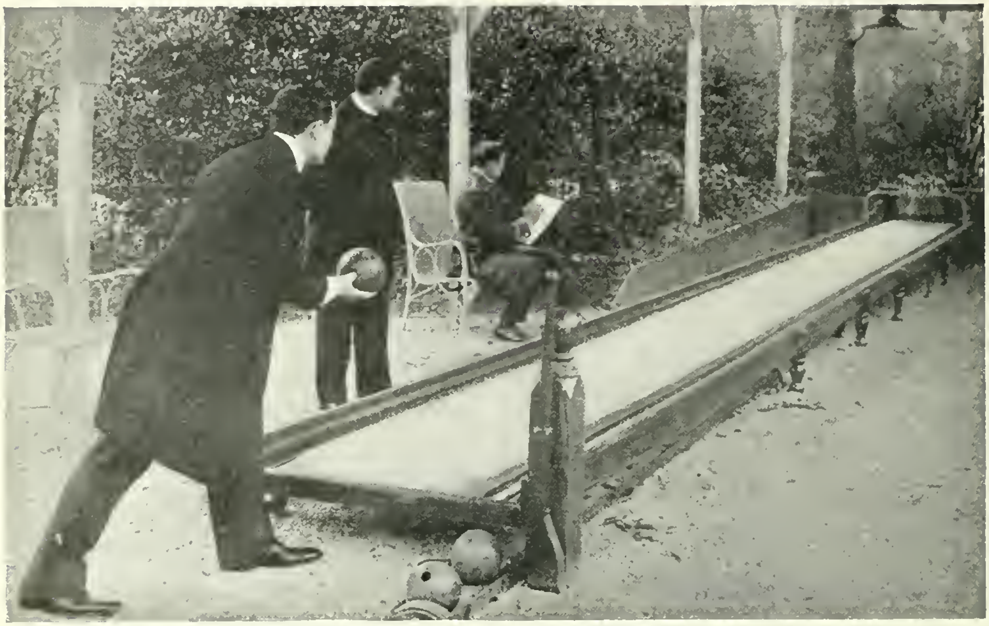
Every child has its pigeon hole containing soap, tooth brush, etc., and provided with a number to prevent mistakes.

Royal Children "Up a Tree."

Prince and princesses, children of the King of Italy, enjoying themselves on one of their father's estates, near Rome.

Style of Street Car, with Entrance in Middle, Is Gaining in Popularity.

Space and better ventilation are secured by this arrangement.



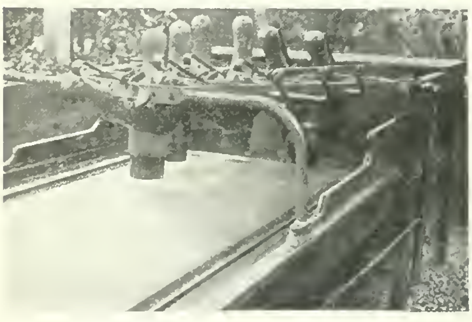
BOWLING ON THE IMPROVED ALLEY.
The pins are set without the aid of a pin boy.

BOWLING PINS THAT SET THEMSELVES

At last the pin boy in the bowling alley is about to lose his job. When the machine was introduced which accurately sets the pins in position on the polished boards, after being thrown in by the boy, for that purpose, it was felt, and justly, too, that a big step forward in the rapid playing of the game had been made. Moreover, there was a greater accuracy secured in the proper placing of the pins, such as one could scarcely hope for from the tired or careless pin boy.

Now this latest invention in the field of games further simplifies matters. By means of a cord attached to a lever, and running from the "frame" to the foul line, the bowler may set his own pins. This device also makes the playing of the game less expensive, thus increasing the popularity of the sport.

A piece of felt, which covers the floor of the alley, decreases the customary rumbling noise. The apparatus is a European contrivance.



Apparatus for Resetting Bowling Pins.

Forked Tree as a Well Sweep.

One end is weighted with a big stone to counterbalance the weight of the full bucket and the rope is knotted at intervals to make it easy for the drawer of water. This landmark stands beside a mission near the Mexican border below San Diego, California.

Wall Clock as Champagne Advertisement.
A noted French liquor firm's gift to its customers.

CHAMPAGNE CLOCK AS AN ADVERTISEMENT

AMERICANS are very enterprising in a business way in giving all manner of household goods, such as mirrors, fans, and odd trinkets, as advertisements, in the way of trade. But the French have even surpassed us in their greater ingenuity in certain forms of advertising, as witness the clock in the illustration.

It is a very modern firm of champagne makers, indeed, who give their patrons clocks constructed almost entirely out of champagne corks, bottles, and the implements which open the latter. On the dial is the name of the dealer. Even the most careless housekeeper could not disregard this constant reminder that the supply of champagne must not be permitted to run out, and where it might best be replenished, whenever that catastrophe might menace the gustatory peace of the household.

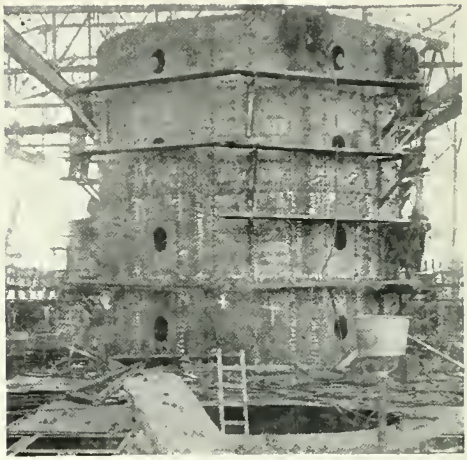
Candidate for Position of Mounted Policeman Struggling to Bridle His Refractory Horse.

POLICEMEN DO COWBOY STUNTS

THE city of Los Angeles has just conducted an interesting test in order to pick out available members for the mounted police squad. In the far West there are many ex-cowpunchers who have drifted into the city, and there are a number on the regular police force, so it was not difficult to find expert horsemen and lariat throwers in the ranks. The photographs show some of the policemen as they were indulging in rough play

ROPING A FELLOW POLICEMAN.
The man on foot has been "noosed" by accident.

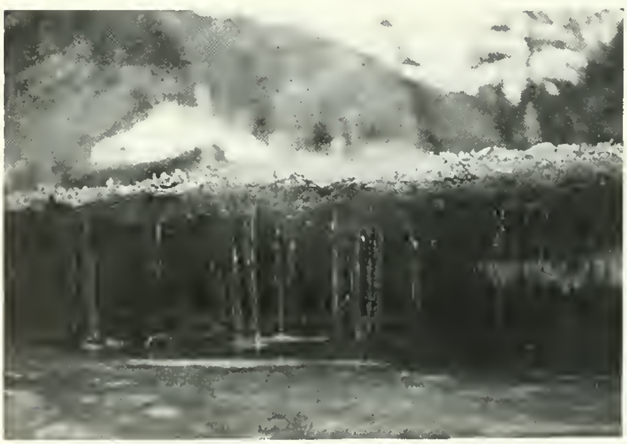
A Hat Pin with the Danger Extracted.
An extra head slipped on and fastened by a twist of the wrist renders the long hat pin harmless.



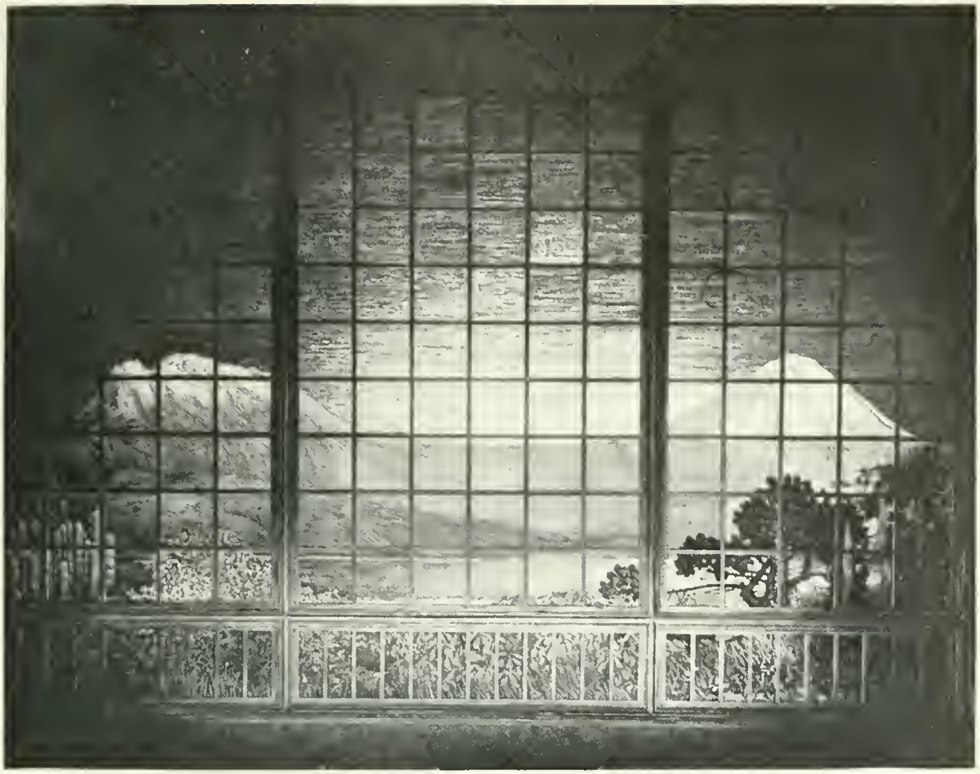
First Battleship Built in America for a Foreign Power Under Construction at Quincy, Mass.
The *Rivadavia* for the Argentine Republic, is to have a displacement of 27 000 tons. She will be one of the most powerful battleships afloat.

during the test. The officer on horseback, a former cowboy, has just ridden by the man on the ground and while his horse was going at a lope he flipped the noose back over his shoulder and roped his fellow policeman. Another photograph shows a less experienced "cop" struggling to get the bridle on his refractory mount, indicating that not all the applicants were experts. In fact as one of the local newspaper men described the roping test: "Some of the policemen caught the galloping horse, others caught the rider instead of the horse, and one of them succeeded in roping himself, but before the test was over each man had caught something."

The equipment of the horse for this new mounted squad will consist of a regular cattleman's outfit, the saddle having a double cinch and a horn, so that when a runaway is roped by a pursuing policeman it can be easily brought to a halt. The horses, too, are experienced cow ponies, trained to brace themselves against the rope, so that Los Angeles is likely to have exhibitions of rough riding and rope throwing on its main streets at any time. Thus the arts of the frontier will be employed to save the man of the city from the peril of runaway horses.



Peculiar Ice Formation Left in a Cave in South Dakota by a Thawing Stream.
Taken with portrait camera at a distance of four and one-half feet.



THE FIRST GLASS THEATRE CURTAIN EVER MADE.
It costs $100,000. The ordinary theatre curtain costs about $2,000.

THEATRE CURTAIN OF GLASS

THE first glass theater curtain will soon be installed in the National Theatre, which is now nearing completion, in the City of Mexico. It contains more than twenty-five hundred square feet of glass mosaic and weighs twenty-seven tons. To insure its safe transportation from the studios in New York City, where it was built, to the City of Mexico it was divided into two hundred panels, containing nearly one million separate pieces, which were inlaid in a concrete composition impervious alike to heat and moisture. A wonderful art pattern has been put upon the glass. It shows the last rays of the setting sun to the right of Popocatepetl, gilding the icy summits of the volcanoes and revealing the prone figure of Ixtaccihuatl, the upper slopes of the mountain, suggesting her streaming, luxuriant hair. Above, in the vast expansive sky, the glory of the blue changes to a deep purple as night approaches. The observer is impressed with the deftness of the artisans who executed this poem in glass. The completed curtain illustrates the decorative possibilities of glass mosaic. Its opalescence, iridescence, and the beauty of

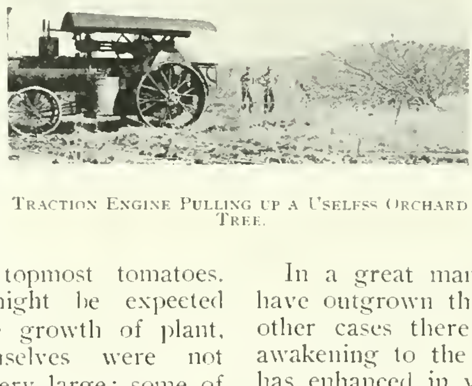
HOCKEY MATCH AT RICHMOND, ENGLAND, BETWEEN ENGLISH AND IRISH WOMEN TEAMS.
Ireland gets away with the ball after a "roll in."

its finish lend a touch of reality to landscape scenes that can not be obtained as effectively through other mediums.

PICKING TOMATOES WITH A STEPLADDER

Justifying the California Climate.
A tomato vine, whose top has to be reached with a stepladder.

IF an ordinary tomato plant in southern California is given all the climbing space it wants, it will clamber over the highest of garden walls and onto roofs and up to the top of telegraph poles. Next to Jack's bean stalk, a California tomato vine is the most remarkable climber in the world. The illustration here given shows a tomato plant, of the ordinary "beefsteak" variety, which came up voluntarily in the back yard of a Los Angeles home. It made its appearance above the ground sometime in April and by the end of November had reached a height of nearly twenty feet. To gather the fruit required a six-foot step ladder and a six-foot man, and even then a hoe or a rake was sometimes needed in addition, to get the topmost tomatoes. Contrary to what might be expected with such a profuse growth of plant, the tomatoes themselves were not only abundant, but very large; some of them weighing close to two pounds.



Traction Engine Pulling up a Useless Orchard Tree.

The Tree Yields Easily to the Irresistible "Pull."

NEW DEPARTURE IN REMOVING ORCHARDS

ON most of the smaller farms a few acres of the most fertile ground is reserved for an orchard.

In a great many cases the orchards have outgrown their usefulness, and in other cases there has been a gradual awakening to the fact that the ground has enhanced in value and it would be more valuable for agricultural purposes.

In these cases it has been found an expensive thing to remove the old trees.

The discovery was made that an inexpensive mode of removing these old trees could be accomplished by using a traction engine. It is a very simple process. A chain is wound around the tree, and the traction engine is attached by means of a cable. It only requires a slight pull, to draw the old tree out.

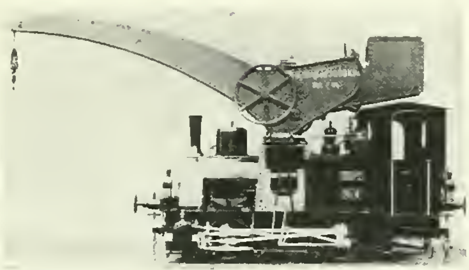
An old orchard of ten acres was entirely cleaned out in two days at the small expense of thirty-five dollars.

This departure bids fair to be followed by a great many others in the near future, as it is done for about one-third of the expense required by the old method.

Pet Raccoon Feeding from Its Mistress' Hand. An offer of eight hundred dollars for this amiable little creature was refused.

RACCOON VALUED AT SMALL FORTUNE

THE New York Zoological Garden contains at present a unique specimen in the shape of a raccoon of snow white color. While the natural color of the raccoon is a dark gray or brown, this one is white from tip to toe with pink nose, eyes and toes. The little animal has been named "Pinkie," and is the property of Mrs. Rose Shaw of the "Aerial Shaws," who recently toured Europe, and left her pet in the zoo to be taken care of. Pinkie is three years old. The management of the zoo offered Mrs. Shaw $800 for Pinkie in order to use her for breeding purposes, but the gentle mistress refused the offer.



German Locomotive Equipped with Powerful Loading Crane.

LOCOMOTIVE CARRIES WRECKING CRANE

RAILROADS are usually decently progressive in the adoption of modern appliances and labor saving machines as it behooves them to use every possible effort to facilitate the transportation of passengers and freight. The photograph above shows the newest and one of the most practical inventions of recent years. It is the new German locomotive engine. This locomotive carries a powerful crane which is attached, and operated by the engine. In the case of a wreck or at other times when a crane is needed the combination eliminates the necessity of the coupling of an extra car, causing a saving of time and labor.

CHANGEABLE STAGE SCENERY

IN every large city the theaters are divided by the building inspection laws into different classes according to the fireproofing qualities of the buildings and the number and accessibility of the exits, only those of the better class being allowed to use drop curtains, which permit of quick changes in the middle of an act, while some are even debarred from making a change of scenery at the end of an act.

Managers might do well to try out an electrical scene-changing effect which removes a drop visually without moving it bodily.

The model shown comprised a pano-

Does the Camera Lie? Well—It Sometimes Exaggerates.

This photo of oranges was taken from an upper window overlooking racks where the fruit was piled, at St. Petersburg, Fla. The camera being at close range, this freak was produced.

CEMENT SCENOGRAPH MODEL OF STAGE SCENERY WHICH SHOWS BUILDINGS USED WITHOUT ANY SHIFTING OR MOVING OF THE WALLS.

ramic view of the buildings, lighted by concealed lamps. In addition to thus showing the exterior of the plant, the interior of the main building was presented every few minutes without any shifting or moving of the front wall.

This was accomplished by making the front wall of a fine wire gauze, and painting it in such a manner with doors, windows and trimmings that, when lighted from the front, it matched the rest of the picture perfectly. By turning off a part of the lights in front and turning on a row of lamps concealed in the top of the building, the light inside the structure would be made so much stronger than the outside illumination that the interior of the building would be rendered clearly visible through the gauze.

BURNING FALSE WEIGHTS AND MEASURES WHOLESALE IN NEW YORK CITY.

It is stated that the seizures will probably result in Congress taking action to the end of compelling a standardization of so-called barrels and bushels all over the country. As matters stand, the terms are variously interpreted in different sections, and almost invariably to the disadvantage of the consumer.

Whale Taken Off California Coast with a Pleasure Launch.

The *Camaguin* with Thirty-Foot Whale in Tow.

PLEASURE BOAT AS A WHALER

THE captain of the *Camaguin* of Long Beach, California, a small launch used as a pleasure boat, recently performed the feat of killing and towing triumphantly home a thirty-foot whale. It was one of the few whales killed in those waters and this twenty-ton specimen created quite a sensation when it was exhibited alongside the tiny launch. The gun used for killing this sea monster was provided with a harpoon which contained an explosive that was discharged after entering the body. Four shots were fired, all of which took effect.

When the whale's body was being towed to Long Beach its mate followed the launch at a distance, apparently realizing that some misfortune had overtaken its companion.

When exposed above the surface of the water the carcass was found to be covered in spots with barnacles, which, the local mariners stated, was a sign of considerable age.

Brick Building Demolished by a Steel Coal Car.

A wooden coal car immediately behind was thrown twenty-five feet from the track and its contents dumped in the back yard of a grocery and between two buildings as nicely as if such had been intended. This occurred at Troy, Ohio.

AIRSHIP BUILT LIKE A BOAT

SOME aeroplane builders take the birds for their models, others look with much favor upon the form of construction used by boat makers in putting together their craft. One of the most recent air ships to appear on one of the testing grounds in France belongs to the latter class. Indeed, it is quite dissimilar in appearance to most of the aeroplanes that have preceded it.

This odd craft is the Gonnel Uniplane, as it is called. It is about 24 feet in length, 10 in width, or diameter, and weighs in the neighborhood of 800

New Boat-Like French "Gonnel Uniplane" Ready for a Flight.

It was recently tested.

Oil Pool of One Thousand Barrels That Was Fired to Save a Town.

pounds complete. The motor is of fifty horse-power and contains four cylinders. The photo shows the device all ready to take its flight through the air.

POOL OF OIL BURNED TO SAVE A TOWN

THE ten inch oil pipe line of a big transportation company near Coalinga, Cal., sprung a leak which developed into a bad break. Soon the oil was running toward the city in a menacing black stream and it was feared that the town would be destroyed by fire unless the oil were checked.

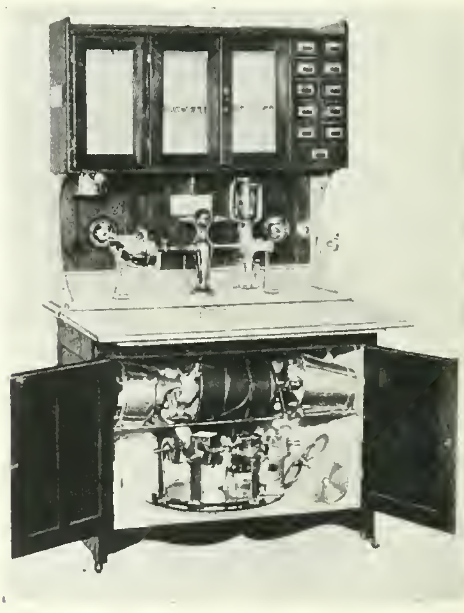
Quite a large pool, containing about one thousand barrels of oil, was formed less than a quarter of a mile from the outskirts, and it was decided to ignite this pool rather than allow it to overflow and reach the city. One thousand barrels of oil went up in smoke. In the intense heat the heavy oil became almost as thin as water and streams ran out from the main body in all directions, making long arms of flame. The fire lasted for about three hours, destroying the oil to the last drop and leaving a black crust over the surface it had occupied.

NEW AID FOR THE HOUSE-KEEPER

THE latest development in kitchen supplies is an electric cabinet.

The power is transmitted from the motor to the work shelf of the cabinet by means of a vertical shaft and by enclosed gears in a shaft head located in the center of the shelf to which the various devices to be driven are attached. An egg beater, vegetable slicer, coffee grinder, meat chopper, lemon grater, cherry pitter, knife sharpener, knife polisher, bread mixer, cake mixer, and an ice cream freezer are furnished with the outfit, any one or two of which can readily be attached by slipping the driving shaft of the device into one of the sockets on the shaft head. Means are also provided for holding each attachment in place while it is being used and the sockets are so constructed that there are no parts which can catch the clothing or fingers of the housewife or servant while the machine is in operation.

All the attachments are readily packed in the lower part of the cabinet when not in use, leaving the work shelf clear for other tasks that must in the meantime be performed.



The Housewife's New Ally—the Electric Kitchen Cabinet.

ARTIST IN CORK

A FRENCHMAN, coming from one of the southern provinces of the republic, has recently attracted much attention in the famous "Latin Quarter" of Paris by his very ingenious, and indeed remarkable carvings in cork. On account of the peculiar texture of the material in which he works, not only must he possess artistic cunning but an unusual patience and care as well. If you have ever attempted to trim down a piece of cork to serve as a stopper for a bottle you will have some realization of the significance of this statement.

He is very versatile in the character of his work—the sea, the jungle, the great monuments of civilization being equally well represented. Whether carving ship, elephant, or Pantheon, he is invariably successful in his results. As a patriotic Frenchman he is especially proud of his reproduction of the Pantheon, the structure in which the great of the nation find their final resting place. Among the most celebrated men buried here is the realist, Zola, as famous for his championship of the unfortunate Captain Dreyfus, as for his writings.

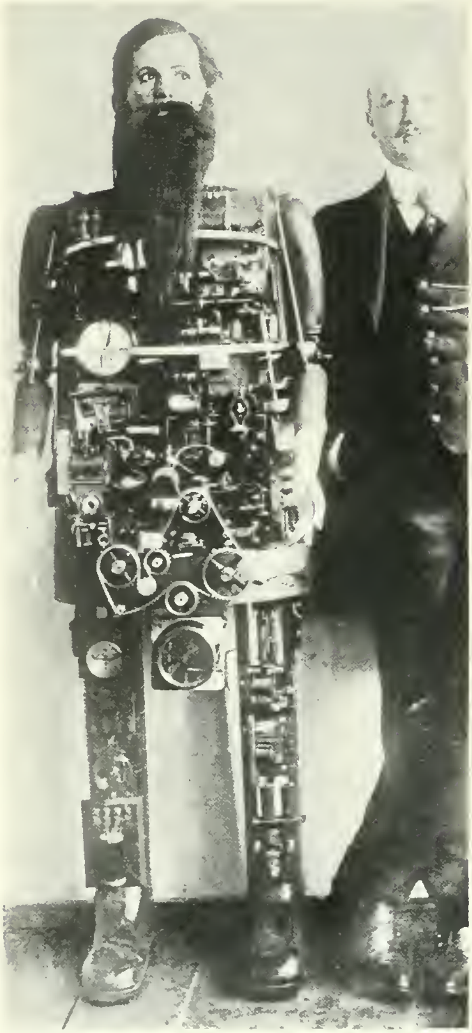
The artist first lays out his pattern very accurately, giving to this part of the work the utmost skill and attention, as, of course, all subsequent results depend absolutely upon these initial steps in the work.

Reproducing the Pantheon of Paris in Cork.

Boiling Eggs in a Hot Spring in Mexico.

LIVING CLOSE TO NATURE

IN an isolated part of the upper Rio Grande border region of Mexico is located a remarkable group of thermal springs, the waters of which are said to contain wonderful medicinal properties. Although the springs are visited by many health-seekers annually there is an entire absence of hotel and living accommodations at the place or within a distance of fifty miles of it. The nearest railroad point is fifty miles away. The visitors must provide their own tents unless they sleep upon the bare ground with the canopy of heaven for a covering, as most of them do. They must all shift for themselves when it comes to cooking and eating. The cooking is done almost exclusively in the hot water that comes from the springs. There are hundreds of the little streams of water trickling from the rock formation and forming pools in the arroyo. The temperature of the water ranges from 75 to 188 degrees Fahrenheit. In the absence of modern bathing accommodations the water is utilized for that purpose by shoveling out a hollow in the earth and using it for a bath tub. The efficacy of



MACHINE-MADE MAN THAT TALKS, SINGS, WHISTLES AND LAUGHS, AND HIS CREATOR.

these thermal springs was known to the Indians as far back as there is any historical record of the upper border region. In the early days many of the tribes of the Southwest used the hot water as a remedy for various kinds of physical ills. The nearest town to the springs is Candelaria, six miles distant, on the Texas side of the Rio Grande.

The illustration shows three of these health seekers dipping eggs for breakfast into the pot always kept boiling by Nature's hand. The free spirit of the open air seems to possess them.

MACHINE-MADE MAN TALKS

A BERLIN inventor has, after many years, succeeded in making an artificial man, "Occultus," who can walk and make other human movements, such as speaking, singing, whistling, laughing, etc.

Any person in public can give this artificial person orders and Occultus will follow them out. He obeys every word such as "go," "stop," etc. Some other person tells him to turn his eyes toward right and he so does. Another tells him to turn around and he does so.

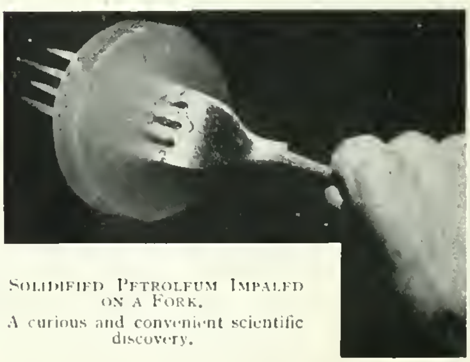
Occultus can also speak and answer questions, and is able to sing, laugh, and whistle.

Occultus is not an illusion or a hokus-pokus trick. He can be placed in a throng and wherever he stands, on wood, stone or carpets, he can always act.

The secret of Occultus is with the inventor alone, a Mr. Whitman.

POWER IN JELLY FORM

THE photo shows a piece of solidified petroleum which is described as a perfectly transparent product possessing the same colors as the petrols used for its manufacture. It is made in the form of a jelly of sufficient consistency to be carried and handled like any other solid body. It can easily be cut into pieces and may be conveyed in cardboard boxes without danger. The physical properties are the same as in liquid petrol, evaporation is very easy and with the same heating power its inflammability and heating power is very intense as also is its carburetting power. When ignited it does not melt but burns like wood or coal.

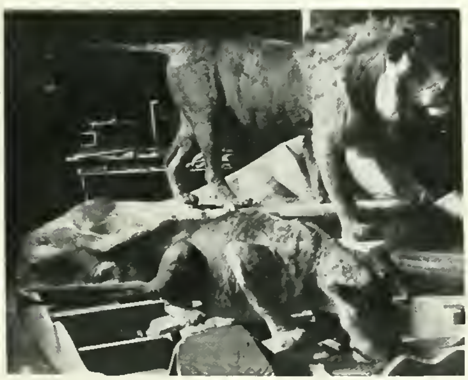


SOLIDIFIED PETROLEUM IMPALED ON A FORK.
A curious and convenient scientific discovery.

MOUNTING THE ROOSEVELT LIONS

THE photograph below was taken the other day in one of the workrooms of the National Museum at Washington. It shows a group of lions in process of being mounted—the scene to be represented being "Lions at the Drinking Place." A couple of young lions and another lioness will be in the group when it is finished.

These lions were "collected" by the recent Roosevelt hunting expedition in the wilds of Africa.



"Lions at the Drinking Place."
Specimens collected by Theodore Roosevelt in Africa, in process of being mounted at the National Museum, Washington.

MINIATURE ELECTRIC FOUNTAIN

Psyche in an Electric Fountain for Table Decoration.

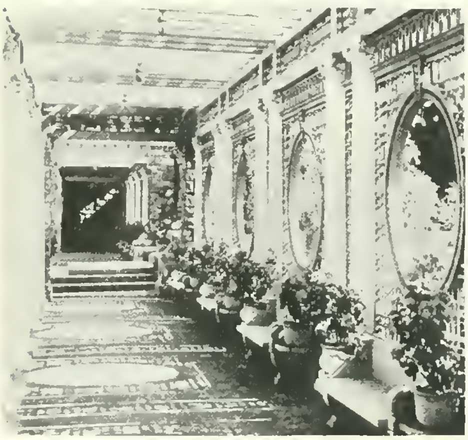
THE imagination can hardly do justice to the charming effect of the fountain shown in the illustration when used as a centerpiece upon a dinner table. The endless variety of colored flashes emanating from the glass rock in the center set innumerable liquid rubies, sapphires, and diamonds dancing in every direction and streams of glistening spray pour over the figure of Psyche as she stoops to catch the reflection of her face in the water below. All this is done by simply turning a switch for the fountain is operated by electricity being connected with the lighting fixtures by means of a cord.

A centrifugal pump driven by a small electric motor supplies the water from the basin within to a multiplicity of nozzles surrounding the figure in the center. After the streams have spent their force the water returns to the basin to be pumped up again as before. No plumbing is required as all the water used is contained within the basin of the fountain. Electric lights within the glass rock cause it to throw out many colored lights through its variegated sides.

As an artistic decoration for a reception room, hall or library the fountain is most attractive and the scenting of the

SWIMMING POOL ON THE POCANTICO HILLS, ESTATE OF JOHN D. ROCKEFELLER, NEAR TARRYTOWN, NEW YORK.

Steps lead down under the water at one end. Beneath the coping stones a pipe, pierced at intervals by fan-shaped outlets, is run. This serves to spread the water and throw it toward the center of the pool in a perfect mist, so that when the sun is shining the pool is filled with a myriad of rainbows.



INTERIOR OF THE PERGOLA ON THE ROCKEFELLER COUNTRY ESTATE.

When this photo was taken the vines intended to cover it had not yet reached the roof. This is an ideal retreat for the hot days and warm nights of summer.

water adds another rare and entertaining feature seldom found in a house decoration of this character but which modern luxury now seems to demand.

As a means of entertainment for a sick person the fountain fulfills a happy mission, while the addition of a mild antiseptic to the water renders the air of the room sterile. It also cools the atmosphere and collects the dust from the air, depositing it in a strainer from which it can easily be removed from time to time as required.

The fountain shown in the illustration is 26 inches high with a base 12 by 16 inches. The basin is constructed of bent art glass with a base and figure of bronze with appropriate finishing touches to round out the design. The whole presents a most pleasing and artistic effect to the eye.

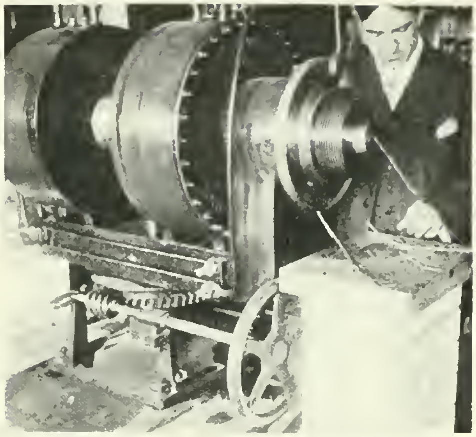
NO MORE CRANKING

WHEN one is cranking an auto engine, if the compressed charge in one of the cylinders happens to be ignited before the piston of that cylinder is ready to begin its downward stroke, the result is known as a "back-fire," or in other words the explosion in the cylinder turns the engine for a part of a revolution in the reverse direction. If the man at the crank has a good grip on its handle he is likely to be jerked violently downward and there is danger of his being injured in several ways as a result.

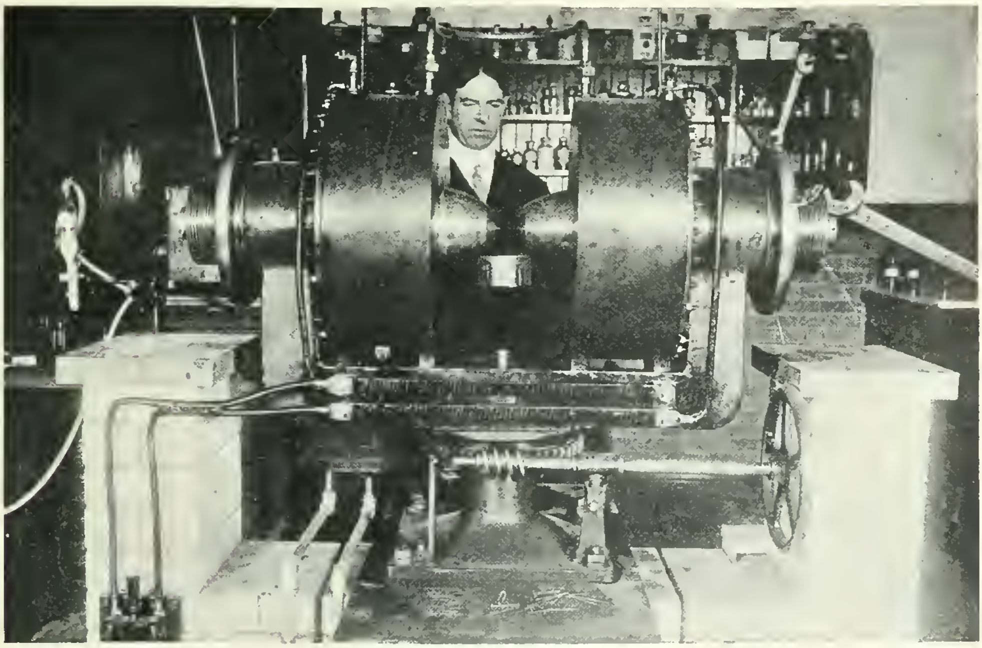
There are numberless cases of sprained and broken wrists resulting from back-firing and not a few of injury to the face from violent collision with the car's radiator.

There is not sufficient space to describe all the devices that have recently been placed upon the market for this purpose, but one is worthy of consideration because of its ingenuity and the near approach to the principle upon which the automobile engine normally operates.

As will be seen by reference to the illustrations on the next page, the apparatus consists of a hand pump attached to the floor of a car within easy reach of the driver and a tube extending from it making connection through small valves with each cylinder of the engine. The opening and closing of the valves is

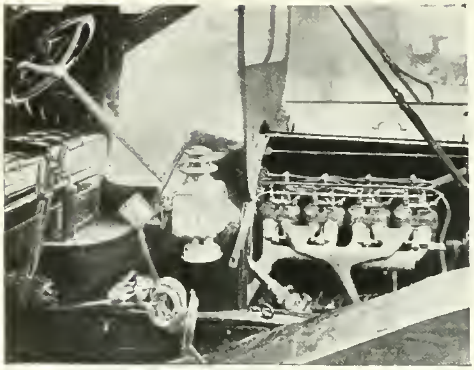


THE LEAKAGE OR "STRAY MAGNETIC FIELD" OF THE MOST POWERFUL MAGNET HOLDING WIRE NAILS IN SERIES.



THE MOST POWERFUL MAGNET IN THE WORLD SUPPORTING A GLASS BOWL BY MEANS OF THE POWER OF ATTRACTION EXERTED UPON A SMALL PIECE OF IRON INSIDE THE BOWL.

This magnet is at the United States Government Bureau of Standards, Washington.



"No Cranking" Apparatus Attached to a Motor Car.

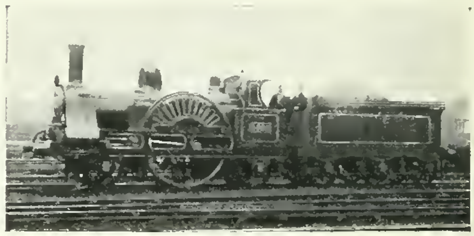
accomplished by means of a push rod extending through the dash in front of the driver.

In raising the piston of the pump, air is drawn in through a carburetor which is also supplied with gasoline from a small tank within the pump's cylinder. This action prepares an explosive mixture similar to that regularly supplied the cylinders of the engine when running. The downward pressure of the pump forces the mixture into the cylinders and two or three such operations supplies adequate compression so that the engine may be started on the spark.

LOCOMOTIVE IN SERVICE SIXTY YEARS

FEW locomotives have remained in service sixty years running express trains. This, however, is the distinction of the celebrated engine Cornwall, which was designed by the late Mr. F. Trevithick for the London and Northwestern Railway. Intended for high speed the single driving wheels were eight feet six inches in diameter, and to keep the center of gravity low the boiler was slung underneath the driving axle. The engine was built at Crewe in 1847 and was named "Cornwall," after Trevithick's native country. As originally constructed the engine ran on eight wheels, the two leading pairs being three feet six inches in diameter and the trailing pair four feet. The weight of the engine was only 27 tons.

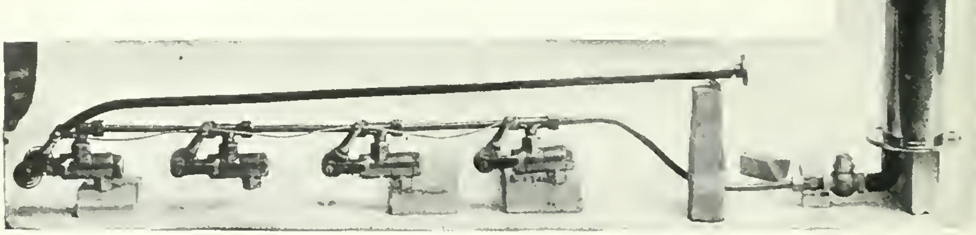
The underhung boiler was not found satisfactory and in 1858 the engine was rebuilt to the form shown in the photograph, with the boiler in the usual place above the driving axle. Twice since then the boiler has been renewed and other improvements made.



A Patriarch Among Engines.
A locomotive in service in England for sixty years.

The engine has only recently been withdrawn from service but is still capable of hauling light trains at record speed. It worked regularly for many years between Liverpool and Manchester, averaging 31½ miles in 40 minutes.

This locomotive may well be called a "Patriarch Among Engines," with a record and a length of service like this behind it, such as none other can probably boast.



THIS APPARATUS RENDERS CRANKING OF AUTOS UNNECESSARY
A description of its action is given in the text.

NEW MEDICAL INSTRUMENTS

BY the use of an instrument lately invented, iodine can now be applied in the form of vapor, thus avoiding the secondary effects produced by the tincture of iodine. The secondary effects are due not to the iodine but to the drying effect of alcohol, its dissolvent.

The vaporizer shown by our photograph, is composed of a glass cell attached to a cylinder by a metallic binding, at the center of which is a tube which brings the air from a pear-shaped india rubber blowing-apparatus as well as from an electric connector communicating with the spiral of platinum attached to its extremity. The iodine is vaporized by the current of air from the blowing apparatus which, on its way from the thread of platinum, carries it to an extremely high temperature.

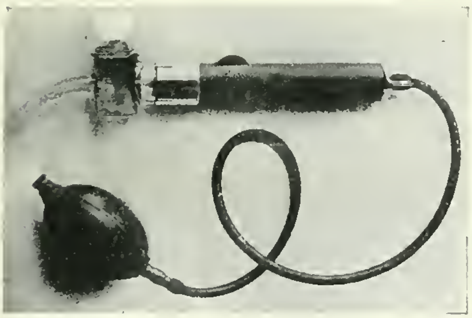


FIG. 1—VAPORIZER FOR IODINE FOR TREATING DEEP WOUNDS AFTER OPERATIONS.

This new way of applying iodine is particularly valuable in treating deep cavities after operations.

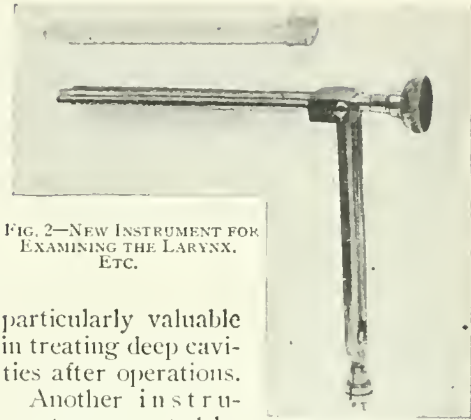


FIG. 2—NEW INSTRUMENT FOR EXAMINING THE LARYNX, ETC.

Another instrument represented by figure 2 is the pharyngoscope. It is used for examining the bucco-nasal cavity and the larynx. It is composed of an optic apparatus which assures an angle and very extended vision; it is furnished with a small lamp with metallic thread, an accumulator of 4 volts furnishes the current to feed the lamp.

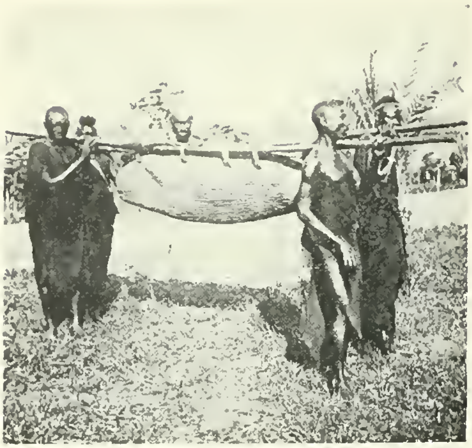
Points difficult to reach by the laryngoscopic mirror are easily examined by this instrument.

COLLEGE BOYS LIVE IN TENTS

BEGINNING with four years ago, the attendance at the Texas Agricultural College barely grazed the 400 mark. With the leaps and bounds with which this great state has grown in intelligence and particularly in agricultural knowledge during the past four years the enrollment has grown apace till today the students number 1,100. This increase has been housed in tents and the institu-

A CANDY BOUQUET FOR THE MATINEE GIRL.

She now provides herself with a dainty bouquet of flowers, real blossoms, but candied. They are mounted artistically with stalks and leaves of thin strips of candied citron and tied together with a ribbon. The sweets are all naturally colored and scented and form a feast for the eye and the sense of smell as well as for the sweet tooth.



HOW THEY CARRY KINGS IN GERMAN EAST AFRICA.
The Sultan Kiegoma of Usumbura is riding in the hamper.

tion is thinking seriously at present of increasing the tent colony to take care of the influx of new students who will appear with the beginning of the new school year in the fall.

"But," is the question not infrequently asked, "do the poor students have to live in those tents all winter through?" "Certainly," is the reply of the student guide as he wends his way through the white walled alleys which ramify through the 243 canvas sleeping apartments, "and moreover the boys rather enjoy their experience."

To the uninitiated the idea of living in a canvas tent all through the nine months which make up the school year and "enjoying it" would hardly seem consistent and yet it is entirely true. Of course there is provision for heat in the tents as well as light and besides this the tent walls are wainscoted up to where the roof intersects with the perpendicular walls. The tents are also floored with tight matched flooring and provided with comfortable sleeping cots. The heating is accomplished through the use of an ordinary sheet iron stove with the aid of ordinary wood for fuel. There may be more efficient ways of heating houses but not tents, and to say that the students are satisfied with this mode of keeping warm is putting it mildly. With the combination of dry and green wood provided for the use of the students the chill wintry blasts which sweep the snow over the Texas prairies have no terrors and when the bugle blows for study hours the pupils bend over their books to the light of hundreds of electric bulbs which illuminate the great expanse of tents so that it may be seen for miles around.

A HOME IN TENTS.
Where boys at the Texas Agricultural College eat, sleep and study.

SUMMER HOUSE OF CONCRETE BUILT IN IMITATION OF A STRAW HUT.

CONCRETE LOOKS LIKE WOOD

THIS dome, built of concrete, is an imitation of a log and straw hut, but constructed in such an artistic manner that the illusion is most true even after a close examination. In fact, many persons do not believe it to be made of iron frame and concrete but of trunks of trees, with bark and straw.

To make the illusion more complete, in some parts of the timber trunks the artist has imitated the work of the teredo worms and some of the pillars appear to be rotted by the same.

This work of art is a part of the beautiful gardens which are in one of the suburbs of Havana, and has been made by Mr. Ramon Magriñá, a modest artist, who is in charge of the gardens. This dome is used for picnics and has a seating capacity of 200 persons. In the center there is the spiral stair leading to the observatory above, from which a magnificent view of the Almenardes river basin is enjoyed.

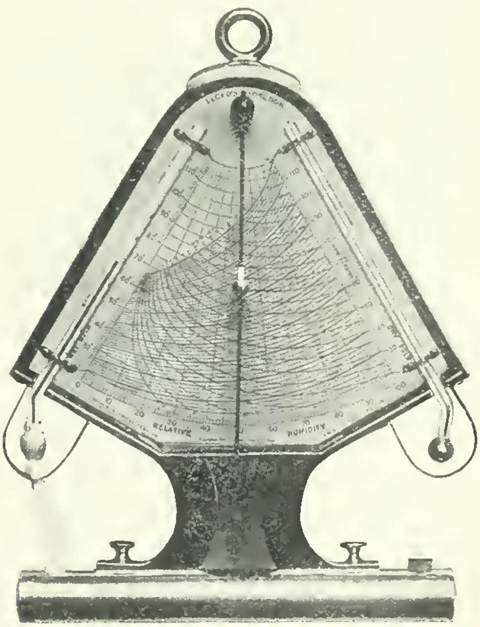
MEASURING "AIR WETNESS"

HERETOFORE instruments for measuring this peculiar quality of the atmosphere have been complicated devices. With the new instrument shown in the illustration, however, a person unfamiliar with mathematics or the laws governing the qualities of the atmosphere, can readily ascertain whether or not the healthful amount of moisture is contained in the air we breathe.

A glance at the illustration of this new instrument shows that there are two thermometers in the instrument, one on either side of the chart. The bulb of the tube on the left, you will note, has a wick wrapped about it and extending down into a tank in the base containing water. This is called the wet bulb and indicates a temperature somewhat lower, as a rule, than that of the dry bulb on the opposite side, because of the evaporation which takes place from the moistened wick surrounding it. The greater the heat of the room, the greater will be the evaporation and the consequent difference in the temperature recorded by the two thermometers.

If the air of the room contains much moisture, the wick of the wet bulb will give off but little moisture, consequently there will be but a slight difference in the temperature recorded by the wet and dry bulbs.

Upon the index finger is an adjustable



FOR MEASURING THE MOISTURE IN THE ATMOSPHERE.
A new instrument that requires no special knowledge to use.

THE AIRDALE TERRIER, "LADY."

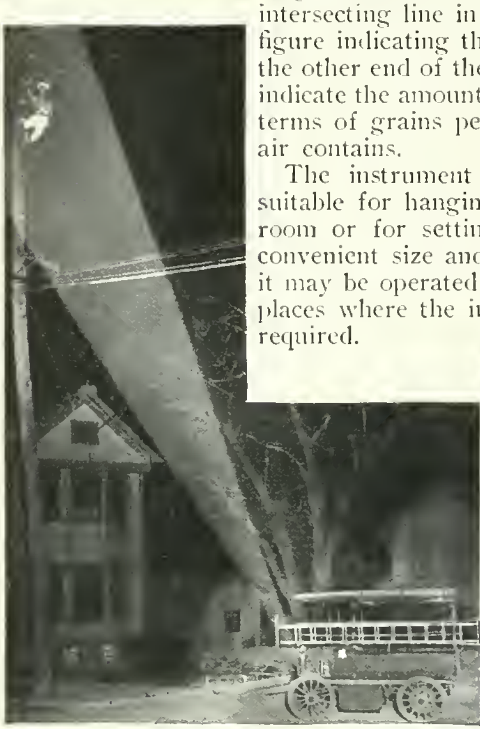
Famous German police dog. She has taken 17 murderers and innumerable thieves.

pointer which, in taking a reading, is first set to correspond with the degree of temperature recorded by the wet bulb. It is then moved to the right until it intersects the line extending downward from the degree of temperature recorded by the dry bulb. When the adjustable point is at this intersection the index figure will point to the figure at the lower part of the chart indicating the degree of humidity.

In addition to the above, the dew point, or, in other words, the amount of moisture the atmosphere will contain at the present temperature, may be ascertained by following the curved lines running from left to right. The end of the intersecting line in any case leads to the figure indicating the dew point, while at the other end of the same line the figures indicate the amount of water measured in terms of grains per cubic foot, that the air contains.

The instrument is made in a form suitable for hanging upon the wall of a room or for setting upon a shelf. Its convenient size and the ease with which it may be operated recommend it for all places where the information it gives is required.

THE POLICE DOG "BOSCORON NEPERIN" ARRESTS A FUGITIVE.



THIS LINEMAN HAS ALMOST DAYLIGHT BRIGHTNESS TO WORK BY.

MORE LIGHT FOR THE LINE MAN

EMERGENCIES often make it necessary to do certain repair work on electric light wiring at night. This is attended with much difficulty and sometimes danger as well in dark streets because of the inability of the lineman to see what he is doing. In Dayton, Ohio, they have solved this problem in a most efficient manner by connecting an electric automobile headlight to the storage batteries used in driving the trouble truck and projecting the light upon the top of the pole where the lineman is working.

The photograph shows the light in operation. A 25 candle power Tungsten lamp is used with a parabolic reflector, the lamp having a spiral coil filament which makes a brilliant spot of light and enables the operator to focus it accurately upon the spot where the lineman desires to work.

Most satisfactory results from the light are claimed for it, as it saves much time and the extra help usually required for the usually very troublesome emergency calls of this kind.

STRONGEST MAN EVER AT YALE.
E. O. Kistler, of Denver, who scored 2,270 points in recent strength test, breaking his predecessor's record by over 200 points.

DOG WALKS TIGHT ROPE

THIS striking picture of a dog on a tight-rope along with his master, shows what a little patience and kindness will do in training a pet. It is pretty evident from his expression that the dog does not feel at ease in his exalted position, but his faith in his human friend is so great that he submits nevertheless. The photograph was taken at the beach near San Diego, California.

DOG AND MASTER TAKING A TIGHTROPE "JAUNT."

WOODPECKERS' STOREHOUSE

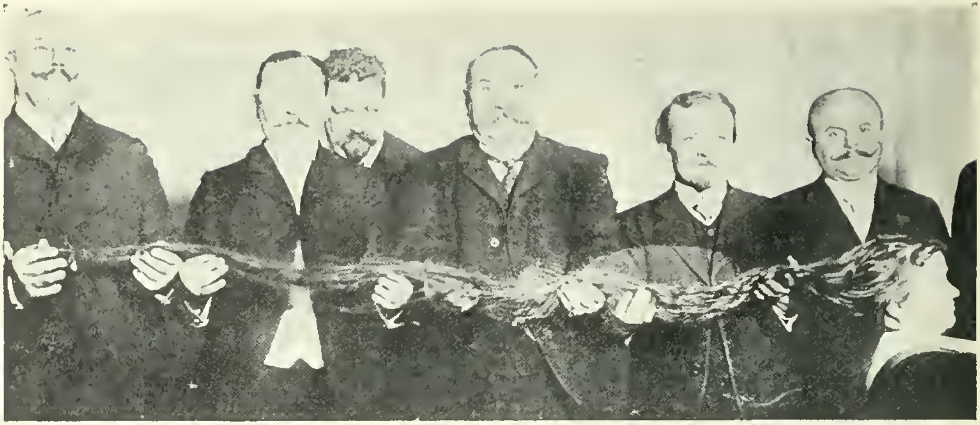
IT may be true that birds are guided solely by instinct, but in some cases the dividing line between instinct and reason is so indistinct as to be almost imperceptible. An illustration is supplied by the behavior of a species of woodpecker that abounds in the mountainous regions of California. In the fall, when the acorns are ripe, it pecks numberless holes in the bark of trees, and in each hole inserts an acorn. Every acorn is placed in the same way, with the apex pointing towards the heart of the tree; and all are wedged in so tightly that one can hardly pull them out with the bare fingers.

Anyone seeing the woodpeckers thus putting away acorns might suppose that the birds intended to eat them in the winter months, when other food becomes scarce. That is not the bird's idea at all. It is providing for a supply of fresh meat for the early spring. When spring comes, a worm develops in each acorn; and when the worm is fat, juicy and fully developed, the woodpecker goes after it, breaking the protruding shell, and devouring its helpless occupant.

LOOKS LIKE A BOILER PLATE STUDDED WITH BOLTS.
It is, however, a tree drilled full of holes in which acorns are placed by woodpeckers for use in the future.

HARD WORK FOR THE AUTO

A NEW state road, between Seattle and Spokane, Washington, is now being built by a method almost revolutionary in character, in that the crushed stone, from which the road is largely built, is handled entirely by machinery from the time it enters the crusher until



THE PRIZE WINNER IN A CONTEST FOR THE LONGEST HAIR IN BERLIN.
This woman's hair is ten feet long.

it is put into service by being spread upon the roadbed.

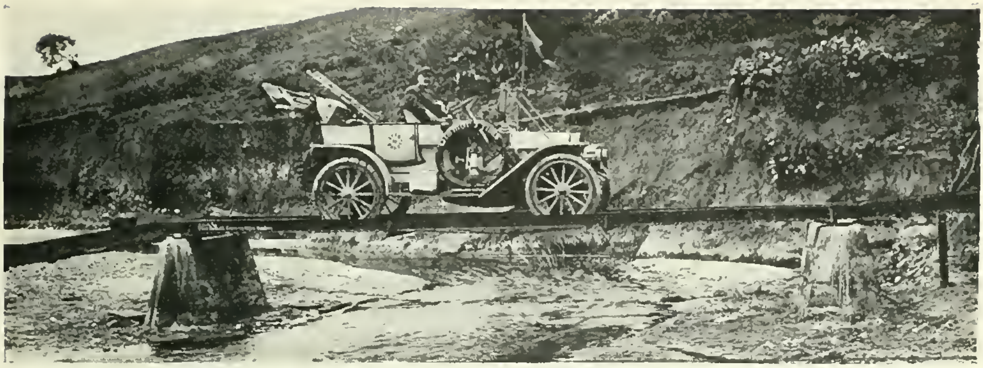
The stone runs from the crusher directly into self-dumping cars, in which

This Motor Truck Does the Work of Thirty-six Horses.

it is transported to the contractors' bunkers. These bunkers are so located that the truck can drive under and receive a load by merely opening a gate. From this point the truck carries and dumps the stone upon the roadbed, spreading it by moving ahead upon the plank stringers.

The motor truck doing the work is constructed with a steel hopper body and carries about 3⅗ cubic yards of stone, or 8,500 pounds at a trip. This, with the truck's own weight of 1,500, makes a total of 10,000 pounds carried at each trip. The truck makes 22 round trips every day, or about 18 times the capacity of one team, as it was estimated by the contractors that each team would not be able to make more than one trip daily, as the hauling is up a very steep grade, carrying approximately four cubic yards at a trip. At a cost of $5.00 per day for each team and driver, the expense of delivering the truck's capacity of stone would be about $90.00, while the truck with two men delivers the same quantity of stone at a cost of $12 per day.

SCHOOL OF THIRTY-SEVEN HUGE WHALES CAST ASHORE ON THE COAST OF TASMANIA.
In pursuit of a multitude of fishes they ran aground in shallow water, and were left to their fate by the receding tide.



BRIDGE FOR AUTOMOBILES IN SOUTHERN CALIFORNIA.

The Automobile Club of Southern California is a live organization which is spending thousands of dollars to improve the highways of that section of the country; a good work, the benefit of which all may share, whether they are members or not. One of their few pieces of work which is exclusively for motorists is the bridge of structural iron and concrete shown in this photograph. It is arranged with a couple of grooves which take the wheels of the auto, but as there is no roadway between them it is impossible to drive a team across

DOUGH UNTOUCHED BY HANDS

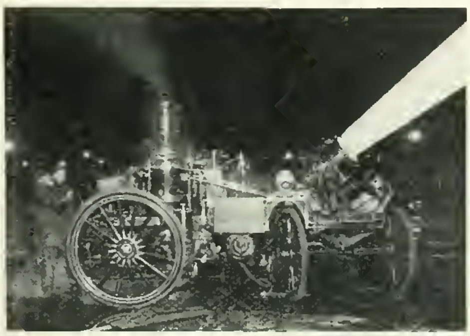
IN Muskogee, Oklahoma, an electric bakery is in operation. It is equipped throughout with electric driven apparatus. The plant has a capacity of 40,000 loaves of bread a day, in addition to the numerous side lines of cakes, pies, rolls and other pastry and it will be seen that this is a profitable consumer for the electric supply company.

Without doubt this is one of the most modern bakeries in the country. The flour and dough are never touched by human hands until the loaves come out of the oven ready for delivery to the consumer.

The power installation consists of numerous small motors from one to five horse-power in size, each machine being individually driven, the total connected load being thirteen horse-power. There

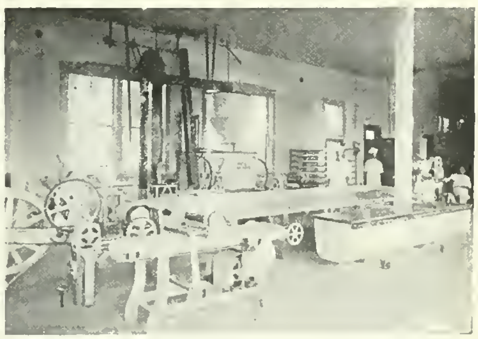
NEW EDIBLE MUSHROOM DISCOVERED BY A FRENCH BOTANIST.

This—the pleurotus cornucopioides—is especially suited to cultivation. It is usually found on the stumps of old elms.



POWERFUL NEW SEARCHLIGHT IN USE ON A NEW YORK FIRE ENGINE.

This greatly facilitates the fire fighters in placing ladders, etc.



WHERE BREAD IS KNEADED AND BAKED BY ELECTRICITY.

A modern bakery at Muskogee, Oklahoma, which turns out 40,000 loaves of bread a day.

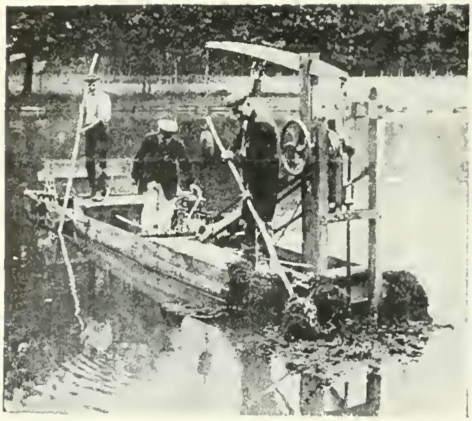


Fig. 1—Taking Out Weeds by Machinery.

Fig. 2—Replacing the Apparatus in Position

is a dough-divider driven by a two horse-power machine and an egg beater operated by a one horse-power motor. A three-barrel dough mixer is supplied with power from a five horse-power motor, which also drives a dough break flour lifter and conveyor, all grouped on the same motor. The 700-loaf revolving oven is provided with a two horse-power machine.

MACHINE FOR WEEDING WATER COURSES

A MOTOR boat which will be of great service to navigation as well as for public hygiene, has just been invented for mowing aquatic weeds.

Fig. 1 shows the machine mowing a fish pond in the grounds of the Institute of France at Chantilly. The boat carries near the front a monocylindrical gasoline motor of 8 horse power. The cutting bars are operated in an alternating movement by cogged connecting rods fitted together with a spring; it mows a width of 4 meters from 2.0 to 2.5 km. per hour. Three men are sufficient for the service. One drives the motor, the second guides the boat, sometimes with a pole, sometimes with the rudder, while the third man is occupied exclusively with the weeding. The weeds on being cut float to the surface and are picked up by a light floating dam, formed of a simple pole with vertical pegs, which is placed obliquely across the canal. The dam is moved along as the mowing machine advances. When meeting a vertical obstacle the cutting bars can be folded backward, as illustrated by Fig. 2. In marshy sections the malarial condition may be avoided by destroying the parasitic vegetation.

FIRST SUSPENSION BRIDGE IN AFGHANISTAN

OUR photograph represents the first steel bridge constructed in Afghanistan. It was completed and opened for use last year. The bridge is built over the Caboul river on a level with the gorges of Diroontah. Before this bridge was built communications were assured only by means of ferry boats operated by cables; this very primitive medium of transportation became insufficient and it was found

This Bridge is 820 Feet High in the Middle.
Gôteik railway bridge over the Caboul river, Afghanistan.

THE "AERMOBILE"—A MONSTER AEROPLANE UNDER CONSTRUCTION IN CALIFORNIA.

necessary to replace it by this bridge 130 meters in length. The construction of it was extremely difficult because of the steepness of the embankments.

HUGE "AERMOBILE"

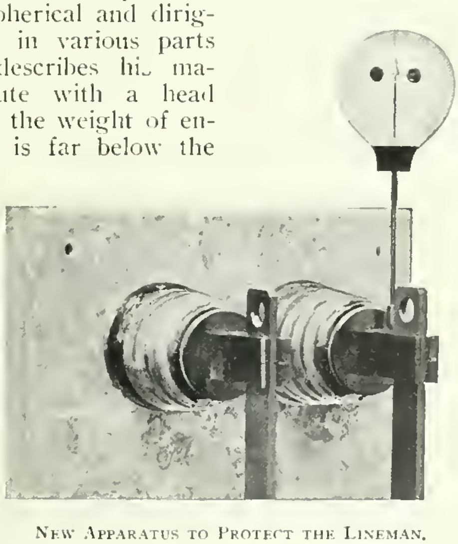
A MONOPLANE of the gigantic dimensions of 105 feet by 60 feet, and with a lifting area of 6,000 square feet has been built recently at Venice, California, and is now awaiting the installation of its two 100 horse power engines before attempting flight. This is not only the world's largest aeroplane, but is also an absolutely new attempt at the solution of the problem of flight. The aermobile, as it is called, is the work of Captain August E. Mueller, an aeronaut who has had experience with balloons, both spherical and dirigible, for many years in various parts of the world. He describes his machine as "a parachute with a head and a tail," and as all the weight of engines and passengers is far below the great oval plane, there should be no danger of its turning turtle.

The "aermobile" has six metal propellers, each furnished with three blades. These propellers are well distributed under the plane, two in front, two on the rear and one midway down each side.

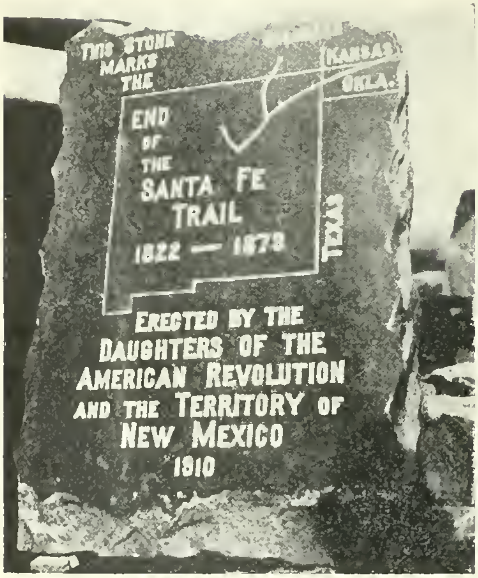
DETECTOR FOR "LIVE" WIRES

ELECTRICAL wiremen, in making repairs or adjustments in central stations, need to know whether the current is on the lines and other conductors, so as to avoid risk of shock. But since the presence of the current makes no difference in the appearance of the conductor, there was considerable risk in this work until the invention of the voltage detector illustrated herewith, which announces to the eye whether the conductor is "alive" or not.

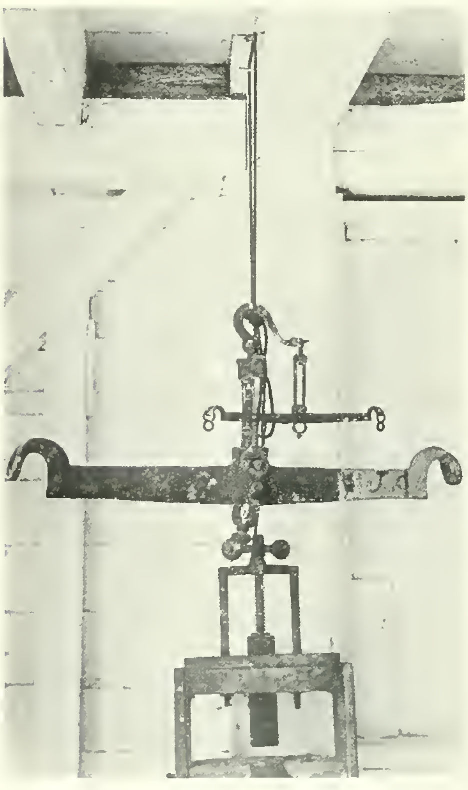
This simple contrivance was invented by J. B. Taylor, an American, and has obtained a special prize in France as an accident preventer. It consists of a light S-shaped metal vane, pivoted at its center upon a vertical metal stem like a compass needle and enclosed in a small glass globe. The lower end of the metal stem is fixed to the conductor which it is desired to safeguard—such, for example, as the disconnecting switch of a high-voltage power-transmission line. The electrostatic charge on the conductor, when alive, produces a repulsion at the points of the vane, causing the latter to spin around; and



NEW APPARATUS TO PROTECT THE LINEMAN.
The detector states the presence of a dangerous voltage.



MONUMENT MARKING THE TERMINUS OF THE FAMOUS SANTA FE TRAIL.
It will stand in the Plaza, at Santa Fe, New Mexico.



RELICS OF THE HALCYON DAYS OF FUR TRADING.
Scales and letter press used a century ago by the American Fur Company.

the motion is made more conspicuous by light paper disks attached to the points. One of the detectors mounted on each line reveals to the eye, without fail, the presence of a dangerous voltage in the wires.

MARKING LAST OF SANTA FE TRAIL

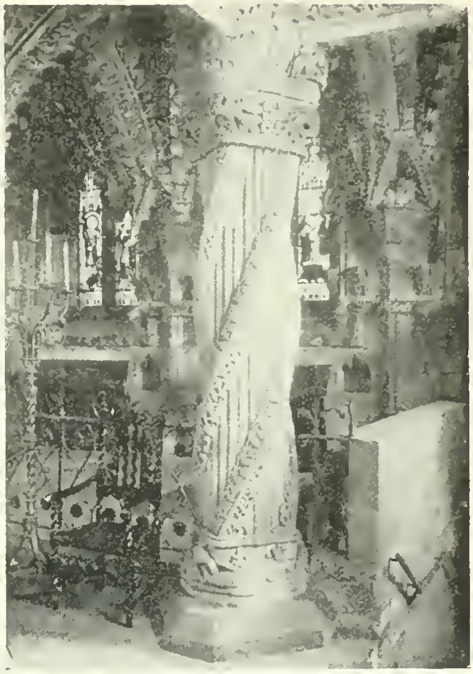
THE old Santa Fe Trail, the most famous pathway of the pioneers in America, will soon be marked from beginning to end with the type of granite tablets illustrated here to show the traveler the route of the scout, the Indian, the soldier and the settler. The course through Missouri and Colorado has already been marked with twenty-five or thirty tablets, erected by the Daughters of the American Revolution, and the present tablets are to mark the course of the trail through New Mexico, the last one to be placed in the Plaza in the city of Santa Fe. The first one of the stones in New Mexico will be placed at Lynn, a few miles below Trinidad just over the border. One will stand at Las Vegas, five in the vicinity of Raton, and the others at intervals till Santa Fe is reached. The one destined for the Santa Fe Plaza is a little more elaborate than the others, and bears on its polished face a little map of the trail, showing its beginning and end and the courses of both branches. The others bear merely the lettered inscription shown in the photograph. The tablets are of dark gray Colorado granite, at once durable and pleasing to the eye.

ORIGINAL ASTOR SCALES

THIS illustration shows two pairs of scales and an old-style letter press which were used by the American Fur Company, of which John Jacob Astor was the head. This company was organized on Mackinac Island in 1815, and continued in business until 1852. The original building in which the furs were stored is still standing and is used as a hotel. These scales are in the possession of the Cable estate, which also owns the building in which the historic relic is housed.

THE FAMOUS PRENTICE PILLAR

A PLEASANT ride of two hours from Edinburgh will bring the visitor along hawthorn-fringed roadways to an architectural gem, Roslyn Chapel. Not the least pleasing feature of this fairy-like structure is the marvelous Prentice Pillar with its tale of revengeful jealousy. The story goes that while the chapel was in process of construction, being founded in 1446, the master workman went to the Continent for new ideas. When he returned he found that his apprentice had constructed this wonderful pillar. Enraged beyond bounds by this act, which he considered unwarranted audacity, he seized his sculptor's mallet and killed his assistant on the spot. Furthermore, when the Bishop of St. Andrews, whose diocese included Roslyn Chapel, was in Rome at the time when the chapel was nearing completion, he obtained from the Pope a dispensation to reconcile Roslyn, that is, to cleanse it from the pollution of some deed of violence committed within its precincts. After the publication of "The Lay of the Last Minstrel" Roslyn Chapel became so popular that a coach was started from Edinburgh and a new inn was built, taking the place of the old inn where Boswell and Dr. Johnson dined.



ROSLYN CHAPEL. MADE FAMOUS BY SIR WALTER SCOTT'S "LAY OF THE LAST MINSTREL."

THE FIRST BRITISH BATTLESHIP WITH BUT ONE MAST—THE *Hercules*.
Her armament consists of ten 12-inch guns with a full broadside. She has a displacement of over 20,000 tons.

AERO WON'T TURN TURTLE

A RESIDENT of Totowa Borough, New Jersey, has constructed a "non-capsizable" aeroplane, the inventor claiming that, on account of its design, it is impossible for it to turn turtle while in the air. There is no other like it in the country today. Clifford B. Harmon built one, but never installed the engine. There are fourteen of similar make in process of construction in France.

The machine is equipped with a 50-horse-power engine and a nine-foot paragon propeller. This strange-looking bird weighs 620 pounds. The circular construction—shown in the picture—is twenty feet in diameter and has a depth of nine and a half feet. The gasoline tank and radiator are inside the massive circular frame, which is made of naid, a specially prepared linen, made in Ire-

SOMETHING SAFER FOR THE AERONAUT.
An aeroplane that can't turn turtle

land, and coated in this country. The motor is in front of the frame, while the driver sits under and behind the machinery. The whole affair is set upon four aeroplane wheels.

Several flights, none of them very successful, have been made.

BEARS RECAPTURED WITH SWEETENED WATER

THE manager of a little circus touring the San Joaquin Valley was careless enough to allow three performing bears to slip out of their cages and roam about the countryside a short time ago.

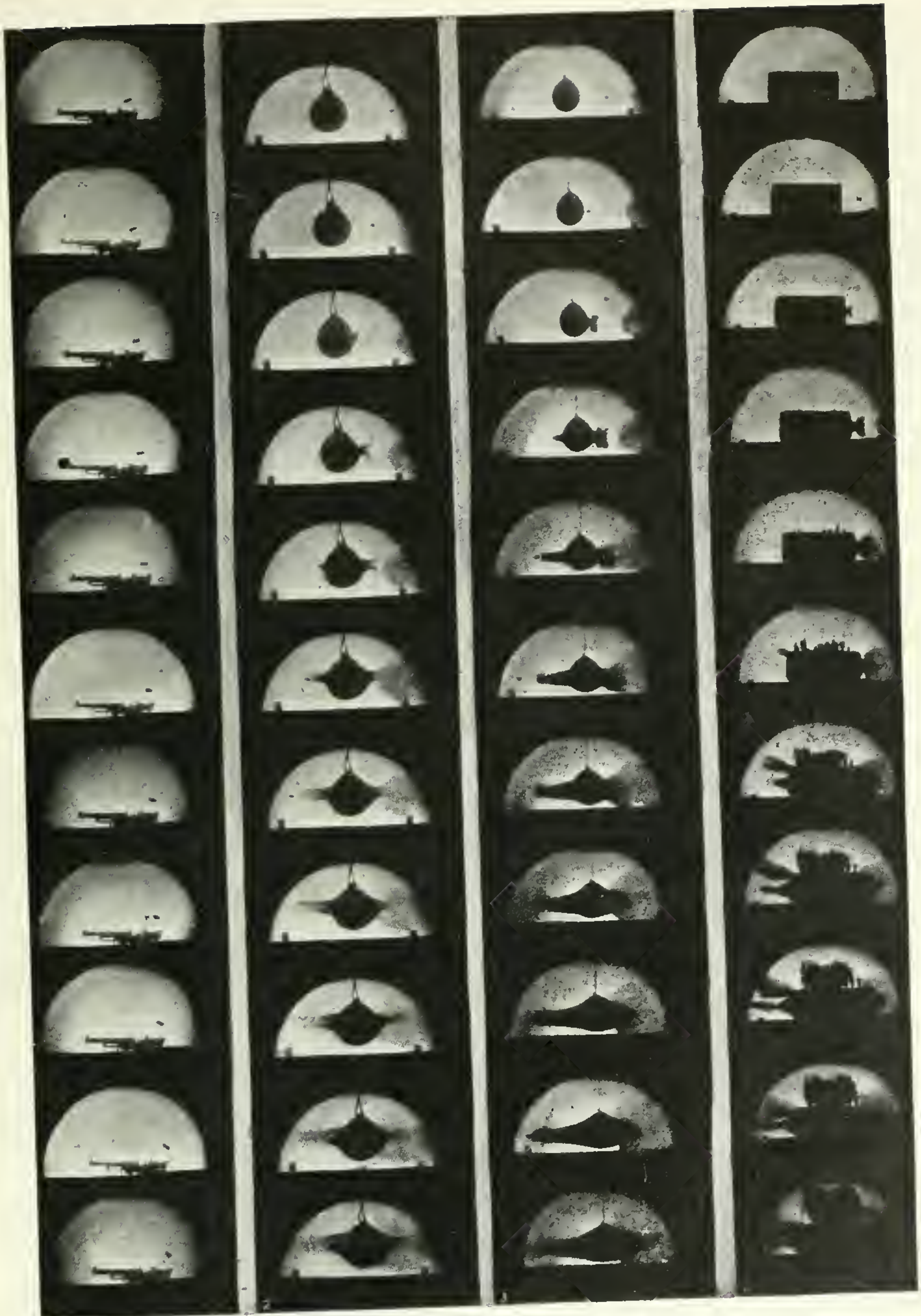
Fortunately the only weapons that happened to be available were shot guns charged with bird shot, so that when the ranchers went forth to do battle with the invaders the Bruin family was only tickled with a few little lead pellets that could not penetrate their tough hides.

Meanwhile the manager appeared and quieted the fears of the populace, explaining that the wild animals were only trick bears and were not likely to do any serious damage. His main worry was to get them back to their cage. An acquaintance of his who happened along in his automobile hit upon the right idea. This man had seen the bear trio professionally engaged in the show, where they sat around a table and drank huge quantities of sugar and water from beer bottles. The automobile owner loaded up his tonneau with as much of the sweet mixture as he could find, threw in the clutch and sallied forth to the neighborhood where the bears were enjoying their liberty.

Once near enough to them to display his bait there was no further difficulty. The bears recognized the bottles and shuffled forward eagerly. Liberty was sweet but sugared water was sweeter. All three of them were enticed into the automobile where they sat up as if the show were on and poured gallons of the delicious beverage down their hairy throats.

It was at this time that the camera man took the pictures and immediately thereafter they were hurried back to their cages.


RECAPTURED BEARS FORGETTING THEIR ESCAPADE IN A DEBAUCH OF SWEETENED WATER.



CINEMATOGRAPH FILMS—"MOVING PICTURES"—TAKEN AT THE RATE OF 5,000 A SECOND. THIS ACHIEVEMENT IS DUE IN PART TO THE USE OF ELECTRICITY.

Figure No. 1 shows the automatic discharge of a used cartridge from a revolver; No. 2, a projectile approaching, entering and passing through a ball of clay; No. 3, same through a rubber ball; No. 4, projectile approaching and entering a lead tube full of small holes.

A Freak Photo.

This curious appearance was brought about by placing the negative too near a hot stove in order to dry it quickly, causing the gelatine on the plate to run.

SEA MONSTER CAPTURED BY WOMEN

PROBABLY as weird a monster as was ever hauled from the sea is the gigantic and shapeless fish which was brought to the gaff by the three fisherwomen shown beside it. It is a sun fish weighing 1,600 pounds and is said to be the record catch of that sort. It was captured off Catalina Island, famous all over the world as a piscatorial paradise. This queer creature is almost tailless and propels itself by the powerful dorsal and anal fins, the pectoral fins being small and comparatively weak. It has prominent eyes and a small mouth apparently to offset this prominence, with an undivided dental plate somewhat like that of a turtle.

It has no value for food, as the flesh is tough and stringy, but oil is sometimes extracted from the huge carcass. It is stated that the name of the sun fish is given to this creature from its habit of basking on the surface of the water in bright weather.

It is as shapeless and hideous a lump of flesh as many of the monsters that spend their lives in the depths of the ocean and never come near the surface.

Shipping Motor Sledges.

These were for Captain Scott's Antarctic expedition. The upraised arms at either end of the sledges are lowered when in use and they are to prevent the vehicle tumbling down crevasses when in the Antarctic.

SUN FISH WEIGHING 1,600 POUNDS, CAUGHT BY WOMEN OFF CATALINA ISLAND, CALIFORNIA