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WATER SUPPLY
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OF



THE FURROW METHOD OF IRRIGATION.

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THE IRRIGATION AGE.

VOL. XIV.

CHICAGO, OCTOBER, 1899.

NO. 1.

THE PROGRESS OF WESTERN AMERICA.

**At
Missoula,
Mont.**

The old gentleman with the sythe gets around with such agility that a year vanishes almost before we are aware of it. It seems but a few months since we chronicled the meeting of the seventh annual convention of the National Irrigation Congress, but lo it has been a twelve month and the eighth annual meeting is now history. Montana having succeeded in capturing the Congress this year, it was held at Missoula, Sept. 25, 26, and 27, and was a gathering of earnest, intelligent men, working in complete harmony for the furtherance of a cause which all had sincerely at heart. It was a profitable and interesting meeting, fuller particulars of which are given in another department of this issue.

**Chicago
Next
Time.**

At the risk of appearing prejudiced in its favor, we must confess our intense gratification in knowing that Chicago is to be the meeting place of the ninth annual Irrigation Congress. We think it the best, the most convenient, the most central—in short, it is the ideal place in which to hold a convention—but then, we live here, so possibly we are not altogether disinterested in our opinion. Anyhow, we're glad. If Chicago cannot do anything else to prove herself equal to the occasion, she can get up, on short notice, such a varied assortment of 'weather' with its accompanying mud, wind, smoke and dirt as will make the country dweller go back content with his station, wondering how people can live in such a dark, dirty place. Let us trust she

will be gracious. Hurrah for the next convention and Chicago.

**A
New
Firm.**

From time to time we have made mention of the progress being made in irrigation in Aleppo, Turkey. A recent communication from there tells of the formation of a commercial house that has for its object the importation of irrigating machinery, engines and other machinery and the furtherance of knowledge in the subject. This new firm which is under the auspices of the governor of Aleppo, and has prominent men as its officers is known as "El Agha." American manufacturers are becoming favorably known in foreign countries in various lines of goods and there is no reason why we should not supply Turkey with all the machinery she imports. Manufacturers and dealers should correspond with this new firm.

**Our
Admiral.**

It requires a strong head to bear adulation in large quantities without experiencing bad results. A welcome so enthusiastic as that accorded Admiral Dewey is calculated to turn the strongest head, but the Admiral bear, his honors modestly as becomes a brave man. "It was so like Dewey!" was the verdict upon learning that he had reached his native land two days ahead of time.

It is almost a year and a half since Dewey won his great victory the first of May, yet his welcome by the American people was as enthusiastic as if the great Manila Bay event had occurred only last week. They honor him even more for the

steady adherence to duty which caused him to remain in the trying climate of the Philippines when he might have hastened home to receive the enthusiastic honors awaiting him than for the victory itself. The country went wild over the great commander and the cartoon representing the statue of "Liberty," at the mouth of New York harbor, as having dropped her torch and seized a telescope with which to watch for Dewey is typical of the attitude of the nation. It watched and waited for the commander who was not only a sea commander, but who, during his long stay at Manila, "shone as a diplomatist and a manager of men. He maintained his own dignity and that of his country. He got his government into no disagreeable complications." He well earned the sword which was presented to him and is worthy of the admiration with which the American people,—democrats, republicans, anti-expansionists, free-silverites, all combined, regard him.

Even the caricaturist, who like the Lord, "is no respecter of persons," has spared Admiral Dewey and the public press has had no disparaging remarks, no shaft of ridicule for him.

"Chicago Day." Chicago is this week celebrating the anniversary of the great fire, which twenty-eight years ago laid the city waste and, it was said, ended its existence. Chicago is a good example of what may be accomplished against almost overwhelming difficulties; built on a marsh, a location which the doubters claimed was against it from the start, it justified the confidence of its founders by becoming a great city. Then came the fire, from which it rose phoenix-like from the ashes, to become one of the foremost cities of the union. So the 9th of October, 1899 finds it gay with flags and decorations, crowned with people and business superceded by rejoicings and celebrations.

The Corner Stone. The laying of the corner stone of the new post-office building was one of the events of the week, and speaking of the corner stone leads one to think of the many disagreements and unpleasantnesses connected with the stone; of the protest from the labor

unions because, it was claimed, the stone had been cut by non-union men; the strike ensuing, and the threats and counter threats. The unprejudiced observer is constrained to ask "What, after all, do strikes accomplish?" An exchange says: "A strike, even if ultimately successful, rarely compensates workmen for the pecuniary losses they sustain during the period of idleness. A lockout deranges the business of an employer, interferes with the fulfillment of contracts, necessitates the employment of unskilled labor or of mechanics unfamiliar with the employer's methods. A duel between labor and capital makes victims of both parties, and creates sores that contrive to rankle long after reconciliation is supposed to have been effected."

At a meeting in Chicago of representatives of building contractors controlling capital to the amount of \$5,000,000, a resolution was adopted unanimously as follows:

"Resolved, That it is the sense of this meeting that lockouts, boycotts and strikes are injurious and costly to employers and employes and detrimental to the interests of the city, and that we pledge ourselves to avoid these methods, and pledge ourselves to use all peaceful means to better our relations with employes."

Hysterical France. Another chapter of the true story which reads like a romance has been finished: Dreyfus has been tried, found guilty, and then—crowning act to this shameful farce—pardoned. Not long since I saw a photograph—they are for sale in almost every store—of Dreyfus at the time of his first trial and at the present time, while between the two, the young soldier and the prematurely aged man, stands the faithful wife, and the thought came, even if he were guilty, a punishment so severe as to change a man as that had done was inhuman. In speaking of the trial recently some one said: "I always think of France as an hysterical woman." This I think aptly describes the nation. Impetuous, fickle, capricious, republic, monarchy, bigot, infidel, full of contrasts, such is France. But the inhuman treatment of Dreyfus, whose long imprisonment and torture has won for him the sympathy of the civilized world, is the darkest stain yet on the flag of France.

BIOGRAPHICAL SKETCH.

BY HARRIET B. SMYTHE

William Ellsworth Smythe was born in Worcester, Massachusetts, December 24th, 1861, having descended from New England pioneers of the seventeenth century. He was educated in the common schools of his

work and learned to love the smell of printers' ink. Furthermore, he was fascinated with the character and career of Horace Greeley, as set forth in the most entertaining of biographies by James Parton. So he promptly chose to do as Greeley had done, and become an apprentice in a printing office.



WILLIAM ELLSWORTH SMYTHE.

native town. At the age of sixteen his father asked him to choose between preparation for a college course and learning a trade. He was already engaged in publishing a small amateur paper called *The Yankee*, and in writing stories and articles for other amateur papers. In this way he had conceived a taste for newspaper

Thus at sixteen he left home to make his own way, entering the office of the *Southbridge Journal*, then owned and edited by George M. Whitaker, who is now widely known as the editor of the *New England Farmer*. In less than a year the young apprentice, who had been using all his spare time in reading history and

scribbling for the newspapers, was told that he would never make much of a mechanic, but was already fitted to undertake responsible newspaper work. For the next two years he worked as reporter and night editor of the Haverhill *Gazette*. At the age of nineteen he became editor of the Medford *Mercury*, and his writings on Massachusetts politics attracted considerable attention among the politicians, who were generally surprised to find a boy on seeking the editor. Later Mr. Smythe did good work on the Boston *Herald* and other daily newspapers, until he was attracted into an ill-fated book publishing business in his early twenties. When this venture ended disastrously Mr. Smythe accepted an offer to become editor of a daily paper in one of the boom cities of Nebraska. The newspaper, the Kearney *Enterprise*, perished with the boom, but not until it had made a state reputation for the editor, who had on more than one occasion been invited to remove to Omaha and take a position on one of the leading papers.

In the autumn of 1890 Mr. Smythe joined the staff of the Omaha *Bee*, devoting his time to writing editorials and signed special articles. It was here that his interest in irrigation began, with a series of articles that attracted wide attention, and may be said to have marked the beginning of a new era in the agricultural life of Nebraska and the irrigation movement of the West.

In 1890 the Corn Belt suffered a severe drought. It happened that Mr. Smythe had business that season in New Mexico. Passing through the blighted fields of Nebraska and eastern Colorado, he was amazed to discover in New Mexico and the greater portion of Colorado a land which sustained a perpetual drought, yet prospered beyond districts favored with generous rainfall. He was immensely impressed with this fact. Looking into the matter more closely, he discovered that aridity is a positive blessing when supplemented by irrigation.

Returning to Nebraska Mr. Smythe be-

gan a campaign for irrigation in that state with a series of vigorous articles in the Omaha *Bee*. The editor, Mr. Rosewater, at first demurred to their publication on the ground that they would be regarded as a libel on the state, but he consented when the writer offered to sign his own name and personally assume the risk of unpopularity or lynching. The result was most surprising. It was indeed a popular uprising throughout the western counties, but in favor rather than against irrigation. Mr. Smythe now entered on an active campaign of speeches and conventions to organize the public sentiment he had aroused. The result of a series of county conventions was a demand for a state convention, which assembled at Lincoln in the winter of 1891, with ex-Governor Turner as president and Mr. Smythe as vice-president. The result was the organization of a strong movement, which persisted year after year until the state had adopted a code of irrigation laws, second to none in the United States, provided a State Engineer, and brought 400,000 acres under irrigation. These events made a revolution in the agricultural methods of Nebraska and other semi-arid states, and put prosperity where hopelessness had been. Of course many influences contributed to this great result, but the beginning was Mr. Smythe's articles in the Omaha *Bee*, and the state campaign he conceived and engineered.

There was another result of far-reaching consequence. Mr. Smythe brought before the Lincoln Convention a project for calling a national congress for promoting irrigation sentiment. The motion prevailed, and he was named as chairman of a committee to arrange for the formation of such a congress. The result was the First National Irrigation Congress held at Salt Lake City in September, 1891, and was followed by a permanent organization, which has become one of the strongest factors in the intellectual life of the West, and made its influence felt throughout the nation. In fact, its influence has been

yet more widely felt, as delegates from Canada, Mexico, Australia, Chili, Peru, Russia, France and Great Britain have at times accepted the invitation of the President of the United States to attend its sessions, and have carried the reports of its doings to foreign courts and legislatures.

For four years, beginning with the Salt Lake Convention and ending with that at Albuquerque in 1895, Mr. Smythe bore the chief responsibility for the executive conduct of the Irrigation Congress, first as secretary and later as chairman of its national committee. During this period he traveled thousands of miles, made many addresses, wrote many articles, and carried on a large correspondence in the interests of the work. He aimed steadily at two chief results—first, the improvement of state water laws and the provision of state systems of administration; second, at the formulation of a national irrigation policy for presentation to the law makers at Washington. In both respects, but especially the first, much progress was achieved during his time of service, and he retired in 1895 with a unanimous expression of thanks and respect, registered by rising vote of the Albuquerque Convention.

In April, 1891, Mr. Smythe began the publication of the pioneer journal of its kind in the world, *THE IRRIGATION AGE*. It immediately sprung into circulation and influence, becoming the organ of national irrigation sentiment, and making a reputation for its editor as the foremost popular writer on the subject. Though the measure of its support was never equal to the standard set by its publishers, and its maintenance therefore entailed a constant struggle, there can be no doubt that the magazine contributed powerfully to the growth of the cause for which it stood. Mr. Smythe has always felt that the acquaintance with men, localities and institutions gained through his years of hard work on *The Age* compensated him for the cost.

What Mr. Smythe has been doing since

he severed his connection with this magazine, four or five years ago, and what he proposes to do in the future, is so closely identified with the colony plans which he will describe in these pages, that nothing need be said of it here.

Mr. Smythe is a hard and constant worker, and impresses all who come in contact with him with an enthusiasm which is fairly contagious, and a strength of conviction which leaves no room to doubt the sincerity of his own belief in his cause and his love for the beautiful West, for the advancement of which he has worked so hard and so long.

GUY E. MITCHELL.

Mr. Guy E. Mitchell, the recording secretary of the National Irrigation Association, who is located at the Glover Building,



GUY E. MITCHELL.

Washington, D. C., is doing yeoman service in the interests of national irrigation. Mr. Mitchell's location at the National Capital, and close touch with government officials and congressmen, enables him to prepare much valuable matter on this and kindred topics, and many irrigation news items and articles appearing in the west-

ern press are from his pen, though unsigned. Mr. Mitchell is a practical fruit grower and owns a farm in Virginia, near Washington. He lived for some years in the Michigan peach belt, and took a course at the Michigan Agricultural College. He tells us incidentally of a year's experience in Nicaragua where irrigation was quite unnecessary; the rain guage measured during the year 299 inches.

He is a staunch advocate of the federal storage proposition, and sees nothing but disadvantage in the policy of the cession of public lands to the States. On the other hand he thinks the leasing of the grazing lands, the title to remain in the general government, until actual settlement, and the applying of the rental to state improvement, the most practicable solution of the range question.

"There will undoubtedly be a very strong effort made," Mr. Mitchell says, "to get Congress to act upon this question during the coming session. Western representatives realize that something must be done to adjust this overstocking of the public range, with its accompanying controversies and conflict between stockmen, and the leasing of these lands in limited areas would seem to be the most feasible plan. The scheme is in successful operation on the railroad lands of the great trunk lines, and appears to be very generally favored in all quarters. Secretary Wilson tells me he believes it the best solution of the problem. He also states that the overcrowding of the grazing lands and their reduced capacity is at the bottom of the present beef scarcity."

WHAT THE WINDS BRING.

Which is the wind that brings the cold?

The north wind, Freddy, and all the snow;

And the sheep will scamper into the fold

When the north begins to blow.

Which is the wind that brings the heat?

The south wind, Katy; and corn will grow,

And peaches redden for you to eat,

When the south begins to blow.

Which is the wind that brings the rain?

The east wind, Arty; and farmers know
That cows come shivering up the lane.

When the east begins to blow.

Which is the wind that brings the flowers?

The west wind, Bessy; and soft and low
The birdies sing in the summer hours,

When the west begins to blow.

—Edmund Clarence Stedman.

IRRIGATION AND COMMERCIAL EXPANSION.

BY JOEL SHOMAKER.

An era of unprecedented prosperity has dawned upon the irrigated realm of the United States—the trans-Mississippi division of North America. The oriental trade, the Alaskan demands and the ever increasing avenues of domestic commerce have made requisitions on the producers of Arid America that compel greater expansion of the fields of labor. Over 500,000,000 of the Asiatic inhabitants are looking to the ships of America for flour, fruits, vegetables and general farm products, and the irrigated states are expected to supply the majority of this permanent order. While men may differ on political theories concerning national policies of governing new territories, the real, active commercial expansion is an enforced condition, which must be grasped at once by the tillers of the soil and those engaged in shipping.

The great northwest, comprising the states of Washington, Oregon, Idaho, Montana, Utah, Wyoming, Nebraska, Dakotas, Minnesota, Iowa and even to the east of the Mississippi, lies at the gateway of this vast Pacific commerce, and the irrigated farms constitute the basis of individual prosperity which will contribute to the national wealth and independence. This area has the natural facilities: mountains of perpetual glaciers, reservoirs of abundant waters, rivers of never ceasing flow, carrying soil moisture and plant food to millions of acres, which when properly cultivated, yield profusely of the cereals, grasses and fruits required to supply this new world of humanity.

A short time since I visited Tacoma harbor, the open gateway to the commercial ports of the oriental isles, and witnessed the actual transactions of this new era of financial expansion. The Northern Pacific railway with its seventy miles of side tracks, crowded with trainloads of farm products, was delivering to more than a score of large ocean vessels, carrying one thousand tons or more each, the food for millions, to be conveyed across the waters. At this port over one-half the imports and exports of Puget Sound, the inland arm of the Pacific northwest, are loaded or unloaded. The exports for last year, from the Puget Sound ports aggregated over sixteen millions of dollars, while the imports reached about six millions, the trade being chiefly with the irrigated districts of the northwest.

While the northwest is particularly favored by location, for the Pacific and Alaskan trade, the southwest portion of Arid America,

which includes California, Arizona, New Mexico, Colorado, Kansas and Texas, has a direct ocean connection with foreign points, and the grains and fruits, with cattle, hogs and sheep, are in demand for shipment to the consuming cities and isles of Oceanica. The land of irrigation of the present day has no idle laborers in any honest vocation or legitimate industry. If agriculturalists are wandering about the country in quest of employment, they are of all men the most miserable, for numerous opportunities are open on every hand, for labor investments. The soil has yielded of abundant fertility, and harvest fields await reapers.

The entire people of our vast country must be interested in this development of commercial interests. As irrigation is necessary to



TACOMA HARBOR.

successful soil culture in twenty states and territories, the general government should exercise a paternal oversight in directing and shaping the destinies of those engaged in reclaiming the land from desert aridity. To properly lend assistance in this matter more national forest reserves should be established and the native forests protected. This can be done by Congressional enactment, and the appointment of competent foresters who will forever prohibit the destruction of those mountain reservoirs, by excluding sheep and cattle from the limits and preventing the woodman's ax from making merchandise of the timber.

Individual efforts cannot conquer the western enemy of soil husbandry—the lack of rainfall—but the general government, through a union of Congressional and State legislative action, can construct

reservoirs for impounding the immense volumes of surplus water flowing down the many mountain streams, to waste in the ocean. If the sources of the Missouri river were controlled, and the surplus held in suitable reservoirs, erected in Montana, the Dakotas and Nebraska, and that water properly distributed throughout the irrigable districts, there would be thousands upon thousands of prosperous homes created in what is now the worthless deserts, and the annual appropriation for the improvement of the Mississippi river be unnecessary. This would enhance the value of every farm and increase the business interests of every industrial city in the Mississippi Valley.

The art of irrigation is an important study, which necessitates



WHEAT ELEVATOR, TACOMA, WASH.

the mental development of the agriculturist. It contains no elements of chance; there is no need for speculation on crop failures or successes; and the farmer who attempts to master its wonderful intricacies, will become a learned man, in all that constitutes a broad financiering education. Certainly our government is directly interested in the moral, physical and financial growth of her millions of noble men and women making up the agricultural or wealth-producing classes. In building reservoirs and constructing canals in the Rocky Mountain states the government would not only enable thousands to erect new homes, but would protect a similar number of equally good and industrious citizens from annual losses by reason of inundation of surplus waters.

If the forests are preserved and the watersheds are held in tact

the range industry will become a thing of the past, but civilization will take the place of the semi-nomadic life characteristic of the present utilization of the eminent domain. It is more important to the colonizing of our country, as contemplated by the declaration of independence, that we erect homes, establish agriculture, and build up the waste places, for the benefit of the masses, than that a few should monopolize the free government range for temporary herding grounds. It is better for the progress of the people as a whole, that permanent home builders have the undisturbed right of occupying the lands of the government, than for transients to speculate upon its gratuity, and destroy the usefulness of its mountains and valleys.

When the arid lands are reclaimed and brought under cultivation



ORIENTAL STEAMSHIP.

by the ramifying canals of irrigation, the era of intensive soil culture will be appropriately ushered in. The farmers will then become the stock raisers and wool growers of the west, and where as at present a constant warfare is maintained, there will be peace and prosperity for the masses. The cultivated lands may be sown to alfalfa and the fields pastured with hogs, cattle and sheep and every farmer thereby become an independent capitalist, shipping his products to the markets far and near. There is nothing visionary or speculative about the existing conditions, as the ships of commerce are touching the irrigated shores and the consumers are ready and anxious to purchase the products.

Industrial development always follows in the train of agriculture, and in some instances creates the field for horticultural progress.

With the growth of soil products comes the railways, the postal delivery, the schools and churches and the wheels of manufacturing plants. While European countries are bidding for the expanding trade now awaiting American enterprise, the factories for making desirable goods should be located in the irrigated empire. These require labor and raw materials coming directly or indirectly from the rural districts where irrigation produces both the strong, healthful laborer and the material of which we must weave the finished article of commerce. Will the people of this country grasp and retain this new era of prosperity and develop Arid America, or shall the tide pass by and others gather the golden pearls brought from the isles of the sea?

BROWN'S EXAMPLE.

"There," said Brown, with a shake of his head,
 "I've painted the house and the barn and shed!
 The fence has been fixed, and the lawn's been mowed,
 But I do wish the town would fix up that road.
 It's a shame. I call it, just plain and flat,
 That we have to drive over roads like that!
 I'll wait no longer. I'll start to-day
 And fix my part of it anyway."

Now, Brown was one of those fellows who
 When they start a thing, just "rush it through."
 And a week or two after, as Neighbor Jones
 Was driving home with his pair of roans,
 Brown's road was dry, while his own, next door,
 Was mud to the depth of a foot or more.
 "By George," said Jones, "I'll let Brown see
 That I can build roads as well as he!"

Now, Neighbor Smith, who lived below,
 Saw Jones repairing his road, and so
 He fixed up his, to be "in the game."
 And Neighbor Robinson did the same,
 And soon every householder in town
 Was trying his best to "beat out Brown."
 And now, when the town committee meets
 To talk of roads, they call them "streets."

* * * * *

The moral this tale to the reader brings
 Applies to roads and other things.
 Reforms, like snowballs, will keep on growing,
 If somebody only sets them going.

—Joe Lincoln—

THE TRIUMPH OF IRRIGATION.

WEST RIVERSIDE.

BY T. S. VAN DYKE.

Nothing in California is more wonderful than the quiet, steady progress made South of Tehachapi during the last six years. Starting with the collapse of a real estate boom that would have laid any other land flat on its back for twenty years, it plunged headlong into the hard times that begun in 1893. Before that, Providence had smiled upon the whole section, through ten winters of rainfall so ample that thousands believed tree-planting and electric wires had changed the climate of over two thousand miles of coast. The disenchantment was the most painful any country ever had to endure. Six winters followed, of which only two were up to the average, and two scarcely a fourth of it. And two of the worst came in succession and upon top of the series.

It was freely predicted that the water supplies of the mountains would give out, and this was greatly feared by many who dared not predict it. The failure of the irrigating water was supposed certain, and every one knew what the result would be, although it was certain that in most sections the trees could be kept alive with cultivation only, while in all others there would be water enough to save them even if the crops were lost. But the loss of crops was apparently certain, most people believed even the trees would be lost, while thousands more believed the climate had changed the wrong way, and capital was scared.

Under such circumstances, who could expect a country to grow? Yet Southern California not only has grown, but has done better than any other part of the Union in the same time. It has surpassed all records but its own, and in places has even done that. The dozens of feet of decayed rock and soil in the mountains, and the hundreds, even thousands, of feet of gravel and coarse sand in the valleys, the great washes and slides at the feet of the mountains, have proved vast sponges, holding untold stores of water in the grip of years, and letting it down slowly to supply the needs of the land below. None have been more surprised at this than those who thought they knew the country best and none so much as the most experienced engineers.

The consequence has been a continuation in most places of that substantial growth that sprung from the wreck of the great boom, quiet, unostentatious, and looking only to business-like cultivation of the soil. As an object lesson of this kind of prosperity and good

sense, no place surpasses West Riverside. Few of those who know the country best even suspect its existence. The tourist, looking always for something in sight of the railroad station, would not dream there was such a place. And the people of West Riverside go on attending to their orchards and alfalfa fields and don't care whether the world knows them or not; the same as the people of Duarte, and other rich sections lying a little off the lines of travel have done for years.

The land on the West side of the Santa Ana River at Riverside is exactly the same as that which has worked such wonders on the South side. But being three miles from the Santa Fe station at Riverside, and some four miles from the Southern Pacific line west from Colton, one is not compelled see it. Like Arlington, East Riverside and other parts of that wondrous section lying under the Riverside ditches, West Riverside has a large area of frostless land which has stood the severest test of the last seven years, and on these are now dozens of orchards of orange and lemon that equal the best of any other section. All deciduous fruits, alfalfa, berries and all else do the same as at Riverside and Arlington, and cannot do otherwise since the conditions are exactly the same.

The whole success is dependent on the same solid water right as that of old Riverside. The canal drains the same vast reservoir of gravel and coarse sand that is now, after six years of steady flow, holding the old ditches up to the same water line that has marked their sides within the memory of man. It is almost incredible that this unparalleled drouth of six years has made absolutely no impression upon this supply. The owner of land in Riverside can get today any amount of water he wants and at almost any hour he wants it. West Riverside has 600 inches of water out of the old Meeks & Daley Ditch, which ran to the old Mexican settlement of Agua Mansa. About 1888, Riverside, to compromise this claim, which was a first lien on the water of the Santa Ana River, cemented the whole ditch and turned it over with the agreement that it should have eight hundred and twenty-five inches of water before any went into the Riverside ditch, a perfectly safe arrangement, as time has shown. If Riverside is safe with this the other is better, for it cannot fail until the three thousand inches or more of water that now go to Riverside have failed.

Of course many other places have gone ahead in the same manner, but I have selected this as the most remarkable because it is out of the sight of all lines of travel and has been done with no blast of the trumpet. Strict attention to business has done it and that business has been strictly irrigation instead of townsites, hotels, colleges, waterpowers, factories, bays, or "natural advantages" of any kind. It shows that irrigation is good enough and that all else can be trusted

to follow in its own time if this be properly taken care of; that irrigation is the surest and quickest of all foundations for prosperity directly from the soil when the projectors believe in their own game and devote all their business capacity to it.

In striking contrast to this as an object lesson is the canal on the Mojave, near Dagget. Several hundred inches of water are there flowing today exactly the same as four years ago, coming from the underflow of the largest of Southern California rivers. It is plain that there is ten times (or more) that amount that can be taken in by extension of the drains, an operation both cheap and simple. The water has been flowing four years upon land that has been perfectly proved and has nothing the matter with it. Tens of thousands of acres more lie beneath the water. No better proposition lies out of doors, that is for one equally remote from big centers. Every pound of stuff raised there has a freight rate of fifty-six cents a hundred in its favor, and four years ago the produce laid down at the single point Dagget, was ninety-seven thousand dollars a year, all of which could have been raised there. The proposition has been approved by every expert who has seen it, yet it lies there a desert today. I own, myself, two feet of the water, a hundred inches, and want to put a half section in alfalfa. Yet I won't do it or allow any of my friends to consider it in its present condition.

What is the matter? 'Townsites, smelters, waterpowers, stamp mills, electricity and everything in the world but the simplest, surest and quickest way of getting money out of the ground, *irrigation*. That is of the last and least importance. That can take care of itself. All else must be attended to first. That can afford to wait.

She heard old Winter on her track,
 And running faster and faster,
 She tripped upon a slender vine,
 Its scarlet love-knot tying
 About an oak tree's mossy root
 And sent her treasures flying.

So now on every sunny hill,
 In every little valley
 Or meadow, where the amber brooks
 With music love to dally,
 And all along the winding road,
 With summer dust still hoary,
 Her scattered garlands blossom yet
 In gold and purple glory.

NATURE'S STORAGE RESERVOIRS.

BEING A PAPER READ AT LOS ANGELES BY
THE EXECUTIVE CHAIRMAN OF THE
NATIONAL IRRIGATION CONGRESS.

BY GEORGE H. MAXWELL.

Nearly every one now recognizes the need and importance, all through the arid region of America, of great storage reservoirs to save the waters that now, in the seasons of high water, run away to the ocean, not only wasting the wealth that the use of the water would produce, but oftentimes carrying destruction in their pathway, as the floods sweep down the mountain sides and through the valleys.

There are not so many who realize the equally important fact that Nature has already made for us great storage reservoirs which must be preserved if we are to maintain the water supplies that we are now using. These natural storage reservoirs are absolutely essential to the very life of many communities in the arid region, and yet, in many places, we are allowing them to be recklessly and ruthlessly destroyed.

Much that I would have said to you on this subject has already been better said by others. In his address to-day Mr. Schuyler strongly brought out the close relation between forests and reservoirs, and showed how essential it is, if we are to utilize the opportunities which Nature has created for building storage reservoirs in the mountain canons, that we should preserve the forests and the foliage that covers the mountain sides, so that the winter storms will not bring down masses of detritus which will rapidly fill up and destroy the storage capacity of the reservoirs.

He has showed, too, how imperative it is, if we would preserve our sources of water supply, that we should preserve the reservoirs which Nature has provided for holding back the water in the natural sponges, made by the network of undergrowth and roots and decaying leaves, and shrubs and brush and trees which in so many places line our hillsides and the precipitous slopes of our mountain canons. And he has showed you how, when this natural sponge is once destroyed by fire or grazing, the waters will rush down in torrential floods, carrying away the scant remaining soil, and making it difficult and often impossible to restore the growth on the slopes that are left barren.

Mr. Olmstead, the City Engineer of Los Angeles, also portrayed

to you most vividly what a wonderful natural reservoir existed to enlarge the water supply of the city of Los Angeles from the Los Angeles river, by filling with water in times of flood the great gravel bed lying between that river and the mountains, leaving it to gradually percolate out into the river in the later months of the year.

In this suggestion there are great possibilities for water storage in probably every arid state, where the water can be led out in time of floods on to the high mesa lands and the porous sandy and gravelly soils on the higher levels can be saturated with water in seasons when it is abundant, leaving it to gradually find its way out into the canals and natural channels on lower levels in seasons when it is needed.

Mr. Olmstead has given us another illustration to prove the fact now so generally recognized, that water stored on the headwaters of navigable rivers, and first taken out on the bench lands for irrigation, will find its way back into the river in the low-water season when it is most needed for navigation. The use of the water for irrigation is merely another illustration of water storage one of "Nature's storage reservoirs" until it is needed for navigation, and shows how superficial is the objection sometimes made to the use of water for irrigation which has been stored for the benefit of navigation.

I was deeply impressed by what was said by Mayor Eaton and by Mr. T. S. Van Dyke as to the lack of information by the public generally on these subjects, and the need of a campaign to arouse the interest of the general public and awaken a public sentiment which would demand and accomplish the solution of the various problems that confront us in the preservation of our forests and water supplies. And I could not help thinking that if the enormous importance of these matters was appreciated there would not be a man who is now tilling an irrigated farm or vineyard or orchard in Southern California who would not be here to-day.

Every irrigator from an underground supply would be here if each would only stop and ask himself: "Where is the source of the well or the tunnel from which my water comes? How long will it last? How do I know that Nature is replenishing for me the supply from which I am drawing?"

As you watch an artesian well, every one realizes that the beautiful drops that are thrown up from below by the unseen power to glisten and sparkle in the sunshine have not come up underground direct from the sea. They were at some time evaporated from the ocean and carried in the clouds to the mountains and precipitated there. Now what checked them from rushing down the hillside and back through stream and river to join again the ocean from whence they came?

Somewhere in their onward course they were stopped by some leafy covering which held them until their course was turned down-

ward into the earth. And from thence they have percolated through some underground channel or stratum until they have found a vent through the artesian well that has brought them once again to the surface. They may have fallen with last winter's rainfall; they may be coming from some one of "Nature's storage reservoirs" underground, which has been gradually filling for a thousand years; it may be that each winter's rainfall is replenishing the underground supply as fast as it is being drawn off, and it may be that it is not.

But of one thing we may be sure: If we allow our mountain slopes to be deforested and permit the destruction of the undergrowth and foliage which did check, in their downward flow, the waters that are coming to us now, our underground reservoirs will cease to be replenished and refilled. The waters which should find their way down into the earth to come up again in our wells and out through our tunnels will rush down the steep and bare mountain slope in torrents to the sea. And not only our underground supplies but our surface supplies as well will be gone, and aridity will overcome our fertile fields just as it has where the forests have been destroyed.

This need not happen and will not happen if the people will wake up to the possibility and the danger. All we need to do to prevent it is to preserve these storage reservoirs of Nature and see to the maintenance of conditions that will perpetually replenish our underground reservoirs. How are we to do this? By a campaign of education. It is absolutely essential that the whole community all through Southern California should be aroused to the vital and far-reaching importance of this great subject. The people must be awakened from their apathy. The dead wall of indifference on the part of the people generally must be broken through.

We must unite all who realize the magnitude and immediate importance of the subject to preach a crusade to awaken a right public sentiment about it, not only in Southern California, not only in the West, but all through the East as well. It is a national, not a local, problem, and as a national problem we must treat it.

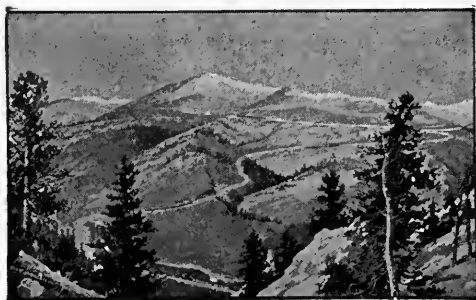
The preservation of our forests means not only the preservation of water supplies for irrigation in the West; it means the preservation of water supplies throughout the whole country for power, for navigation, and for all the manifold needs for which the waters of the eastern streams and rivers are used.

The American Forestry Association is a national organization. It is already strong and influential. It has worked wonders already in its labors for forest preservation. Let us make it still stronger and more influential by extending its membership and resources. By doing so you are putting in the field an army of peaceful and ceaseless workers to protect your homes from destruction by Drought—an enemy as much to be feared as any foreign invader.

The National Irrigation Association is another organization fighting in the same field, one of its purposes being forest preservation. It is strongly advocating the inauguration of a leasing system, which will enable the now wasted resources of our great public domain to be utilized so as to yield a revenue for forest preservation and irrigation development in the arid region. Several million dollars annually could be realized from such a leasing system. Of course the mountains of Southern California have too great a value as sources of water supply to permit of their never being leased for grazing. But after excluding all forest areas which should be exclusively reserved for water conservation, there are still left in California over 25,000,000 acres of public grazing land.

Through this National Irrigation Association we must first unite the West in favor of one district policy, and then turn to the work of converting the East. It needs only concentration of purpose and tireless work to accomplish this. The wage-earners of the East want wider fields for labor. The manufacturers of the East want new markets for their wares. Where can either get what they want so fully as by the development of the great arid West which is capable, with irrigation for its irrigable lands, of sustaining a greater population than the whole United States holds to-day.

And here in Southern California there is a local organization which every one who has any interest in the welfare of the people of this section should join. It should number its members not by tens but by thousands. And its influence will grow as its membership roll lengthens.



THE COLONY BUILDERS.

ANNOUNCEMENT.

WILLIAM E. SMYTHE.

Beginning with the November number, the AGE will publish as a regular feature a department under this head. It will deal with the subject of home-making for the masses in the unsettled regions of the world, particularly with the problem of developing homes, farms, and institutions in the reclaimed valleys of the West. The department is specially designed to serve the needs of those who would like to improve their condition by settling in such colonies as may be well located and wisely planned. It will also prove of interest and value to the managers of irrigation enterprises, but it aims to be much more than a directory for settlers, or a chapter of suggestions for managers.

One of the most striking economic facts of the time is that there is throughout the world surplus land, surplus people, and surplus capital, millions of acres need men; millions of men need acres; millions of dollars need profitable employment. Those who control the land do not command the labor: those who control the labor do not possess the capital. The result is suffering and discontent, which threaten grave social and political consequences in course of time.

The evils resulting from these conditions are worldwide. They are felt in every town and city of every country. The remedy is colonization. This alone will absorb and utilize the surplus land and other natural resources, the surplus men and surplus dollars. But colonization is itself a problem, and a problem of the most difficult and complicated kind. No other work touches human natures at more points, or deals with interests more delicate and precious. Nothing involves more chances of failure, more possibilities of bitter disappointment. Nothing calls for more knowledge of all the factors to be dealt with, nothing demands more devoted and unselfish leadership. Sound industry and social plans are essential, but hardly more so than a certain indefinable quality of direction and management, which may be spoken of as the personal equation in the colonists and their leaders. This quality is not conceived with the commercial aspect of the matter, but belongs to its higher atmosphere,—to its ethics rather than its economics.

There is and ever must be, however, a strong commercial side to the work of colony-building. Colonies cannot be made without capital. Capital cannot be had without security and profits. Security and profits cannot be assured without responsible and able management.

To the settlers' side, too, there is a strong commercial aspect. Land, water, industry, and capital do not alone and of themselves assure success. It depends much upon what is produced and how the product is handled. It depends on how the supplies are purchased. It depends on how labor is directed. It depends on the industrial polity, which must be such as to provide the certainty of a living and the hope of an independence.

It is upon these broad lines that this department will be conducted. It will aim to outline a practicable program for the conquest of waste places by waste labor and waste capital throughout the earth. It will deal not with theories, but with practice. It will bring all its plans to the test of actual experience in this and other countries. It will seek to deduce lessons from failures in the field of colonization as well as to find light in the many instances of success. It will describe conditions in different localities with perfect candor, speaking of their drawbacks as well as advantages.

Some of the practical questions to be discussed are these: How much capital is required to establish a family on an irrigated farm? What is the best size of the farm unit? What scheme of production should be recommended in different localities? What is the best way to dispose of the product? What economics can be effected in the purchase of supplies? Are people from the cities well suited to make homes on small farms? Is any form of superintendence feasible as a means of preventing mistakes and assisting settlers to prosper?

Questions of equal importance are: How can homes be had by people having no capital, save their ability to perform productive labor? How can people of means invest their money safely and profitably to be used by others? How can people of regular income set apart a portion of it each month and year and so provide homes brought to a complete state of production at the end of a certain period? How can investors who never intend to be resident settlers invest in a colony and share its profits?

Some of the larger economic questions are: In planning the industrial organization how much should be undertaken in co-operation and how much left to individual enterprise? What measure of control should be exercised over settlers who operate entirely or mostly on borrowed capital, and how long should they work under such control? By what method should states, industries, and other enterprises closely related to colony development be conducted? What social scheme is calculated to conduce to the contentment and prosperity of the settlers? Is Socialism feasible at the present time in new colonies of small membership?

Many widely-scattered colonial efforts will be drawn upon for experiences. Among them are the labor colonies of Holland, Germany, and Australia; the communities founded in the Forties under the Forties' teachings; the Mormon settlements in Utah; the famous places.

in Southern California, and many others. The co-operative industries of Europe, especially of Ireland, will be examined for valuable lessons. In a word, the best thought and experience of the world in relation to the improvement of social and industrial conditions for the masses will be made use of in planning methods and institutions for the conquest of surplus land by surplus men and money.

The various valleys in the seventeen states and territories west of the Missouri River will be discussed in the light of their availability for enlightened colonization effort. All sorts of questions pertinent to this subject are invited and will be answered fully and carefully.

In announcing an undertaking as important as the study and account of colonization proposed in this department of "The Colony-Builders", it seems quite impossible to avoid a personal word, since the value of the work depends entirely upon the writer's fitness to perform it.

Older readers of *THE IRRIGATION AGE*, familiar with its pages during the period of my editorship, 1891-'95, will recall many editorial allusions to the need of the most enlightened efforts in colony-making upon our arid lands. Perhaps they will remember an article called "The Republic of Irrigation", in which I appealed with passionate earnestness to certain distinguished Americans to help us in forming institutions which should make arid America the scene of the highest civilization in the Twentieth Century, and the place where social equality and industrial and intellectual independence should best be realized by the common man. At that time I saw but dimly the outlines of what I have now come to believe is the greatest problem of our time—the problem of giving the masses of our fellowmen ready access to the land and other idle natural resources, and of so guiding their efforts that they and their children may be really and forever free, in the full economic sense of the word. I felt that there must necessarily exist some true relation between the surplus people in old countries and large towns, and surplus lands, waters, forests, and mines which abound in the greater portion of our own and of other continents. I was impressed with the idea that the solution when found, would apply as well to the social congestion of London and Paris as to that of Chicago and New York, and as well to the utilization of the natural wealth of Australia and Africa as to that of Idaho, California, and the other great western States.

Originally I had no design of personally becoming an organizer and founder of colonies. Always interested in sociology—in human society—I found the history and progress of western settlement a most fascinating study. When living in Chicago I found that there was in our great cities a vast number of people who earnestly desired to make homes in the West if the way could but be opened. Finally I concluded that the only method by which the idea could be advanced was by making an actual colony, and decided to mark my last year as

head of the National Irrigation Congress by founding a settlement. Hence, the Plymouth Colony of Idaho, of which more will be said in future numbers.

The Plymouth campaign taught me that, if colonization was to be developed on a sound basis, there must be a permanent organization, and that this, if successful, would almost inevitably combine many irrigation projects, since there are a hundred unanswerable arguments in favor of organizing the western emigration movement of the future upon a great scale. Hence, the Associated Colonies, incorporated in New York in the Spring of 1897, under my presidency. The work of this company has taken me constantly back and forth across the continent, and called for frequent addresses from Boston to Los Angeles. It took me to Europe last year and gave me a brief but fruitful opportunity to see co-operation in its triumphant progress as the regenerator of agriculture where the industry had formerly sunk well-nigh to hopelessness. I found the greatest American magazines—such as *The Century*, *The Review of Reviews*, *Atlantic Monthly*, *Forum*, and *North American Review*—ready to offer me a platform to present the claims of our cause. Some of my literary work has been translated and republished in France, Germany, and Austria, and resulted in correspondence with eminent social scientists and reformers, who have encouraged me by saying that the ideas of colony-building presented are sound and feasible and adapted to the improvement of their own as well as of our country. During the past summer I have completed the final revision of a book dealing with the whole subject, and hope that through this medium the message will reach the widest publicity.

The work in which I am immediately engaged, as the practical part of the general movement, is the making of Standish Colony, in Honey Lake Valley, among the mountains of Northern California. Having determined that at this stage of the work I can do no better service than personally to conduct the initial settlements, at least during that part of the year that may be spared from the eastern field, I have built my house in the midst of the sage brush and propose to share the experiences of pioneer days with my friends, the colonists. At Standish we are applying all the plans of settlement that will be advocated in this department, so that it must, at least, be granted that I possess the courage of my convictions and am willing to bring my ideas to the test of actual experience. I shall speak frankly of Standish and the Associated Colonies in these pages, giving all other colonies and irrigation enterprises the benefit of anything learned of our trials and progress.

I ask the reader's pardon for intruding so much of a personal nature upon his attention, but when I consult a doctor I want to know that he has had opportunities both of education and practice, and those who may look to these pages for guidance in home-making, or

for ideas of social progress, have a right to know that the person who edits this department has at least some claim to authority on this subject. For ten years I have been thinking of nothing but irrigation and the social problems growing out of it, and for five years been practically engaged in planning and organizing colonies. It has become my life-work. I feel that it is my mission, and that the presentation of it is my message. Like all work that partakes of the nature of construction or reform, it has been attended by many difficulties and hardships. It has not yet reached the point of acceptance and of triumph—not, perhaps, by many hard years. Yet no salary or position could tempt me from the work to which I have set my hand. I believe profoundly in its usefulness and its ultimate success—aye, in its very *necessity* as an imperative condition of the peaceful progress of human society everywhere. And in future numbers of THE AGE, I shall try to give good reasons for my faith.

Standish, Cal., Sept. 25, 1869.



THE EIGHTH ANNUAL IRRIGATION CONGRESS.

HELD AT MISSOULA, MONT., SEPT. 25, 26 AND 27.

About 200 accredited delegates attended the meeting of the National Irrigation Congress. They came from every part of the union in which an interest is taken in irrigation of heretofore arid lands, and included a number of officials from Washington, D. C.

Prof. J. E. Stubbs was chosen temporary president in the absence of Dr. S. B. Young, of Utah, the president.

Guy E Mitchell, of Washington, D. C., briefly stated that the work the congress is to accomplish was "The proper presentation of the problem of satisfactorily disposing of the grazing lands by the leasing system, and the securing of a just and suitable share by improvement appropriations for the development and improvement of interior states, along with the seaboard states."

Prof. Maxwell's address was practical throughout. He held that irrigation congresses had accomplished about all that could be accomplished by them along the lines that had been followed. It was useless to appeal to eastern congressmen. They could not be brought to see the question as the people of the west view it. They believe that when we ask for government aid to construct storage reservoirs we have the desire to put our hands in Uncle Sam's pocket and take therefrom what we want. He said that if the people of the west would go about it right they could secure in one year what they have been working for for 10 years or more and are no nearer than at first. The politician should be left alone. We should demonstrate to eastern manufacturers, wholesale merchants and trades unions that by the reclamation of arid lands trade would be quadrupled within a year or two and that the poor man with a few dollars could make a home for himself and his descendants. He held that we must appeal to the pockets of the manufacturer and the merchant and the good sense of the wage earner if we secure co-operation, and only by that co-operation can government assistance be had. He advocated the holding of the next session of the congress in Chicago. The west asks for nothing more than is just and fair. It wishes for no more than its due, and equitable distribution of the appropriations that are made for improvement of water courses and a system that will properly recompense the western states for the expenses that they are put to in policing the vast areas of public lands; combined with this a system

of education upon matters that pertain to the problems of irrigation—that is the plan of the congress. It is composed of men who are earnest and devoted workers in this field and who are numbered among the best informed men in the work upon matters that are associated with these problems of reclamation of arid lands and the improvement of those that are semi-arid.

Hon. Elwood Mead, superintendent of the federal bureau of irrigation in Wyoming, read an interesting paper on "Water Right Problems." Mr. Mead outlined the growth and development of the water right problem, and showed its importance. He illustrated the knotty points that have arisen, and pointed out the dangers that they threaten. Suggestions were made as to remedies of existing evils and valuable outlines presented of explanations that would work the reform that is much needed.

Hon. T. L. Cannon, secretary of the St. Louis Manufacturers' Association said in part:

"The appropriation of money for irrigation is as necessary as it is for the improvement of rivers and harbors. The Congressman must understand that when he spends public money he spends your money and you are entitled to some of its benefits. Private capital can not accomplish this great work of reclamation. States can not do it as states. The authority and the funds of this work must come from federal sources. This cause is just. You must work to convince congress, that is, not by threats, but by presenting the cause in its true light. Every dollar that is expended in building storage reservoirs and irrigating canals will carry on this development and will be returned a hundredfold. If it was right to spend millions in Havana harbor; if it was right to pay \$20,000,000 for the Philippines, my God, is it not right to spend money for the reclamation of vast empires of arid America?"

Continuing, he said that it is convincing facts that must be presented to congress.

"It is not what irrigation will do, but what it has done," said he, "that you must show them. The next congress should be held where you can show the east what you have done. Instead of having your exhibits up here in the mountains, send them where they will be seen by the people you want to interest. Interest the manufacturers who sell you wares. Show them how they will have bigger markets if the arid lands are reclaimed."

Mr. Cannon advised the congress to hold its next meeting in some great eastern manufacturing center.

Prof. Newell then delivered his lecture upon "Hydrographic Work of the United States Geological Survey," of which he is at the head. The lecture was illustrated with stereopticon views. Prof. Newell traced the history of irrigation legislation in the United States, saying at the beginning: "The origin of the reservoir investigations

carried on by the geological survey may be traced to the early work of Major J. W. Powell, and particularly to the report prepared by him on the lands of the arid region transmitted April 1, 1878."

After this review he spoke interestingly of work done under these laws. Most of it has been of the first class mentioned—that of exploring for reservoir sites and investigating the flow of streams and other possible sources of supply. The progress of the work was carefully traced.

In conclusion Prof. Newell said: "To sum up the present conditions of reservoir surveys, it may be stated that at scattered localities throughout the arid region a number of reservoir sites have been surveyed and that some of these have been constructed; others still more important may be built, but probably this can not be done with direct financial profit. The great body of the public lands has not yet been examined in detail, but as fast as means will permit reservoir surveys are being conducted on a small scale. These should be extended whenever practicable. The United States is still the owner of one-third of its whole area, exclusive of Alaska, an area three times as great as the thirteen original states. This one-third contains not only great resources in minerals and grazing, but also immense tracts of rich agricultural land capable of supporting a population of many millions wherever sufficient water can be had. The utilization of this land or any considerable portion of it and the development of the resources of the western half of the country are practically at a standstill owing to the lack of water conservation. The measurements of this survey have shown that during each year great volumes of water run to waste, much of which could be held by storage in natural reservoir sites already surveyed or believed to exist among the high mountains and upon government land. In order that these sites may be utilized whether by the individual or by the community, it is necessary to continue and extend accurate surveys and obtain correct information as to the location, capacity and probable cost of construction."

The lecturer closed with a discussion of possible causes of failure and explanation of details of construction of dams and selection of sites.

The work now being done by the hydrographic department is of incalculable benefit, and will contribute largely to the success of the plans for reclamation of arid lands.

The trend of action so far has been toward government ownership and management of streams, the waters of which have been or may be diverted for irrigation purposes. Hon. Ellwood Meade, expert in charge of the United States division stationed at Cheyenne, Wyo., is outspoken in demanding repeal of the law now governing water rights and the enactment of laws which will vest such rights

in owners of the land irrigated and not in persons who appropriate water under the present laws for speculative purposes.

Dr. Seymour B. Young, vice president of the congress and permanent presiding officer, is a grandson of Brigham Young. The doctor is well posted on irrigation in Utah and is proud of the system established by his grandfather. The paper of Fred Bond, state engineer of Wyoming, read to-day gave many for the first time a knowledge of the irrigation laws of Wyoming, acknowledged to be the best laws of the kind on the statute books of any state. Higher praise could not be given Wyoming than was uttered by State Engineer Wilson of Nebraska, who said that the irrigation laws of Nebraska were silly when compared with those of Wyoming. He said Nebraska had copied after Colorado, where litigation over water is continually going on, where every farmer has to retain an attorney and keep a shotgun loaded to protect himself against encroachments of water companies.

The delegate most in evidence seems to be Professor Maxwell of California, who is well posted on all irrigation problems, who is often on his feet, who has something to say on every question, who is a fluent talker, and who pours forth his words with such rapidity that the official stenographer puts down his pencil and tries to look pleased.

On an informal ballot for location of the next congress, St. Paul received ten votes, Chicago thirty-six, the rest scattering. Upon motion Chicago was made the unanimous choice of the convention. The time for the meeting was left to the executive committee.

The report of the committee on nominations was received and adopted unanimously, the secretary casting the vote of the congress for the following officers:

- President—Elwood Meade, Wyoming.
- First vice president—S. M. Emery, Montana.
- Second vice president—L. W. Shurtliff, Utah.
- Third vice president—C. B. Hurtt, Idaho.
- Secretary—H. B. Maxson, Nevada.

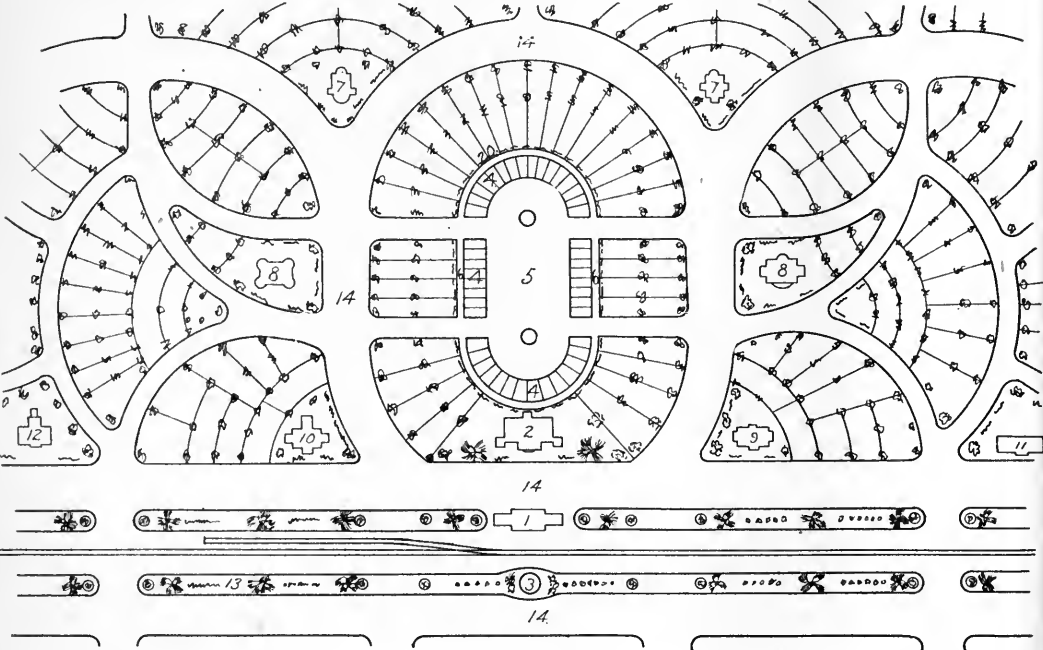
On motion, George H. Maxwell of California was elected national lecturer and ex-officio member of the executive committee.

The national executive committee elected is as follows: Arizona, J. H. McClintock; California, Scipio Craig; District of Columbia, E. F. Best; Idaho, D. W. Ross; Illinois, J. E. Forrest; Indiana, J. H. McNeeley; Michigan, O. E. McCutcheon; Missouri, Tom R. Cannon; Massachusetts, Herbet Myric; Minnesota, F. W. Wilsey; Montana, I. D. O'Donnell; Nebraska, E. M. Allen; New Mexico, Bradford Prince; Nevada, J. E. Stubbs; Oregon, A. N. Jones; Utah, C. L. Swendson; Wyoming, Fred Bond.

PROPOSED PLAT OF RAILROAD TOWN.

BY CHAS. C. CHRISTENSEN.

Whenever I cross the deserts of Colorado, New Mexico, Arizona and California—and I generally do so once a year—I see something else than the white sand and the giant cactus; I see the future farms, gardens and cities; I see the electric cars running; I see the whole landscape brilliantly lighted by electricity; I pass by schools, colleges and churches, and thousands of lovely homes, surrounded by semi-tropical gardens, orange and lemon groves; I see five, ten and twenty acre fruit ranches and extensive alfalfa fields, and through the land-



scape I see the silvery shining lines of the life giving irrigation canals and laterals.

Now we can see all that already in reality in Salt River Valley, Ariz., Southern California and other places, and surely the time is not far away when a mighty army of homeseekers will stream westward to the arid lands, and the cry will not be "Klondyke, Klondyke!" but: "To the desert! To the desert!" and by the magic water the arid lands will be conquered and cultivated.

Enclosed please find a plan and description of my modern railroad towns for the arid regions, from which you will see that I take some interest in the arid land question. As you will see from my design, I am not in favor of square blocks in towns; I prefer the curved lines—the lines of beauty; neither do I like to see a town started with a so-called “main street,” where the saloons outnumber the stores; it is not inviting, and will not draw intelligent settlers.

Hoping my idea will be of some interest for the readers of the AGE.

BRIEF DESCRIPTION.—As a means of developing the desert lands in portions of Colorado, New Mexico, Arizona and California, it is proposed to lay out, at the railroad lines, towns on suitable locations, where irrigation can be made available according to the plan submitted, with streets in curved lines, as shown. The grounds around the railroad station are to be selected for a park, and are to be beautified by flower beds, lawns and shrubbery. Residence portions of the town are to be planted with ornamental and fruit trees, flower bushes and shrubbery before the lots are sold. The business part of the town is to be hidden from view and located around an oval market, the building restrictions of the town being so drawn that business buildings will be permitted only in this locality, thereby doing away with the everywhere present “main store,” with its shanties and saloons.

On either side of the railroad lines, extending to the town limits and around the town, it is proposed to lay out boulevards and plant them with shade trees, with here and there flower beds, shrubbery, etc. Just outside the residence lots, the land is to be laid out in five and ten acre tracts, with larger ranches, farms and alfalfa fields outside the town limits. The scheme would seek to give all possible assistance and encouragement to actual settlers who would buy and improve land along the railroad lines in both directions from the town, by low prices for land, privilege of long time payment, low interest, etc., and giving as far as possible, the work of laying out the town, the building of roads and streets, irrigation pipe lines and ditches, the planting of trees and the care of lots, ranches, etc., to the settlers.

In this way it is thought that, starting with the place partly improved, the homeseeker with capital would come and invest in ranches and lots, and it is also thought that, with the restrictions above noted, an intelligent and progressive class of settlers could be drawn, who would soon make use of the sites for schools, churches, library, Y. M. C. A. building, etc.

To explain the lay-out of the town, the following key is attached:

- 1, Railroad station; 2, hotel and opera house; 3, fountains; 4, stores; 5, market; 6, alleys; 7, church sites; 8, school sites; 9, library and club house; 10, Y. M. C. A. building site; 11, natatorium site; 12, electric light and power station; 13, lawns and flower beds; 14, boulevards; 20, high trellis for climbing rose around business alleys.

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

THE AGE wants to brighten the pages of its Diversified Farm department, and with this object in view it requests its readers everywhere to send in photographs and pictures of fields, orchards and farm homes; prize-taking horses, cattle, sheep or hogs. Also sketches or plans of convenient and commodious barns, hen houses, corn cribs, etc. Sketches of labor-saving devices, such as ditch cleaners and watering troughs. A good illustration of a windmill irrigation plant is always interesting. Will you help us to improve the appearance of THE AGE?

CULTIVATION OF TOMATOES.

Tomato growing is one of the most pleasant and profitable industries for the farmer and market gardiner. The fruit can be used in many ways for household necessities, and where a market is near there is good money in marketing. Under ordinary circumstances an acre will produce 200 to 500 bushels of first class fruits. If this be sold in crates, of three-fourths of a bushel each, the crop will bring \$200 to \$500 per acre. In some localities the price seldom drops below five cents a pound, but as a general rule choice tomatoes will command at least two cents throughout the season.

The tomato may be grown on any average soil, but will yield more satisfactory returns from a light sandy loam, with warm exposure. If the land is too rich from barnyard manure, the vines will probably be too rank, and fruits not ripen. Tomatoes require considerable nitrogen and must have suitable fertilizers containing this element of plant food. If the ground is well prepared and about a half ton of fertilizer containing a proportion of available phosphoric acid 7 per cent., potash 6 and nitrogen 4 the plant foods will be all that the crop requires.

There are many varieties possessing differing degrees of merit, but, as a rule,

the Stone will give entire satisfaction as a hard, long shipper. The Canada Victor is a fine, solid tomato, desirable for shipping or canning. Among the large varieties the Imperial is one of the best. The old timers such as the Acme, Beauty and Perfection each have good qualities, and are always in demand. It is well for the grower to study the conditions of soil, climate and market facilities, before selecting seed, then secure several seed catalogues and read up the characteristics of each variety before deciding what to plant. Seed should be obtained fresh every year from reliable growers. If early tomatoes are wanted, and they are the most profitable, the seed may be started in boxes in the house, or hot beds out of doors. For late plants the best plan is to burn a brush heap, in some fair spot, rake off the trash, and dig in the ashes, while warm, and sow the seed broadcast. After raking in and firming the surface with a shovel, place a good covering of fine brush over the bed and leave until all danger of frost is over. These plants will be hearty.

Transplanting is best done while the plants are small, only four leaves showing. A dibble, or sharpened peg about ten inches long, in the shape of a carrot, is the best tool for this work. Where the land is irrigated, ditches should be filled

with water until the soil is wet, and the plants put in during the afternoon. If the furrows run north and south and the plants are to set on the west side, the beds will hold moisture longer and a stand is easier secured. For general cultivation with a plow the furrows should be at least three feet apart and plants set three feet in the rows. If only a small path is desired, and hand cultivation the method, the vines may stand two feet either way.

Thorough cultivation is necessary for success in tomato culture. When the plants reach one foot they should be trellised, if that plan is desired. Some use poles, tying the vines up, others have frames and some use wire poultry netting. As a general rule the vines will do as well without trellises, if topped when about two feet high. This is done by clipping back all the shoots with sharp shears. If the blight or black rot appears the vines demand thorough watering, which in most cases will destroy the causes of disease. When the vines become a very dark green they must have water to make the fruit set.

Picking is best done in the morning after the vines are dry. All fruits showing even the slightest color should be picked and placed in dark boxes to ripen. The most successful gardeners pick the fruits as soon as the under side gets white and store in boxes to ripen. This insures a more uniform color and enables the grower to market in large quantities. For home use the solid, half ripe specimens are the best, if put in large five gallon tin cans and sealed, instead of using the smaller bottles.

JOEL SHOMAKER.

TO TRY RAISING TEA ON IRRIGATED LANDS.

Prof. Elwood Mead, irrigation expert in charge of irrigation investigations, has been advised by the Department of Agriculture that he is to take charge of the proposed experiments in tea culture by irrigation in the United States. Dr. C. U.

Shepard, special agent, who has been in charge of the preliminary work, has been directed to report to Expert Mead for instructions in conducting the experiments. He is authorized to expend \$700 for the necessary apparatus for the work. A sum of \$5,000 is now available for experimenting in this matter.

Secretary Wilson of the Department of Agriculture, is greatly interested in this new work, and every effort will be made to determine whether tea can be successfully and profitably grown in the United States with the aid of irrigation.

The annual importation of tea into the United States amounts to 90,000,000 pounds, valued at \$15,000,000. At the present time no tea for commercial use is grown in the United States. The best teas are grown by irrigation in climates, at elevations and in soils similar to those which, it is believed, may be found in the United States.

BIG SALE OF MARSH LAND.

The Northwestern Grass Twine Co. of this city has bought 5,000 acres of marsh land from the Northern Pacific Railway, located some 50 miles west of Duluth.

This land has never been supposed to be of the slightest value. The company's large factory there, which will make this worthless grass into a valuable binder and other twine, will be finished the coming winter.

TO BE SENT TO THE ORIENT.

Southern California will this year make its first shipments of apples to a foreign country, the Orient being the country looked to for an outlet for what is sure to be a leading product in the course of a few years.

This is an abrupt change in the apple market, for until recently the country has not been self-sustaining in the apple line.

During recent years there has been a heavy planting of apples on mountain land, and the trees are now coming into production. There is no prospect of the state consuming the entire crop.

BEET-LIFTING MACHINE.

Among the agricultural implements needed in cultivating the sugar beet no machine is more useful than a good beet digger. In fact, some such device has become absolutely indispensable to every one engaged in that kind of work. In order to ascertain which is the best, the Deutsche Landwirtschaft-Gesellschaft (German farming association) has opened a prize competition, offering premiums amounting to a total of \$130. The examination of the competing machines is to be held in the fall of the year 1900. An additional prize will be given to that machine which will raise and top the beets at the same time.

In conjunction with the above association, the Verein der deutschen Zuckerindustrie (association of the German sugar industry) has offered prizes amounting to \$1,904 and \$2,380. These prizes will be given to machines that are not only the best of those exhibited in the competition of the farming association, but that in addition thereto come up to certain other requirements and specifications set forth in the conditions of the prize offer. This competition is open to foreigners.

BIG TIMBER FRAUDS IN WASHINGTON STATE.

Officers of the United States Government are now investigating a gigantic timber fraud which has been perpetrated by logging and milling companies in Western Washington. These companies and firms have been engaged for years in securing large belts of most valuable timber in the state.

Many of these tracts were located in Mount Rainier, Cascade and Olympia forestry reserves. When these reserves were set apart under the Cleveland administration, it was provided that owners of timber lands within reserves could deed them to the government and receive in lieu thereof an equal acreage of good

standing timber obtainable elsewhere on government lands.

There was no distinct provision that lands within the reserve should not be denuded of their timber before exchange was made, and neither was any date set when such exchange should be made.

The result has been that a number of companies have made short work of logging off great acres of timber lands within the reserves. Now they are ready to exchange these denuded lands for heavily timbered government lands which their cruisers have spied out. The government has just discovered that portions of its forestry reserves are now forestless, and steps will be taken to prevent further timber cutting on reserves.

THE NEW ONION CULTURE.

The growing of marketable onions is one of the most profitable and certain of all farm products. Although many thousands of acres are devoted to onion culture in the United States, importations are made from all the onion countries of Europe to supply our demand. The increasing markets of the orient, the Klondike, China and Japan make demands upon the western farmers and truck growers that cannot be supplied. Some growers harvest 1,000 bushels per acre, and the price has ranged from \$20 to \$65 per ton during the past few years. Several factories have been built near the Pacific Coast shipping points, for preparing desiccated vegetables for Alaska, and there is nothing more in daily demand than choice onions.

Onions may be grown on any clean, rich soil, but that which is well drained and contains a large amount of decomposed vegetable matter is the best. In some sections the black, swampy muck makes an excellent onion soil if drained and cultivated. If an alfalfa or clover field is plowed in the fall, and stirred or worked over with a disc harrow in the spring it will make an ideal onion field.

An analysis made by the Connecticut Experiment Station shows that a ton of mature onions contains 2.70 pounds of nitrogen, 0.92 pounds of phosphoric acid, and 2.09 pounds of potash. This shows conclusively that the soil must contain these elements, and if it does not the crop will be a failure, at least to the extent of their deficiency. The onion field should then be fertilized with some commercial fertilizer, using about 1,500 pounds per acre, of that containing 6 per cent phosphoric acid, 7 of potash and 4 of nitrogen.

There are several varieties, but the red Wethersfield, Yellow Danvers and Silver Skin are the favorites of gardeners and truck farmers. The seed should be purchased from reliable seedmen who make a regular business of supplying customers. It does not pay to buy cheap seed of anybody. As a general rule it does not pay the beginner in onion culture to try any but the standard varieties but some of the novelties may be planted as experiments. The old plan is to drill the seed in rows about fourteen inches apart, early in the spring, then thin as the plants come on to about four inches in the row. This is hard, tiresome work, and deters many who might be good growers from attempting the work. If the seed is sown in the hot bed or cold frame, and the plants reset in April, the crop will be larger, require less attention, give more uniform tubers and net more money at less outlay than the old plan.

The ground should be put in good condition, the rows laid off about fourteen inches apart and everything in readiness for planting as early as possible. When the plants are six inches high they may be taken from the seed bed and transplanted. The best tool for this work is a dibble made of wood about ten inches long, in the shape of a long parsnip. Water should be run through the rows long enough before planting to thoroughly soak the loose earth, so that when the dibble is used the holes will be in moist

soil. Make the holes about four inches apart and set a single plant in each hole, gently squeezing the moist earth around the plant. In two or three days run water through the rows again and when the ground is dry cultivate very shallow. If barnyard manure has been used the weed seeds will germinate and cause much labor.

Thorough cultivation and plenty of moisture are necessary requirements for producing good crops. If the onions are irrigated the water should be run through the rows at intervals of probably two weeks, but not be permitted to soak too much, as that tends to decrease the yield. The transplanted onions may be cultivated almost exclusively with small teathed garden implements. Harvesting should be done when most of the necks turn yellow and are withered. If delayed the old sets will begin to grow again. The bulbs may be pulled and thrown in winnows for a few days to dry. After drying the tops should be cut off and the bulbs marketed or stored for winter selling. Sheep shears make excellent toppers. A bushel weighs 56 pounds, so that the selling price may be easily reckoned when quotations are in tons. Onions should be sold during the winter or as early in the spring as possible.

JOEL SHOMAKER.

CULTURE OF RICE IS A NEW TEXAS INDUSTRY.

A branch of planting which has lately been successfully carried on in Texas is the culture of rice, an industry which is new to the State and but just developing to notable proportion. It is scarcely ten years since a feeble beginning was made, but as the occupation proved profitable additional acreage was planted. This cereal requires constant irrigation for successful culture, and can only be carried on where frequent inundation of the fields can be accomplished.

The success which has attended the small enterprises in rice growing has en-

couraged the enlistment of capital, and it is now proposed to purchase 15,000 acres of suitable land and sow it with rice, leaving the care and culture of the crop in the hands of experts. The chances of profitable investment are regarded as so encouraging that the prospectus of a company has been issued, with the object of carrying on the business.

The Trinity Rice, Land & Irrigation Co., of Chambers County, Tex., expects considerable earnings on the capital invested. A recent statement of the company shows a net earning of \$91,500 on an investment of \$260,000 in the purchase and planting of 10,000 acres of land. Now additional capital is sought to still further develop the enterprise, and it is being subscribed to the company's stock in a satisfactory way.

The company was organized last April. Among its officers are men of note in the business world, who are already standing at the head of successful business enterprises. A majority of the stock was taken by the organizers. The object of the prospectus just issued is to sell about \$120,000 worth of the company's unsold stock. It is expected that one year's operation will put the stock above par.

The adaptability of the lands to be purchased, abundance of water, drainage and all necessary features to insure success, have been ascertained beyond a doubt. A committee was sent from St. Louis to Chambers County, Tex., and a full investigation was made. Farmers were interviewed, the land owners consulted, the soil examined and every necessary precaution taken. The methods adopted in the successful rice lands of Louisiana are to be used, and those interested have every reason to look forward to the success of the enterprise.

TREES FOR DRAINAGE.

It is a popular belief that trees about a house tend to make it damp. It is true that after heavy rains a dwelling with trees surrounding it takes more time to

dry out than one not so surrounded. On the contrary it is just as true that where trees are the soil is very much drier than it would be otherwise. Some years ago the daily papers had much to say of the drainage of a malarious district in Rome by the planting largely of the fast-growing blue gum tree of Australia, *Eucalyptus globulus*. There is no doubt that this rapid-growing tree would quickly change the character of a half swamp, as it grows fast and has thick foliage. When there is a lot of trees full of foliage there is great call for moisture from the ground. The roots are drawing it continually, and this in the long run accomplishes as much as a system of drainage would do. I have myself witnessed the great change brought about by the cutting down and clearing of trees from a low piece of land. What was a fairly dry place while the trees stood became almost a swamp. It is not as easy to start evergreens in such a spot as it is deciduous trees; otherwise they would be better for the purpose as there is more evaporation from them in the winter season. But it must not be supposed that there is entire rest on the part of a deciduous tree in winter. The roots are active and especially toward spring an enormous lot of water is taken from the earth by the roots of a large tree. This is why trees near dwellings which are in damp situations are so valuable. The cellar of a house which is surrounded by large trees will be very much drier than before the trees were there. This I have seen many examples of. There is no need to plant trees so close that the branches will reach to the house and it is not at all desirable that the limbs overhang it. Deciduous trees are better than evergreen for planting near a house. An evergreen is not a top spreader and affords but little shade. The deciduous one gives the shade in the summer when it is needed, and its roots are drying the soil to a great extent in winter as well as largely in summer. One of the best trees for the purpose is the common white maple. It grows quickly, makes a good deal of foliage, and is much more of a surface rooter than many trees, and this is what makes it so good for drainage. Those who may have a piece of land that would be improved by being drier and would not object to trees doing the work for them should plant some. The result would please them very much.—*Practical Farmer.*

WITH OUR EXCHANGES.

THE SATURDAY EVENING POST.

The *Saturday Evening Post* is coming to the front among the publications that one looks forward to receiving. Each number seems better than the preceding one, and the cost is exceedingly small. The editorials are especially good. Beginning with the fiction number, which came out Sept. 28th, the journal was increased from a sixteen to a twenty-four page weekly, with a double number every fourth week. This will allow for the presentation of more fiction and short stories. Ex-Senator Ingall's paper on prominent men—Garfield, Blaine and others, are splendidly written and the lives he so dramatically portrays are of keenest interest to those who remember these noted men.

MCCLURE'S MAGAZINE.

The leading article, or I should say, articles in the October number are about Admiral Dewey. Very appropriate they are in view of the recent home coming of this great sea commander and the enthusiastic interest taken in him by the nation. The first is a tribute to him written by Gov. Roosevelt—a hero writing of a hero. The versatile governor, who is ranchman, soldier, writer, politician, was assistant secretary of the navy at the time when Admiral Dewey was chosen for command of the Asiatic squadron, and the article is therefore all the more valuable. In the one following, by Jos. L. Stickney, more of the personality of the Admiral is brought out and is fully as interesting as the preceding one. Another who has been almost as prominently before the public eyes as Dewey, is Dreyfus, and the "Scenes and Actors in the Dreyfus Trial" by G. W. Stevens, will appeal to the readers.

Mark Twain's contribution to the *Cos-*

mopolitan on Christian Science has brought this delightful humorist more prominently to the fore and gives added interest to the biographical sketch and portrait of him which Samuel E. Moffett gives us in McClures. In lighter vein are the short stories an inimitable "Boyville" story by Wm. Allen White.

SCRIBNER'S.

For October gives us a beautiful colored frontispiece, followed by "The Water-Front of New York" by Jesse Lynch Williams, beautifully illustrated. Theatre goes, especially the older ones among us, will be entertained by the autobiographical sketch of Mrs. John Drew, which begins in this number. In it are given portraits of such well known performances, as Edwin Forrest, Booth, Fanny Kemble, Charlotte Cushman and others. The vaudeville theatre, that much maligned institution, gets a word of commendation from Edward Milton Royle. The "Chronicles of Aunt Minerva Ann" furnish the necessary humorous vein while a touch of pathos is given in the tale by Judson Knox on "The Man from the Machine." There are other good things too numerous to mention.

THE LADIES' HOME JOURNAL.

The author of the famous "Mr. Dooley" Finley P. Dunne, has joined the literary of *The Ladies' Home Journal*, and will create this fall in that magazine a new character, called "Molly Donahue: who lives just across the street from Mr. Dooley." Her creator says that Molly is a bright, pretty girl of nineteen, who has ambitions for the great world of women's clubs, Browning societies, golf clubs, woman's rights organizations, and the "high-toned literary and social life" which

thrives on "the elite side of Chicago." Her mother and brother sympathize with her, but her father, who works in the mill, is hard to deal with in that he will insist on sitting at table in his shirtsleeves and in his stocking feet. "Mr. Dooley" is the family's most intimate friend and is called upon frequently to run across and set matters straight.

In the October number Rudyard Kipling gives not only an interesting but a complimentary description of the "American Girl." We have also the first paper on the "Theatre and its people," the beginning of a series that is to be given. One of the best short stories is "the Widow-hood of Sally Bunn."

Neither the *Forum* nor the *Review of Reviews* for this month has not as yet reached us but we feel assured that both will be fully up to their usual mark in excellence.

A little cloth bound book, brim full of beautiful pictures, was sent us by the Division of Forestry, United States Department of Agriculture. It is Part I of "A Primer of Forestry" by Gifford Pinchot. Every one interested in the kindred topics of forestry and irrigation should have a copy of this book.

THE AMERICAN QUEEN.

Mary Wilkins and Eliza Hood are among the prominent contributors to the fiction in the October number of *The American Queen*, which this month goes

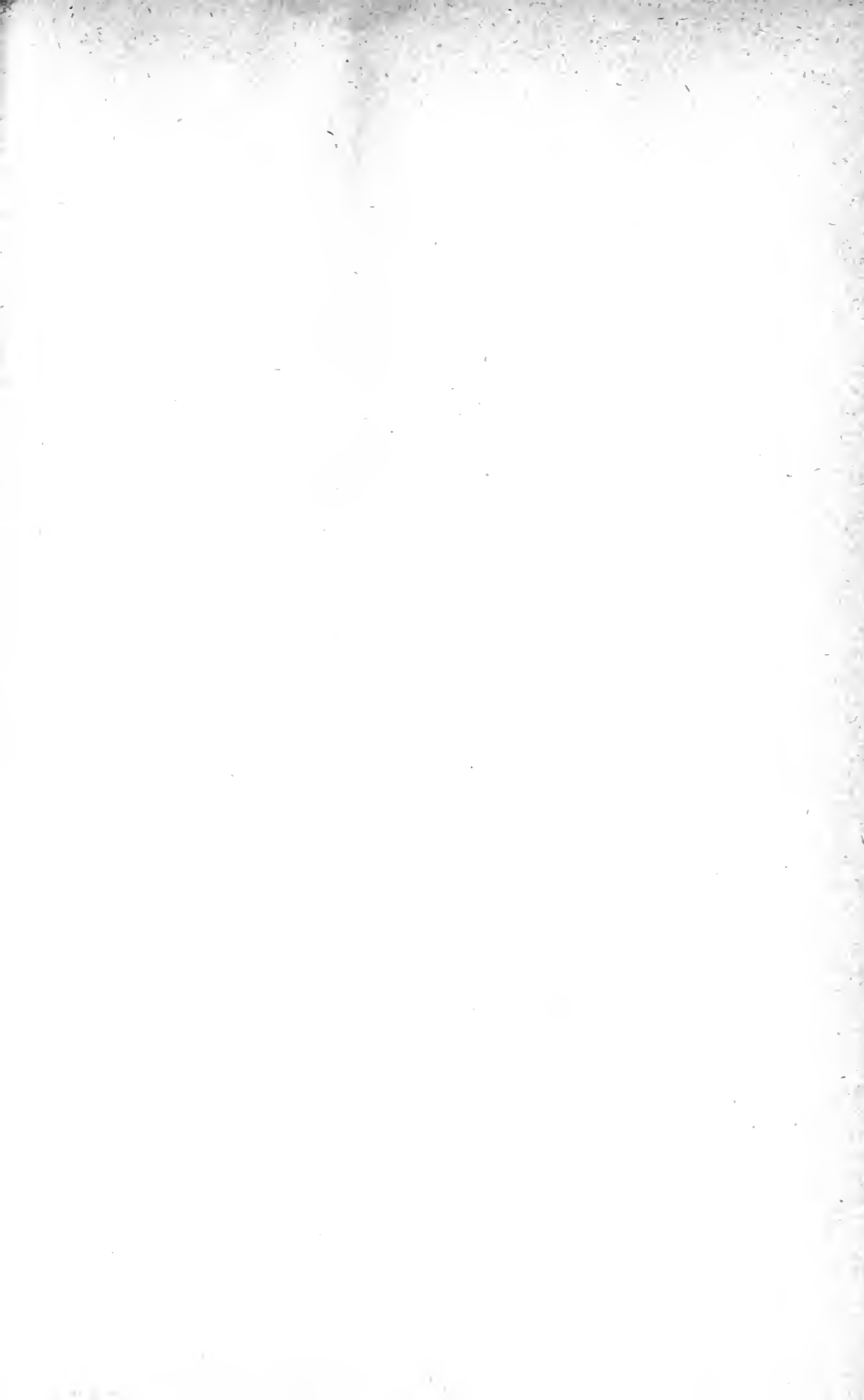
more largely than usual into fashions: Fashion articles on materials, linings and millinery, and exquisite designs in costumes, wraps and hats, are silent features of this issue.

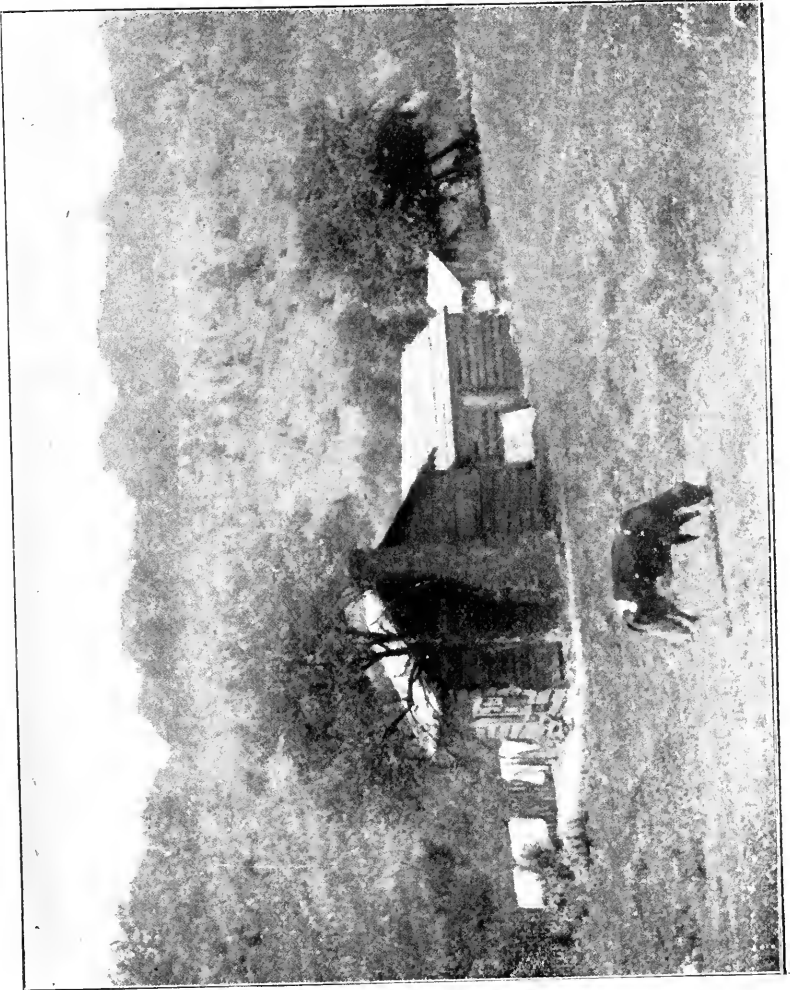
Sarah Grand, John Strange Winter and Isabella Mayo, each contributes an article on the interesting question "At What Age Should Girls Marry," and an article on "The Selection of a Husband" is also from the pen of the first.

The usual embroidery, puzzle, and housewife's departments are replete with excellent matter, and a couple of articles on lawn tennis and the new game of croquet are timely and interesting.

The cover, an exquisite creation by Alexander J. Rummler, is entitled "Hallow'en."

The catalogue of the Witte Iron Works Co., Kansas City, Mo., is deserving of mention, being a very handsome booklet—a credit not only to the company, but to the printers as well. On the dark blue cover is embossed in silver letters the words, "Witte Gas and Gasoline Engines" and after the neat title page, the body of the catalogue sets forth the merits of the goods they manufacture. The half-tone illustrations show the various engines made by the firm, the different parts, the portable engine, etc. These engines are built in parts as are the best steam engines, and their makes include stationary, portable, pumping and hoisting engines for gasoline, naphtha, natural gas, manufactured gas, etc.





THE IRRIGATION AGE.

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THE PROGRESS OF WESTERN AMERICA.

**Boers
and
Britains.**

Whether it is due to the instinctive feeling of sympathy for the "under dog" or whether it is the recollection of sturdy men who fought some hundred years ago for life and liberty against fearful odds, we are unable to say but one of the two, or possibly both, causes many Americans to have a strong sympathy for the Boers. The same spirit which actuated the Pilgrim Fathers to set forth to an unknown land wherein they hoped to worship God after their own belief, caused the sturdy Dutchmen to seek Africa; the same uprising against injustice which was exhibited at the well-known "Boston tea party" is manifested in the ultimatum of President Kruger. "Nothing succeeds like success." Geo. Washington was a hero, the great man of the hour; had he failed he would have been a rebel. The man who fails is the rebel. He who succeeds, the hero. We may all question the wisdom of Oom Paul's ultimatum, since it cannot but provoke war with a mighty power, which might by diplomacy have been averted, but perhaps our Declaration of Independence seemed as absurd a document when first promulgated. The Boers are not progressive; they are not fashionable: they prefer ox-teams to railroads; oppose improvements and innovations which are bound to come; but to balance these defects they are known to be an honest, industrious people, leading simple, pastoral lives with an almost patriarchal form of government: the only favor they ask being the very negative one of being "let alone." Olive Schreiner, whose life

in Africa has qualified her to speak with authority, in a cable to the newspapers, deploras the attitude of England toward the Boers, an opinion which is held by her brother, who holds a position under the British government in South Africa.

Down below the surface is the greed for gold: there are diamond mines in the Transvaal and the Boers are a weak nation. Unscrupulous politicians: men who went to the country ostensibly to represent the British government but who used their position for selfish ends, who by insolence and arrogance contrived to breed discontent among the Boers against the British, to these men, in a great measure, is due the present crisis, just as the revolutionary war was directly traceable to similar causes.

**Thanks-
giving Day.**

Before another number of the AGE goes to press Thanksgiving Day will be one of the holidays to which we look backward. The small boy will have gorged himself and had the regulation discomfort attendant thereon; speeches will have been made; festivities indulged in; and we will have all been thankful. At least we should be, for there are probably none among us so poor, so sorrowful, so forlorn but what our conditions might be worse. It is strange how our holidays have come to have such a different significance from what their originators designed. Christmas from being a solemn anniversary has come to mean mainly a time of gift-giving preceded by a long and agonizing period of preparation in which fancy work and shop-

ping play a prominent part. So Thanksgiving which to the Pilgrim Fathers meant literally a day upon which to give especial thanks to the Creator is now associated inseparably with turkey, cranberry-sauce, and a family gathering at which the family skeleton gets such a thorough outing from his closet as he has not had for many a day. We cannot go back to the simple pleasures of long ago, we cannot feel the same solemnity regarding this day, but we can and ought, each of us, to snatch at least a few moments on Thanksgiving Day to think of our "marcies" and in heart, at least, be thankful for the happiness that may have come to us individually and for the prosperity which has come to our country.

Every now and then we read of instances wherein donations are made to the "conscience fund" at Washington, D. C. Recently \$200 was sent to Treasurer Roberts with the following letter:

"Enclosed find \$200. This is for money just the amount taken from the Government through the Commissary Department at time of war of rebellion. It is herein returned."

This is only one of a large number of persons who, after many years, are induced through some means, to send to the "conscience fund" amounts of which they have defrauded the government. When a man thus tries to right a wrong that is unknown to all save him, it shows that there is such a thing as conscience.

Under this title the *New York Commercial* has the following to say editorially:

"There is no more gratifying or significant sign of the times than the South's seeming determination to become a manufacturing as well as an agricultural section. Only recently the *Commercial* printed an editorial from the *Nashville American* which seemed to voice a sentiment now prevalent throughout the cotton belt. A few years ago newspapers in the old slave States devoted themselves almost exclusively to politics. An industrial article, if it appeared at all, was printed merely as a news item without comment. Henry W. Grady, of the *Atlanta Constitution*,

was the first among Southern journalists to recognize a new order of things, and during his lifetime he wrote ably and pointedly in favor of a new South. To-day such representative newspapers as the *New Orleans Times-Democrat* and *Picayune*, *Atlanta Constitution*, *Nashville American*, *Savannah Morning News*, *Memphis Commercial* and the *Charleston News and Courier* are eschewing politics and devoting themselves to urging material development in their respective communities. This is a gratifying change and its influence is already being keenly felt. One cotton manufacturing concern in Georgia last year paid dividends amounting to 97 per cent. on its investment. Capital will certainly be attracted into such a community, and we hope the good work will continue."

The Philadelphia Board of **A Good Idea.** Trade has recommended the International Commercial Congress the establishment of a bureau for the collection and dissemination of agricultural statistics throughout the world. Such a bureau would be of almost infinite value to both producing and consuming nations. It would give the American farmer, for instance, information as to the visible supply of wheat, corn, cotton and other products and enable him to sell to the best advantage at the most favorable time. International statistics are now collected, but not by governments for the benefit of all alike. Wealthy speculators secure the information and use it to their own profit, buying when a commodity is cheap and selling at an advance when scarcity becomes apparent. Another thing, such a bureau would bring the countries establishing it into closer touch with each other—would stimulate their commercial relations by fostering reciprocal trade. The world would become better acquainted.

Prosperity Versus Crime. Investigations of the records of the Joliet state penitentiary tend to show that crime, in a large number of instances, is due to absolute want. As "good times" commence the number of convicts sent to prison each month decrease, proving the assertion of the *Times-Herald* that "by days for the

merchant and manufacturer mean dull days for the turnkey." There has been a noticeable decrease in the number of men who go about looking for odd jobs. Business has so improved that men who were once driven to crime to avoid want, now have steady work. In May, 1895, there were 1,623 convicts in Joliet prison; now there are 1,278. For the first time in the history of this institution a whole month passed without the addition of a single new convict. In commenting upon this the *Times-Herald* says: "There has been no transformation in the character of men, but the scourge of grinding poverty has been withheld, and the temptation for the weak is not what it was."

Our Exports and Imports,

The table of imports and exports for the nine months ending with September, 1899, the treasury bureau of statistics, gives some interesting facts regarding the classes of articles in which the increase of imports predominates, and the classes most affected by the increase in exports. Importations have increased from \$475,360,803 in the nine months of 1898 to \$585,934,124 in the nine months ending with September, 1899.

An examination of the imports by classes during that time shows that the increase is almost exclusively in articles used by manufacturers and foodstuffs, largely sugar and coffee. The class "articles in a crude condition for use in domestic industries" increased from \$148,937,651 in the nine months of 1898 to \$190,252,298 in the

nine months of 1899. Thus articles for the use of manufacturers increased, in round terms, 50 million dollars; foodstuffs, 37 million dollars; manufactures ready for consumption, 9 million dollars, and articles of voluntary use, luxuries, etc., 15 million dollars.

The export side of the nine months' statement is equally interesting. The total exports in the nine months ending with September are more than \$30,000,000 in excess of those of the corresponding months of last year. An analysis of the statement by great classes presents some curious and suggestive facts, especially when considered in connection with the import figures. The exports of products of agriculture, for instance, are nearly \$30,000,000 less than in the nine months of last year, while those of manufactures are \$50,000,000 greater than those of the corresponding months of last year. This enormous increase of \$50,000,000 in the exports of manufactures is especially interesting, when considered in conjunction with the increase of \$50,000,000 in imports of material for use of manufacturers. Exports of manufactures in the nine months ending with September, 1899, amounted to \$277,502,649, against \$277,822,045 in the nine months of 1898, are formed 31.34 per cent. of the total exports, while in the corresponding months of last year they formed but 22.66 per cent. of the total exports.

Products of the forests and mines also show a material increase in exportation.

STATE AND NATIONAL CONTROL OF WATER.

By J. M. WILSON, State Engineer of Nebraska.

[We are very pleased to present to our readers the following paper which was read by Mr. Wilson at the eighth annual Irrigation Congress.—ED.]

For six years from 1888 to 1895, in the statutes of Nebraska, under the head of "Water Rights and Irrigation" appeared the following provisions for the acquiring rights to water. The title under which this bill was introduced into the Nebraska Legislature is:

"An act to provide for water rights and irrigation and to regulate the right to the use of water for agricultural and manufacturing purposes."

Sec. 8. A person, company or corporation, desiring to appropriate water must post a notice in writing in a conspicuous place at the point of intended diversion, stating therein:

First. The he, they or it claims the water there flowing to the extent of (giving the number) inches measured under a four inch pressure, and accurately describing the point of diversion.

Second. The purpose of which he, they or it claim it, and the place of intended use.

Third. The means by which he, they or it intend to divert it, and the size of the flume, ditch, pipe or aqueduct in which it is intended to divert it. A copy of the notice must, within ten days after it is posted, be recorded in the office of the county clerk of the county in which it is posted.

Sec. 9. Within sixty days after the notice is posted, the claimant must commence the excavation or construction of the works in which it is intended to divert the water, and must prosecute the work diligently and uninterruptedly to completion unless temporarily interrupted by snow or rain.

Sec. 10. By completion is meant conducting the water to the place of intended use.

Sec. 11. By compliance with the above rules, the claimant's right to the use of water relates back to the time the notice was posted.

Sec. 12. A failure to comply with the above rules deprives the claimant of the right to the use of water as against a subsequent claimant who complies herewith except as provided in the next section.

Sec. 13. All ditches, canals and other works heretofore made, constructed or provided by means of which the waters of any stream have been diverted and applied to any beneficial use must be taken to have secured the right to the waters claimed to the extent of the quantity which said works are capable of conducting and not exceeding the

quantity claimed without regard to or compliance with the requirements of this chapter.

Sec. 14. Persons who have heretofore claimed the right to water and who have not constructed works in which to divert it nor applied it to some useful purpose, must, after this title takes effect, and within ninety days thereafter, proceed as in this title provided, or their right ceases.

Sec. 15. The County Clerk of each county must keep a book in which he must record the notices provided for in this title.

An investigation of the water right legislation of the other states reveals the fact that the law or its equivalent has had a place for a longer or shorter period in the statutes of nearly every one of the irrigation states, and that it is still in force in Texas, Oregon, Washington, Nevada, Idaho, Oklahoma and Montana. More than one half of the rights to water now in force in Nebraska have been initiated under this statute. Inasmuch as it is still law in many of the states, it may be worth while to consider it in detail.

First in order is the notice.

The name of the genius who first conceived the idea of posting a notice at the point of diversion is unfortunately lost to history. What possible useful purpose could be secured by posting a notice in some bend of the stream among the weeds and brush, where in nine cases out of ten, it can never be seen except by the party posting, is difficult to conceive. On streams like the Platte River or the Niobrara or the Republican or the Loups of our state what chance that it could be found even if sought for, by any other than the party posting.

Think of a sane man gravely posting a notice in a willow thicket on the banks of the Platte in Sarpy county near the eastern limit of the state of Nebraska to protect himself against and to warn a possible claimant in Scotts Bluff county near the Wyoming line 400 miles away. In contrast with this, the horse shoe and rabbit's foot superstitions seem respectable. At least, they are not mischievous and misleading.

The filing of a copy of the notice with the County Clerk or as in one or two of the states with the County Surveyor, is another provision of almost equally doubtful value. Where the course of the stream is wholly within the county in which the filing is made, this might be considered a fair notice to subsequent appropriators, but in most cases, the division into counties is in disregard of topographical and drainage lines.

The Platte River and its tributaries, the North and South Platte in Nebraska, intersect or bound 22 of the 90 counties of the State. The Republican touches in its course 9 counties, the Niobrara 10, the Loups 13 and the Elkhorn 10.

Every stream of any importance in the state extends through two or more counties, and the records of the filings made during these six

years on these streams are distributed through these various counties.

The provisions as to the beginning and prosecution of the work and the proviso that the claimant who fails to comply with the law shall acquire no rights as against the subsequent appropriator who makes full compliance, are in their way, well enough, except that no provision is made for determining as to who have and who have not complied with the law.

On one claim for 200 cubic feet per second from White River (the average flow is 15 cu. ft. per second) filed June 16, 1891, the total force employed in construction up to April 12, 1895, was two men and one team for one and three-fourths days.

The state was divided into water divisions along drainage lines. Administrative officers were provided whose qualifications and duties were clearly set forth. This is a part of the organic law of the state. At the first session of the Legislature after Wyoming became a state, the principles outlined in the constitution were elaborated into a law which embodies the best that has yet been attempted in irrigation legislation.

This law provides:

First; a place of record. Every claim for water must be on record in the office of the State Engineer. Under this law, there is no need of uncertainty or doubt in the mind of any person desiring to make an appropriation as to what is already claimed. A letter addressed to the State Engineer will bring in answer full and complete information concerning the appropriation of any stream. There is no need of disappointment through the construction of ditches on over appropriated streams.

The law provides:

Second: that all claims whose priorities and amounts have not already been determined by Courts should be brought before one tribunal, the State Board of Control. This Board is composed of the Engineer and the four Superintendents of the Divisions.

The State Engineer brings to this task in addition to his professional skill, the resources of a well equipped office with expert engineering assistance. If special or technical information is desired in the adjudication of any case, it can be obtained at first hand. The Superintendent of the Division in which the case is heard has made a special study of the streams in his division and is familiar with all the local conditions. The other three Superintendents are by their work in their own divisions specially fitted for an intelligent and impartial consideration of all the questions involved. Such a tribunal does not need to act on prejudiced, incompetent and conflicting testimony, as to acres irrigated, dimensions and grades of ditches and flow of streams. By the application of broad general principles, they they can, while taking account of the local irrigation practice and conditions, distribute equal and exact justice to all.

Contrast this with the adjudications of a Court as in Colorado, where a judge without the technical knowledge necessary for the consideration of the questions involved and unfamiliar with all the local conditions and customs, with no means of securing unprejudiced information, sits to hear contradictory testimony and make decrees, while other judges perhaps better mahap worse equipped for this duty are making decrees on the same stream in accordance with as many different principles or precedents as there are judges. In Colorado, each new decision is one more complication. In Wyoming, the adjudications settle something and tend to simplify the problem of distribution.

Litigation over water claims has practically ceased in Wyoming, while in Colorado no one expects to see the end of the litigation so long as the present system prevails.

The law provides:

Third: A well equipped and ample administrative force for the distribution of the water, consisting of the State Engineer, the Superintendents of the Divisions and the Subordinate District Commissioners.

The Commissioner in his district under the direction and guidance of the Superintendent and State Engineer, clothed with full power to enforce the decision of the Board. Thus each claimant is assured of adequate protection in his right.

This law provides:

Fourth: That no new appropriation shall be made from any stream until a definite and complete statement of what is proposed has been submitted to the State Engineer and approved by him, and each appropriation is considered in relation to its possible effects on the prior appropriations.

This to prevent the curtailment of the rights of the older claimant by over appropriation. This is not an imaginary danger. When there was no supervision in Nebraska, on a stream in which the total flow during the irrigating season is less than 30 cu. ft. per second, appropriations continued to be made long after the possible flow was exhausted and until canals were actually constructed covering over 12 000 acres of irrigable land.

The method of distribution in Wyoming is modeled on the same plan as that of Colorado from which it is likely copied, but the practice is much simplified by the superior method of adjudication. In Colorado, the State Engineer may distribute the water of the same stream in accordance with as many different and conflicting decrees as there are judges rendering the decrees. In Wyoming, one principle guides throughout.

Elwood Mead, for many years State Engineer of Wyoming, now Irrigation Expert for the U. S. Geological Department, in a bulletin issued last year entitled "Water Rights on the Missouri River and its

Tributaries," lays down the essentials of a working code of irrigation law: They are:

First. An accessible and trustworthy record of filings on the streams.

Second. A clear definition of water rights and a simple orderly and inexpensive procedure for their determination.

Third. Some means of dividing streams in times of scarcity in order that the holders of prior rights may be protected.

The Wyoming law embodies all these essentials, and is a model well worthy of initiation.

In 1895, the Legislature of Nebraska enacted an irrigation law which embodied as much of the Wyoming practice as a constitution that the state had outgrown would permit. We do not think of it as any improvement on the Wyoming law, but it is accepted as the best that can be done till further amendment to the constitution can be secured.

The four years that have elapsed since its adoption has enabled our State Board to clear away the useless rubbish of excessive and abandoned claims and speculative filings that had accumulated under the old law. The adjudications of the Board are generally accepted. Though ample provision is made for appeals from the findings of the Board to the Districts Courts, there are practically no appeals.

Litigation concerning water rights which under the old law threatened to monopolize the whole time of the courts and consume the energy and capital of the irrigator, has practically ceased.

With proper control, the elements of uncertainty concerning rights to water are largely eliminated. But there is a set of conditions which has caused more serious misapprehension and distrust in many localities for which state control furnishes no adequate remedy.

As with the Counties, state boundaries often divide drainage areas. An interstate stream, without interstate or national control sufficiently broad to protect the right of every genuine appropriator and user of water, is a menace to the peace and prosperity of the the states and communities involved.

Every man who contemplates the digging of a ditch from such a river or the purchase of a water right, asks himself what protection he can be assured as against appropriators in other states as well as his own. As things are now; there is none.

The Mitchell Canal takes its waters from the North Platte in Wyoming to water lands in Nebraska. Wyoming grants them no right and they made no claim to Nebraska waters. In fact, they do not appear on our records at all. Their priority is such that they are entitled to take water among the first, so no question has arisen as to earlier priorities in Nebraska having superior rights. A large part of the normal flow of the North Platte River has now been appropriated, but it is now proposed to enlarge and extend the ditch to cover

another and much larger tract than was served by the original ditch. Just what should be done with this second appropriation, in case it interferes with the appropriations already made in Nebraska, is one of the problems that the state engineer of Nebraska thinks over sometimes.

If appropriations should be made from the North Platte, in Wyoming for large bodies of irrigable land, such appropriations might become a serious matter to every irrigator and ditch owner on the North Platte and Platte Rivers in Nebraska. The prospect is seriously retarding the development of a fine territory where there is abundance of water, and where money has been expended lavishly in the construction of ditches.

Colorado threatens Wyoming through the Laramie River. She has already diverted the waters of the Arkansas so completely, that some of the earlier appropriators from this stream in Kansas find themselves without water, and their works useless.

The only settlement possible now, is through litigation. In other states like complications exist. Such conditions are preventable. It is not creditable or reasonable that they should be permitted to continue. Every year only adds to the complications. An interstate irrigation commission selected with a view to the intelligent treatment of these problems could adjust most of these difficulties and provide a rational plan for the avoidance of future complications.

There are in every one of the western states millions of acres of fertile lands now deserts only waiting for the water to change them into fruitful fields. The millions of acre foot of water which should work this transformation now go unvexed to the sea, and the national government is each year called to expend of its treasure in protecting the dwellers along the Mississippi from the floods of our rivers.

You do not need to be told all this. It is a matter of common knowledge and we, in the west, all agree as to the remedy.

That congress should establish a system of reservoirs for the conservation and distribution of the waters that now go to waste from our western rivers, is the conviction of every one who has given the matter thought.

But there are those who have contributed freely of time and money to develop irrigation interests, who believe that a great system of reservoirs at the sources of the rivers, might become a serious menace to the interests of all below, unless such system is under adequate control.

Such interstate arrangement as shall guarantee protection alike to all users of the interstate waters, is the necessary preliminary to any concerted action in securing national legislation looking to the improvement of the streams and the construction of reservoirs for the conservation of the waters.

The lack of an intelligently constructed working code of irriga-

tion law in so many of those western states, and the lack of such national legislation as shall set at rest all doubts as to the proper and equitable distribution of the waters of the interstate rivers are the most serious obstacles to the reclamation of the arid lands of our western states today.

With these matters all adjusted, with all the now conflicting interests harmonized, there will be little difficulty in securing the appropriation and the necessary legislation for the utilization of our now wasted water resources, and the arid west will enter on an era of development and progress, the like of which she has not yet seen.



WATER DEVELOPMENT.

ADDRESS BEFORE HORTICULTURAL SOCIETY OF REDLANDS, CALIFORNIA.

By T. S. VAN DYKE.

In the severest drouth know in her history Southern California has made her greatest advance. And in this the greatest step has been the absolute proof of her independence of the tourist and land-buyer.

We can now afford to proclaim from the house top unpleasant truths that we once kept for sub-cellar confidence. It is really our duty to drag them into full light of day and see how we can overcome them with the great resources at our command.

Foremost among these is the fact that the reservoir system, as we understood it six years ago is a dismal failure as a system on which to rely in the dry belts for valuable crops. Although there never was any reason to believe that our large reservoirs would fill every year it was generally believed that they would, and the few who knew better were hooted at as pessimists and cranks.

But the reservoir system as it should be is not a failure, though its success involves the recognition of two principles which have long been known to a few and which will be disputed by none who investigate.

First. To bring a reliable supply of water on land high enough above frost for the certain raising of good oranges and lemons costs a great deal of money.

Second. That the combination when well carried out is well worth it.

One great cause of trouble has been that the builders of reservoirs did not properly estimate the cost of water, or if they did that the land owners thought that they were trying to rob them because they themselves would not estimate the cost. The basis for doing it is very simple and should be applied to reservoirs of every kind.

As an inch of water runs in twenty-four hour seventeen hundred and twenty-eight cubic feet or sixty-four cubic yards, to store a continuous inch for two hundred days will take about thirteen thousand cubic yards of space back of the dam.

If the cost of this space is one cent a cubic yard, or about one-tenth the cost of ordinary excavation, the storage costs \$113 an inch to start with. If the dam costs \$5 a cubic yard, then at the rate of one cent a yard for space back of it for storage, one yard in the dam

will only equal five hundred yards of storage space. So that to have storage space for thirteen thousand yards of water at \$130 an inch in place, you will need twenty-six cubic yards in the dam. If these conditions hold out you would have a dam containing twenty-six thousand yards of masonry at \$5 a yard, costing \$130,000, and holding one thousand inches of water continuous flow for two hundred days.

There are few basins in Southern California that will fulfill these conditions, and they are none too plenty in any country. And in this we have not allowed for the evaporation, which will be about three feet for the irrigating season of two hundred days. Seepage and loss in transit cannot be estimated, but generally that loss is trifling.

This does not consider any of the other expenses of the reservoir or the aqueduct or the maintenance of both. It is merely a basis from which to estimate the chief item of expense in reservoir systems. And upon this comes the fact, now proved, that we must carry ahead water for at least two seasons and, for real safety, enough for two and a half or perhaps three if there is much of a town dependent on it.

These are unpleasant facts yet they are stubborn. But they by no means prove the reservoir system a failure. There are sections that can well afford to pay even on this basis, others where cheaper dams may be built, others where the reservoir may be merely supplementary to a stream that most of the year supplies enough water, while in other cases thorough winter irrigation with cultivation will make the draught on a reservoir in summer very light. Yet we must face the fact that good reservoir sites are rare and that the first thing to do is what is generally reserved to the last—estimate the first cost of the water in place back of the dam.

This applies to reservoirs to be filled only once a year or once in two years. Basins that are flat enough and wide enough, with a mouth narrow enough for a cheap dam, with foundation suitable for a safe one, yet with a watershed of sufficient size and rain-fall, but not so large as to have a huge river to fight or a vast wash of sand to fill up the reservoir, are very scarce in any country. But where there is a very large one it will pay to spend considerable on it rather than resort to small ones that are cheaper. For they are quite apt to be cheaper in appearance only. The rule is that the smaller the reservoir is the more expensive is the water. This is certain to be so in nine out of ten of small basins that look very fine, and in all of them there is apt to be more uncertainty about the supply when badly needed.

A reservoir to be filled more than once a year, as is the case with most of those in the Atlantic states, is a different affair, and so is one here to be filled from another source than its own watershed. For reservoiring an irrigating head several times during the irrigating season much more expense will often be justified. Most of the small reservoirs we see made for this purpose will repay their cost because

of the greater efficiency of the inch of water delivered in large heads. But even here it is quite as necessary to see at the start how much water you are going to store for so much money. For building a reservoir is after all mainly a question of what you can afford to pay for it. If one cannot get water in sufficient heads from the canal it will nearly always pay to make a reservoir large enough for those heads. If it should be so large that it will be too costly to cement, or line with anything tight, the loss from leaving it unlined will generally be trifling compared with the great advantage of having it. You can generally afford the cost of the excavation and buying more water to offset the loss. I do not mean that it would be wise to buy under such a canal and fortunately we have almost none of the sort here. But if for any reason the water supply is in small continuous flow you can afford to pay considerable to turn it into large effective heads.

For city supply considerable expense can be endured to make a reservoir tight that would be too great for an irrigator. Many reservoirs leak because of weak foundation and the leakage often increases that weakness. To make a foundation perfectly solid with perfectly tight lining makes a reservoir very costly. A thin lining of cement is almost certain to leak under any pressure and quite certain to crack under any considerable pressure. If constantly filled with clear water it is apt to continue to leak and will not puddle the fine openings or the ground beneath it. I cannot find a case in which such a lining has been washed with crude petroleum until it becomes tight. But there is reason to believe that it will not injure the cement. The Cement company's oil tank at Colton has held oil five years without injury as far as I can learn to the cement. Cement mixed with linseed oil makes a very tough and durable combination free from any cracks that the eye can detect, and is used in Scotland for roofing. Whether it is a true set or whether in the nature of putty, which is linseed oil and whiting, I do not know, but it is certain that the cement is not damaged by the oil. It would be worth while to try cement mixed with crude petroleum into a thin wash so that it would run and lay it over the ordinary cement lining where there is much leakage. Or plain asphaltum could be made to adhere to it if it were first washed with crude petroleum and that allowed to dry in. But in most all cases after a reservoir has had a year or two in which to puddle the loss of leakage, if measured by a gauge while the evaporation is measured at the same time with a floating pan beside it, will be found a mere trifle compared with the benefits of the heads of water it accumulates and which you already understand so well. To make a run of thirty inches for two days requires storage space of little over one hundred thousand cubic feet or thirty-eight hundred cubic yards. This would be about one hundred feet square and ten feet deep. In many cases the excavation alone will cost so much that you cannot afford to line at all, while in many other cases you can only

afford thin lining and cannot spend anything on making the foundation solid with concrete. And you cannot make the lining thick enough as can be done with reservoirs for city supply. Asphaltum may be laid against earth if on much of a slope but considerable care, that I have no room to describe here, must be used. It is probable that ordinary street surfacing washed with crude oil until leakage stopped would be the most effective form for the money.

The subject of procuring water is so large that I have to confine myself to the reservoir branch of it in which I understand you are mainly interested. The last two years have proved our underground reservoirs the most valuable we have and thrown more light on water than the preceding twenty. It is not possible to make any estimates of their capacity or yielding power as we can of reservoirs above ground. but it is almost as essential to do so and we should try to approximate it as nearly as possible.

There is absolutely no ground for the belief that there are any large underground lakes or streams as many water experts are claiming to locate, or that they come from the Rocky Mountains or the Sierra Nevada or from any where but our own local watersheds. It is comfortable and gratifying to our pride to think so but not wise. Our danger is in thinking we have below ground an inexhaustible supply and expanding our orchards and vineyards and alfalfa fields too much on the strength of it. To fall back upon when the water above ground falls from a dry season or two the underground water has proved one of our greatest resources. Some of it will undoubtedly stand any draught that is likely to be made upon it because the expense of pumping beyond the point of natural flow will be the limit of our ability to drain it. But it is quite as certain that much of it is in mere pockets of gravel filled from some distant source, connected perhaps by a mere thread of gravel or even sand. Once exhausted it may take two or more seasons to fill again. No one can tell anything about it.

Whether this water is found in vast beds of gravel hundreds of feet deep as in San Bernardino Valley, or in so many acres of shallow swamp or meadow land as in parts of Yucaipe, it is in every case a reservoir. The dam is friction instead of masonry. but it is none the less a reservoir and if the gate is kept open too long or too wide the result will be same.

It is not at all necessary to run to the Rocky Mountains to account for the stores of water we have found below. The grip of gravel on water is like that of a sponge in most cases, while that of sand is still tighter. The waste water of flood winters is great enough to account for all the accumulation there is in the great storage basins of gravel and sand, because we must not forget that they have really just been tapped. In some cases, as in San Bernardino Valley, the supply is to some extent kept up during the

summer by an inflow of living streams and in other cases it is not. This will make the one more durable than the other, but even it has its limits. Where they are we know not, but it is advisable not to try to find them. For the chances are very strong that if such a reservoir is once emptied it will take much longer to fill again than if it were a reservoir above ground. If we have in the meantime expanded settlement too much on that basis it will not only suffer but the great resource upon which we have fallen back in the last two years will also be gone and legitimate settlement will suffer also.

To understand how easy this may be you have only to wander back in fancy to the time when our valleys were hundreds of feet lower and the mountains thousands of feet higher. You have only to apply the conditions we have seen in our own time of the disposition of the wash from the mountains. You know how the streams change their channels, swinging in the course of ages from one side of the valley to another. Here they leave a bed of gravel this time, and when in time the bed returns again it may cover it with fine sand or finer mud that makes a perfect cut-off from the gravel bed below. When in time another wash of heavy gravel comes upon that, followed in time with another layer of finer stuff, the two beds of gravel become independent reservoirs, perhaps with different pressures. They may or may not be connected at some point above by a common thread of supply. They might last for a year or two or three and then require three years to fill again. In this way the valleys are filled from side to side with old stream beds of various depths and widths, lying one upon another for hundreds and in places near the coast for thousands of feet perhaps. For it is quite certain that the whole country has once been much higher above the sea than it now is as well as much lower at some time.

This cutting off of the different channels from each other is increased by the decay into clay of gravel and sand in streaks and strips as they lie in place below ground. With the pressure these layers flatten into perfect dams. This increases the number of independent channels and pockets of water-bearing gravel and sand. It is easy to understand how the friction on the lower part of these keeps the water from passing away to the sea; so that as long as it is not drawn on too heavily in any other way they will retain the water accumulated from years of good rainfall. There is therefore no need of resorting to the theory of any far distant or inexhaustible supply, but on the contrary it is against probabilities and, if so, it is dangerous to expand on.

There is another kind of reservoir, even more valuable than any of the others and which is in most cases wholly within the control of the irrigator. This is the subsoil—the subsoil for many feet or even yards in depth. In most years the rainfall attends to it sufficiently

but in the last two years there has been considerable loss from its being empty like the reservoirs above ground. You have all seen how a piece of dry uncultivated ground will sap the moisture from several feet of an adjoining irrigated piece. No matter how wet you may make the latter or how well you may cultivate it, several feet of it along the dry piece will be too dry in a very few days.

When you try to cultivate a layer of two or three feet upon the top of an ash heap you have a difficult and dangerous task. The dry stuff below will sap the moisture even more quickly than the air and the sun will sap it from above. The latter you may prevent to a great extent by cultivation. But the downward sapping of the moisture you cannot prevent. If anything fails from neglect of watering at just the right time it is almost impossible to restore it to where it would have been, and, if the top layer is very thin, a very few hours reduce the plant from prosperity to failure.

Quite the reverse is the case when the subsoil is filled with moisture as far as the principles of good drainage allow. It will take a long neglect to injure plants or trees, and if they fail it will be but slightly at first. It will take several days and often weeks for them to fail so far that the damage cannot be repaired quite fully by irrigation of the top soil.

The amount of water required to keep the subsoil in this right condition is much greater than is commonly supposed. Ordinary irrigation is rarely sufficient even though continued through the year. It takes a large rainfall each year to do it, and if that fails then that amount should be put in with winter irrigation. One inch of rain wets dry ground about ten inches if it all goes in. But twenty inches of rain will not wet two hundred inches or anything like it. At least one-half is lost in run off and evaporation from the surface. And one inch does not make ten inches of soil as wet as it should be for the best results. For safety the subsoil should be kept damp down to fifteen feet and even more. Where the drainage is good enough to make the land safe for fruit trees there is little danger of getting in too much. And all that can be put in, up to the point of safe drainage, is an insurance policy of more or less value in all short years.

Ordinary winter irrigation is not enough for this. On most soils in winters like the last two at least a foot and a half in depth of water should be put in. This would take for ten acres thirty inches, twelve days run, if it all went in. But it could not be put into most soils in twelve continuous days or anything like it. Six irrigations of two days' run would be much nearer what is needed and some time should elapse between them. Three years ago with sixteen inches of rain in Los Angeles I found many places during the spring and summer where the proof was positive that the water had not gone down over four feet and many more where it had not penetrated over five feet. The ground below was all dry as a chip from the lack of rain in the

three years preceding. As a rule under all good ditches there is water enough in the winter to avoid this, and if water cannot be reservoired cheap enough above ground the next best thing is to store in this subterranean reservoir all that the requirements of good drainage will allow. Some have done this in the past winter, but there have been too many who have allowed this source of wealth to run to the ocean because they believed the capricious clouds would do their duty.

THE ENGLISH LANGUAGE.

A farmer was trying to plough
 With a jackass hitched up to a cough,
 When they kicked up a terrible rough.
 Said the farmer: "It's hard, I allough
 I could do near as well with a songh;
 I will rest 'neath the shade of this boughg;
 "Such driving for me is too rough;
 I've had of it nearly enough;
 I'll give this old jackass a cough
 And quit, for I'm quite in a hough,
 And ploughing is almighty tough.
 "With farming I'm glad to be through—
 My wife, she is tired of it, tough;
 We're wet with the rain and the dough,
 And ploughing has made me quite blough.
 "I'll sell out and pocket the dough,
 To the city I'll glad enough go;
 I'll through down the shovel and hough;
 In Wall street my money I'll blough.
 "My wife has contracted a cough,
 'Tis time for us both to be ough!"

—*New York Sun.*

BOTANY AND IRRIGATION.

AN INTERVIEW WITH MR COVILLE, UNITED STATES BOTANIST.

As the years roll by the country will see millions of dollars saved to the farmers of the west, and millions more made. The advocates of irrigation for the west claim that the carrying out of their proposition would create a vast empire where is now the great American Desert. Seventy million acres of arid land is the amount estimated by the Geological Survey as susceptible of irrigation with the present surface water-supply of the arid region.

“This utilization of all western waters would increase the arable area of the United States less than 10 per cent”, said Mr. F. V. Coville, the Chief of the Division of Botany of the Department of Agriculture, “and while it would open up a new channel of vast possibilities, I think that we are working along lines which will add almost as much to the nation’s development as would the storage and utilization of all her western waters. What can a work of such magnitude be? Why the finding and introduction of plants adapted to the hundreds of millions of acres of land of the arid belt which must always remain arid even after every drop of water has been conserved by means of storage reservoirs and otherwise. Although the opening up to settlement through irrigation of between 70,000,000 and 100,000,000 acres of land would create thousands if not millions of homes, yet there will always remain these vast tracts of arid and semi-arid grazing lands which while useless for most crops, will produce certain plants in profusion. Most of the western lands are fertile. All they need is water; if not water then some crop which will thrive on the light rainfall they receive; not sufficient to keep alive ordinary crops. We are finding such crops and I think we will eventually cover this arid area with plants of various sorts which will yield millions of tons of additional forage and grain for western flocks and herds. The Department of Agriculture has explorers all over the world searching for such plants. For every acre in Arid America, north or south, of high or low altitude, there is a counterpart in the Old World, and the Old World is full of experience. In Russian Turkestan, in Arabia, on the borders of the Sahara, the varied conditions are exactly similar to those of different parts of our western territory and in these ancient lands they have grown arid-land crops for thousands of years. Every acre of the new West has its double in the old East. Our men are hitting upon valuable things from time to time, and when something of use is discovered, the Department makes it its business to see to its distribution. It

seems strange that even with our advanced methods of transportation and our mail facilities, valuable discoveries are often buried in communities for years.

A PLANT OF PROMISE.

Broom corn millet (*Panicum milliaceum*) is a plant which I expect in time to see cover great western areas. It will grow heavy grain yields where it is both too cold and too dry for Indian corn, too cold for Kafir corn, which would otherwise compete with it, and too dry for wheat. It will produce thirty, forty and even fifty bushels per acre of grain excellent for converting into hog fat, mutton or beef, and this upon land where ordinary crops cannot live. The man who has 10 acres under irrigation and owns adjacent thereto a tract of arid land will want such crops.

A WONDERFUL INCREASE.

Kafir corn itself is an example of what the proper crop will do for a locality. Ten years ago this plant was an experiment in the United States. It was said to thrive on land too dry for Indian corn and it was tested through western Kansas where corn raising was a precarious industry owing to the light rainfall. According to the report of the Kansas State Board of Agriculture, Kansas raised in 1893, 47,000 acres of this crop; in 1898 she raised 535,743 acres valued at \$5,683,380. a reclamation, practically, of half a million acres in a single state. Entire western counties are now yielding magnificent annual crops of this valuable plant which prior to its introduction, consisted of supposed worthless land. Brome grass (*Bromus inermis*) is another instance of a fine arid-land plant which required pushing. Brome grass will undoubtedly reclaim enormous areas of arid land. No grass will grow without moisture but where most grasses would die, brome grass will simply stand still and wait until moisture comes, when it will immediately start off, producing splendid forage. This grass has been known in several sections for a number of years but it has never been grown extensively even in those sections, farmers seeming to be afraid of it, and its fame has never spread widely, until last year the Department undertook to educate Western farmers as to its virtues, and to distribute seed.

A LETTER FROM GALLIA.

TORSION IN FARM WAGONS, FARM MACHINERY, AND GENERAL CARRIAGES (AS UNDERSTOOD IN FRANCE AND ENGLAND).—POINTERS FOR AMERICAN FARM IMPLEMENT PEOPLE. [ILLUSTRATED].

BY L. LODIAN, C.E., PARIS, FRANCE.

[Exclusively Contributed.]

In conjunction with the eminent technician, M. Bannon-Roi, of "la lierre", Val-Roger, Villiers-sur-Marne, Paris, I have been able to compile the following data, which it is considered will be useful to your readers.

Wagon-builders or implement-makers are often called upon to do work entirely new to them in form or in action of parts, and to estimate results which would puzzle a carriage-maker whose work—if really done in his shop at all—is often a tame reiteration of patterns and methods, with conventional insipidity and inaccuracy. It is torsion which makes a carriage of the same weight, with the wheels close together, when used over uneven roads.

Centralized weight may be assumed to be marked "o" zero. Now the supporting contact on the ground by wheels immediately under the body-weight, would make it freest from torsion on uneven ground. Recentralize that weight by extending it many feet apart at four 'wheel-bearing' points—these to bear on a road of uneven surface,—and torsion is created in the body and carriage—however rigid they may be. Springs relieve the action on the body—some forms of springs more than others; but the torsion is still manifest. Its action is to press recurrently on one wheel, then the other, in involuntary action, as most roads are hollows and hillocks in miniature. Should the undulating action and re-action occur in this form, Fig. I., A, B, C, the wheel in a hollow of the road at B, if the weight undulation from one wheel to the other happened to undulate forcibly downward as at B, the draft to surmount the hillock at C is increased by the torsion causing greater wheel-pressure on the ground; and the further the wheel from the center of the load, the greater the leverage thrown on the far-away wheel.

Here it may be remarked that it is not the mere act of body-twisting which augments the draft; for if it twisted as easy as a sheet of paper, the draft would be correspondingly lighter for such an easy-

twisting; whereas if so rigid as to be almost torsionless, the pressure of the wheels on the hillocks of the road is augmented by the rigidity of the body, and causes greater draft. The more flexible the spring above each wheel, the less torsional strain to the body, and the lighter the pressure of the wheels in surmounting obstacles on a road-surface.

This is why between two vehicles on four wheels, both scaling the same weight—the one a wagon, and the other a brougham—the wagon would have the least draft, because of its body twisting and adapting itself to the irregularities of the road. It is this augmented wheel-pressure that causes draft to be *light* or *heavy*. These very terms in common use imply it is the pressure on the road that influences draft.

A professor of science and applied mechanics was watching a Buckinghamshire (Eng.) wagon-maker at work, and ventured to ask him about the *torsion* of the wagon body over rough roads.

The answer was: "I knew a lot of bad language when I was young, but I do not recollect using such a word as that." The professor, smiling at the droll reply, explained that the word meant twisting,—cross-corner straining—warping and the resulting counter-strain, and that the one word expressed the action and condition recurrently of the wagon body when strained on uneven roads. The wagon-builder then said: "We arrange for body-twist by not bolting the near hind corner of the wagon tight down to the cross-bed, only long-pinion it with the bolts, with room for two inches play up and down of the body from the bed, when twisted."

He knew the correct principle without the scientific term for the twisting strain, and its counteraction.

The inquirer then put the same question to a fashionable coach-maker, and the answer was: "We build our carriages so perfectly that body-torsion is impossible." The professor lifted up one corner of a laudau on elliptic springs, by the hind body-loop, and convinced the coachmaker that a strongly-plated body has torsion under cross-cornered strain; and also convinced himself that although the coachmaker knew what torsion meant, he understood less the laws of applied mechanics than his humble, intuition-taught fellow-craftsman, the country wagon-maker.

The law of torsion in vehicle bodies is always determined by the number of *points of contact* under two conditions: the ground-bearing, and the body-bearing on the intercepting carriage and its axle, or axles. This fact will be clear, if we survey the points of contact on the ground,—be it level as a die, or rugged as a "parish-job" roadway after a little wear. A vehicle on one wheel would have no body-torsion due to the road, as it would have but one point of contact; nor would it on two, or even three wheels; but on four wheels, a rugged or uneven surface causes both carriage and body-torsion,—the one acting

on the other. The necessity of springs between body and axle is here apparent.

The c-spring relieves the body of torsion considerably, though the undercarriage may be strained excessively with a four-wheeled vehicle.

Here, the particular form of spring attachment may be explained showing which preserves the bodies of two wheelers from torsion due to the road. The Stanhope and grasshopper plans of suspension quite preclude torsion of body, because bodies so hung are fixed at two points only—in the middle-back and front,—as the diagram Fig. 2 shows. A, B, are the points of connection, where the springs are bolted to the spanions, or irons, that span the body at bottom.

Grasshopper hanging is so seldom adopted (although so excellent), that one writer on coachmaking blunders in saying and illustrating it as long springs fixed, on the dennet plan, to the shafts by scroll irons; whereas it is the spring and axle fixing to the body with long sprawling scroll-irons, like grass-hoppers legs—hence the name—without any contact of the scroll-irons with the shafts. The springs are bolted direct on the axle as with the Stanhope, and from their ends are shackled the grass-hopper scroll-irons, reaching to the center under corners of body, instead of cross springs.

A dennet-hung gig or cart—for it is the spring-fixing that discriminates dennets from Stanhopes, not the shape of the body—has mostly four points of attachment.

Torsion of body is at once established, and becomes the *Bête noire* to the unscientific coachmaker who builds dog-carts, and attempts to put striding-irons between the body and the shafts for altering the balance to suit from one to four riders. The torsion of dennet hanging by fixing the springs to the shafts causes trouble at starting, either preventing the body sliding in the guide-irons, or by rattling, and after a time, wearing recesses in the irons, and causing still more rattle, or increased clogging of the slides.

No agricultural implement-maker would make his implement with four points of body-contact when he could avoid spoiling its action by torsion, by using only three. This is demonstrated by the dennet, which has three spring fastenings.

This modification of hanging with free shaft-ends emanated from a small coachmaker, where implements were made some 35 years ago, but it is not well grafted into the high-class shops, where torsion is a matter that their piece-men blunder over when a dogcart is to be made to slide on the shaft-bearings.

It was in an implement works, that ten years ago the plan of resting the body on small wheels or rollers, made to run on the inside of the scroll-iron "flaps", was first adopted,—leaving the body with its rollers free from any torsional action of the springs or shafts,

so that the body rolled easily, and never rattled in its bearings. The "Tandem club" and dog-cart users generally are those who know what it is they want for a sure adjustment of body-balance for riders of one to four: and for the hills, have more chance of getting satisfaction from a small country shop than a large town works, where torsion is not understood as it ought to be.

Av. opera 21, Paris.

L. LODIAN.



THE COLONY-BUILDERS.

THE RAW MATERIALS, AND AN HISTORIC CONTRAST.

BY WILLIAM E. SMYTHE.

I can well understand that if there are readers of the AGE contemplating early settlement somewhere in the West they will want this department to enter at once upon the practical details of its subject and will have scant patience with a discussion of general principles involved. Such persons want to be advised where to go, how to get there, and how to proceed in making their homes. But there is another, and perhaps larger, class of readers who will be interested in the broader social and economic questions connected with colonization. I shall aim to make these papers quite practical as a whole, but I think they would fall short of the mark if they did not begin by setting forth the larger conditions with which we must deal in attracting people and organizing colonies. We cannot shut our eyes to the fact that all future communities, like all which are now in existence, are simply a part of the complex economic system of our times and that our colonists must work in some sort of harmony with prevailing forces if they are to succeed. Permit me, then, to deal here with some general facts and tendencies as a means of laying a foundation on which the superstructures of colony institutions may be intelligently and patiently reared through future numbers.

Careful observation leads me to think that just under the surface of society the colonizing spirit is more universal to-day than it has been in decades or even generations. I believe it is to express itself in new forms and to accomplish higher and better results than movements which have gone before. Let us examine the raw materials at hand and try to discover how they must be handled to produce results in harmony with the economic forces of the present and the future.

The materials of colonization are land, capital, and people. Of the first there is an abundance in every continent, possibly excepting Europe, though even there internal colonization effort, generously fostered by Government, is prospering in several countries. Not only is there abundant land throughout the world suited to agriculture, but ample resources awaiting development in the broadest sense of the term, including pasture, forest, mine, quarry, water power, and sea-coast. The colonization work of the future, it seems to me, will not stop with merely giving people access to little farms, but will aim to open the vast stores of natural wealth upon such terms that the producing classes may share in the great return.

Capital is as abundant, as idle, and as much in need of employment as the surplus natural resources of the world. A writer in a current magazine discusses the subject. "Can New Uses Be Found for Capital?" He shows how the financial centers are gorged with surplus money, just as the large cities are congested with surplus people, and just as the wide world is full of surplus land. He shows how the interest rate has steadily fallen, so that those who formerly made comfortable provision for old age by the earnings of a certain amount of saved capital must now have three or four times as much money laid by to get the same result. This writer finds the solution of his problem in the opening up of Asia and Africa and the equipment of their waste places with railroads and the machinery of production. Strangely enough, he does not appear to know that we have any waste places in our own country, nor does it seem to have occurred to him that the most valuable "machinery of production" is human beings and that in "equipping" them profitable uses might be found for large capital. It is true that there is plenty of money and that the approved channels for its use have absorbed all and, in some cases, more than can profitably be applied. This fact of surplus money, eager to find safe outlets, is one of the reasons upon which I found my faith in the imminence of a movement of population from overgrown cities to undeveloped territories.

The most important of our materials is the human element—the men, women, and children whose welfare and happiness is the true end and aim of any colonization effort that is worth while. Now, if we want people we must seek them where they are. They are not in the country, but in the cities. Every colony does, of course, draw a certain portion of its membership from farms and small towns, but it remains true that the genuine surplus people are now resident in large manufacturing and commercial centers.

It would be an unpardonable waste of space to rehearse the old story about how the people have been drawn into the cities so that their growth has become a startling problem. When we come to discuss the social side of colony institutions we must, however, remember that we shall deal with a class of settlers having the tastes and instincts of townpeople. It is almost unnecessary to refer to the economic conditions which have created a surplus population. It is a generally accepted fact that labor-saving machinery, department stores, and the concentration of manufacturing and transportation in the hands of comparatively few possessing great capital, has resulted in making a certain number of unemployed and a larger number of half-employed men and women in all our populous centers. The downfall of the small man is the most palpable and significant fact of the times, and, taken in connection with the abundance of unemployed capital and idle natural wealth, leads to the inevitable conclusion that colonization upon a large scale will be resorted to in the new cen-

tury as the most feasible means of escape from social catastrophe.

There is one luminous fact of world-wide conditions to which we must adjust our methods of organizing colonization and planning the industrial order of communities. This is the fact we live in a time when things are done upon a great scale and with combined capital. The people who will furnish the recruits for new colonies are themselves the victims of this most marked of all modern tendencies in our business life. To transplant them from one field where they have gone down in the unequal competition between labor and small capital, on one hand, and superior ability and great capital, on the other hand, and try to make them flourish in another field where the same forces are at work, would be to invite failure. If anything is plain it is that only organized energies and combined capital can possibly prevail and command success in these new undertakings. This principle applies to any effort which has to do either with production or distribution. But in a pre-eminent degree it applies to the utilization of arid lands where water works must be built before the first potato can be raised and where, after works are built, organization and discipline are essential to their successful administration.

We have, then, these foundation facts to build upon:

There is plenty of land, of capital, and of people with which to create a fund of new wealth, and in process of doing which homes may be made for millions of people.

These people are chiefly in cities, and they must be organized in considerable numbers and taught to work under some plan of co-operation in that they must meet on every hand.

Of course I do not mean to say that there is no chance for individuals to settle in localities where they may have success in spite of these facts. People are doing that all the time. Some of them succeed; others do indifferently; still others fail. Crowded as Chicago is to-day, many young men and women go there each year, get a foothold readily, and proceed to become well-off. But such instances do not prove anything as to the economic drift in country and town. When the avalanche slides down the mountain-side it leaves plenty of snow clinging to rocks and trees, but that circumstance does not alter the fact that there was an avalanche and that the tendency of the mass was downward.

In considering the lessons of experience we shall not go into the matter of individual settlement, but confine ourselves to a discussion of the larger social facts. It may be useful to home seekers, however, to say in passing that questions will be answered in regard to the advantages of various localities. Persons planning individual settlement should not imagine that they will escape existing economic evils by changing their place of residence. In some localities the

pressure is less severe than in others, but the same forces are at work everywhere, producing the same results.

I can think of no experience which more strikingly illustrates the importance of suiting institutions to the times than the wonderful Phalanx Movement of the Forties and its ignominious failure, followed by the successful planting of a few of its seeds, in what was then a far western wilderness, twenty-five years afterwards.

The Phalanx Movement became a topic of national discussion and colonies were founded throughout the country. It was one of the products of the hard winter of 1838, a period of bitter times when it looked to many sane observers as if there must be some radical social change to avert universal misery. About this time Arthur Brisbane, a young man possessing both wealth and a purpose in life, returned from France where he had been sitting at the feet of Fourier, the gifted philosopher of Socialism.

Fourier had published some fascinating books in which he set forth with detail his plan for forming communities, or "phalanxes", with lands, tools, and factories sufficient to produce within themselves all that they required for complete support. He provided not simply for material existence, but for all the refinement of life, including books, music, and every intellectual satisfaction. Men and women were to exchange their labor for all that they needed to enable them to enjoy full, rounded, and useful lives. The people were to live in a central hotel, or "caravansary," surrounded by beautiful things of every kind. The various talents of the community were to be utilized in making a little world complete in itself, from the blacksmith shop to the theatre and cathedral. Fourier had figured out exactly how many persons would be required for this purpose in each "phalanx," and how many of each trade or profession.

He did not attempt to make absolute social equality, but recognized the inborn differences of taste and temperament between the peasant and the noble, and made provision for both. Each would have what he needed to make him happy, but the philosopher did not deceive himself into thinking that all kinds of people require exactly the same kind of things to make them happy. But there was to be no misery, to drive men to want or to the grave. The world yielded enough for all its children and, if society were organized on the right lines, they would receive it. The units, or colonies, could be indefinitely multiplied until finally the whole earth would be absorbed into the plan and the millennium be realized. Fourier was a religious man and believed that he had found the key of the divine harmony.

Young Brisbane was full of Fourierism when he set foot in New York and immediately began to spread the gospel. He hired a regular space in the *New York Tribune* and presented his ideas as a practical remedy for the widespread hard times and misery then existing. Horace Greeley, then at the threshold of his remarkable influence,

took the matter up at first cautiously, but finally with characteristic ardor and enthusiasm. Colonies were organized in New York, New Jersey, Ohio, Indiana, and other states. The famous Brook Farm, near Boston, was contemporary with this movement, though not exactly its offspring. It will be remembered that Brook Farm included among its colonists many names which afterward became famous in the world of letters and was led by one of the most devoted and high-minded men of the time, Rev. George Ripley. Indeed, the complaint at Brook Farm, that brightest spot on the map of Utopia was that there were too many philosophers, and too few who could hoe potatoes. This criticism was probably unjust, as the most reliable accounts show that Brook Farm was a working as well as a thinking and reading community—a collection of most charming people who were overcome by business reverses and a disastrous fire.

The argument in favor of Fourierism were, and still are, quite unanswerable, with one exception. The exception is—the result! This was failure, widespread, complete, and hopeless. The plan was humane and Christlike, but it simply didn't work. If space were available, it would be very interesting to look into the matter more closely, but for the present purpose it is enough to say that Fourierism was too good for human nature and too advanced for the times. It was undertaken before labor-saving machinery and concentration of business in few hands had assumed their present importance, yet even to-day we have no reason to suppose that these plans could be relied upon as a general social panacea.

Fourier's beautiful dream may yet come true and future generations may build his monument of bronze and marble in the midst of some such social and industrial paradise as his imagination foretold. But he turned the corner so far in advance of the main procession that he is lost to present view.

One of the Phalanx communities which struggled along fitfully for some years, to expire of dissension and discouragement, was located at Trumbull, Ohio. Among its members was Nathan Cook Meeker, who became agricultural editor of the *New York Tribune* after the war. In his mind the seed of Fourierism, at least the idea of making better conditions for the common people through colonization, remained to germinate twenty-five years later. In the course of a western trip he found a place in Colorado suited to his purpose and proceeded, with the warm support of Horace Greeley, to prepare a prospectus of the new undertaking.

I wish there were space to print side by side, "in deadly parallel columns," the program of Fourierism and then of this later Meeker-Greeleyism, so that we might see just how the experience of Phalanx days, ripened by twenty-five years of thought, had modified the ideas of these earnest men. I wish we might also pause to study the beginnings of the Union Colony of Colorado, or Greeley, as it is now known.

Hon. David Boyd has told the story in a most entertaining way in his history of the colony and I love to study those scenes in the *Tribune* office, and the gatherings at Cooper Institute, when the readers of "old Horace's" beloved newspaper rallied so promptly to his call. But there is space now only to set out the main facts in the briefest way.

The famous Colorado colony was formed in response to the same spirit as that which animated Fourier and Brisbane and Ripley a generation earlier. There was the same demand for a high ideal, the same purpose to make better conditions for average humanity by planting settlements in the country. But Socialism had entirely disappeared. The unit was no longer the whole community, but the individual family and home. Co-operation there was from the beginning—co-operation in organizing the forces at New York; in purchasing and subdividing the lands as a whole; in building the works of irrigation, the first and most vital of public utilities; in planning and making a beautiful town; in developing and maintaining, from the hour of their settlement in the wilderness, such social and civic institutions as would have done credit to the ripest community in New England.

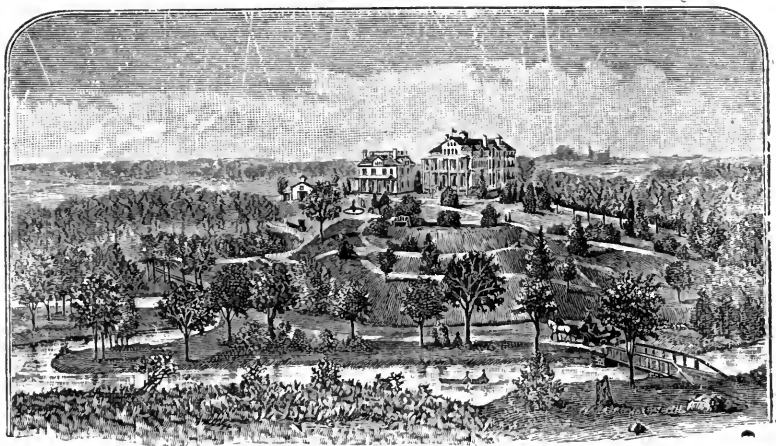
Greeley is no instance of individual settlement as the term is generally understood. It was an organized community and a true colony, animated by a great purpose and inspired by devoted leadership. If the irrigation works, originally estimated at \$20,000 and finally costing over \$400,000, had not absorbed all the capital of the community, including the large amount realized from their common ownership of the townsite, it seems probable that co-operative industry would have been developed on a much larger scale. There might have been stores, banks, and factories suited to the place and time, for the people had the spirit, the brains, and the capital.

The net result of Greeley is Success. This is the historic contrast which it presents to the Phalanx experience, which was ruled by the same spirit and participated in by some of the same individuals. There is as much to be learned from the one example as from the other. Both teach us that there are plenty of people who are willing to engage in the effort to make better institutions at the cost of hardship and sacrifice. Both teach us that we cannot make a new civilization out of hand, or run counter to the inbred traits of human nature and the economic forces of the time. Fourier undertook too much and failed. The Colorado community, no less strenuous for better conditions, went as far as it was practicable to go at the time, and succeeded. Greeley is not Paradise, but only a way station on the road to that far terminal.

The Greeley colony is well worth an entire chapter, or indeed a volume, and the lessons both of its industrial and social life will be

freely drawn upon in our study of colony plans to appear in future numbers.

(EDITOR'S NOTE:—The topic of the December paper in this series will be, "What is a Practicable Colony Plan for To-day?" Letters from inquirers for special information in connection with colonies may be addressed to *THE AGE* by which they will be forwarded to the author of this Department. Such inquiries will receive a personal answer or be treated in these pages, as the case may demand.)



THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

THE AGE wants to brighten the pages of its Diversified Farm department, and with this object in view it requests its readers everywhere to send in photographs and pictures of fields, orchards and farm homes; prize-taking horses, cattle, sheep or hogs. Also sketches or plans of convenient and commodious barns, hen houses, corn cribs, etc. Sketches of labor-saving devices, such as ditch cleaners and watering troughs. A good illustration of a windmill irrigation plant is always interesting. Will you help us to improve the appearance of THE AGE?

THE HOP INDUSTRY.

The growing of hops for commercial use is a farm specialty, not so generally adapted as the market demands warrant. The principal hop districts are in New York, Wisconsin, California, Oregon and Washington. If soil and climatic conditions are favorable hops yield from 1,000 to 2,000 pounds per acre. At present prices the income will range from \$150.00 to more than double that amount for an acre. As the vines require planting only once in many years, the crop is one of profit, and suited to our modern ideas of intensive soil culture.

Hops need a well drained, sandy loam rolling land being preferable. The plants are set six feet apart either way, after the land has been carefully prepared and leveled, to prevent any low places for water to stand and kill out the roots. Hops exhaust the potash elements of the soil quicker than any other substance, and necessitate the annual use of fertilizers containing a good percentage of potash. In ordinary fields the application of 1,000 pounds of fertilizers containing ten per cent potash, eight per cent phosphoric acid and three per cent nitrogen, is necessary every spring, to insure satisfactory results.

In the famous Yakima Valley of central Washington, about three thousand acres are planted to hop vines, and the income from this area this season will aggregate

\$500,000 or more. The roots are planted in the spring and cultivated the same as corn. The first year there are no returns, but with care, the yards continue producing for twenty years, without transplanting. The first season the vines must be trellised. This is done by setting poles, about two by four inch scantlings, ten feet long, in the ground every twelve feet. Wires are then stapled to the poles, six or seven feet above ground, and the vines trained up.

The aphid or louse is the chief hop enemy. This can be destroyed by spraying the blossoms with arsenical compounds similar to those used for orchards. If the season is dry the aphid seldom does harm, and if too much rain falls during the period from ripening to picking the burrs are liable to mold or mildew. Picking is done by hand, an average picker, gathering about two hundred pounds per day. The green hops are taken to dry houses, where they are spread out upon the floor or special drying cloths. The drying process requires twenty-four hours, when the hops are pressed into bales of 200 pounds each and placed on the market. As a general rule hops lose three fourths weight in drying.

Those who have been engaged in the hop industry for many years estimate that the original cost of a yard of ten acres, including plants, cultivation, dry house and complete equipment is about \$200.00 an acre

and the annual maintenance expense reaches \$100.00 an acre. An established yard can be grown, harvested and marketed for eight cents a pound, and as the selling price this year averages 15 cents, the profits are good. Hops are used so extensively throughout the world, for manufacturing and medicinal purposes, that the demand is constantly increasing, and the supply in the United States is limited.

American grown hops sell readily in foreign markets, and are sought by experts because of superior qualities. The hop industry when fully established in a locality, is an important money producing business, as many people are employed in caring for and picking the crop. The three thousand acres in Yakima Valley, this year furnished one month's work to six thousand persons engaged as pickers, besides indirectly employing many others to supply those with food and clothing. There are many farming districts in the United States, where hops could be introduced as a special crop and the people made more independent by engaging in hop growing.

Hop roots are grown by nurserymen, plant and bulb dealers and most of the prominent seedmen quote prices in their annual catalogues. An acre will require about 3,000 roots, which should be set deep in the ground, covering the crowns with about four inches of dirt. If the soil cannot be plowed deep, it is well to run a sub-soil plow to stir the surface as deep as possible. The roots may be set in furrows, marked out either way, the proper distance apart, or by making holes with the shovel, the same as in transplanting trees.

JOEL SHOMAKER.

MONEY IN SWEET CORN.

The growing of sweet corn for market is a profitable industry, which many farmers do not observe. An acre will produce from 2,000 to 3,000 dozen ears, that sell at from 6 to 15 cents a dozen, wherever the demand is created by large centers of population. I have a neighbor who this season, produced over 2,000 dozen per acre,

and sold the most of his crop at 18 cents a dozen. If the entire yield cannot be sold as roasting ears, the remnant may be dried, and placed on the market at satisfactory prices. The dried corn sells at 12 ½ cents a pound, and so far as I have noticed, in the prominent cities, the supply is never equal to the demand.

Corn may be grown on any good tillable land, in almost every State, but the larger crops are obtained from rich, alluvial soil, which has been liberally top dressed with barnyard manure, or contains plenty of leaf mould. Corn requires nitrogen for forming the kernels and the phosphates and potash for making strong stalks. As a general rule the land that has been previously cultivated to miscellaneous crops, is deficient in potash, and repeated experiments, made in various sections have demonstrated that a fertilizer containing about 10 per cent potash 8 per cent phosphoric acid and 3½ per cent nitrogen is necessary. This should be applied in the spring, at the rate of 500 pounds per acre.

Fall or winter plowing is the best for successful corn growing. Stubble or sod land should be turned under early, to allow the plowed field to get thoroughly frozen during the winter. The surface covering of grass and weeds, if turned under, rots and forms a fertilizer for the corn roots, and holds moisture for some time during the early spring and summer growing month. The land should be harrowed and well pulverized in the spring before planting. Early corn is that most profitable, but for drying purposes the late varieties are preferable. Among the choice varieties may be mentioned the White Cob Coiy for early, the Early Minnesota for medium and Stowell's Evergreen for late planting.

The farmer who depends upon purchasing seed corn from corner groceries will not find the growing of sweet corn profitable. Seed should be purchased fresh every year from reliable seed growers, who make a direct business of supplying nothing but first class, true to name seed that will germinate and produce the best possible

results. The honest seedmen have a reputation at stake, and when he sells any kind of seed, he expects to retain the customer, hence does not palm off that which is worthless. Cheap corn for seed will yield poor returns, even if the land has been thoroughly fertilized. If the seed grown in one locality is transferred to another the crop will be better.

Corn may be planted in most sections, during the month of April, but can be put in every month until August. Some varieties ripen in ninety days, and even the earlier kinds may be cut for fodder in fifty days. A hand planter is the best for planting a small acreage. With this the corn can be dropped three to five kernels in a hill about thirty inches in the row, after the field has been furrowed out to three to four feet between rows. After the plants are six inches high, all but two in a hill should be pulled out. If the field is to be irrigated the water should be kept off until the tassels appear in the plants. Under ordinary conditions two irrigations will produce better corn than frequent applications of water.

Dried corn for the market may be prepared by drying in the sun or by using ordinary fruit evaporators. It should be well boiled on the ear, about thirty minutes being sufficient, then cut from the cob with a sharp knife, and put on to dry. If the sun is used, a scaffold like that used for fruits, may be covered with cotton cloth, and the corn distributed over it about one fourth of an inch in depth. This can then be covered with a light cheese or butter cloth to keep out the flies and dust, and the corn will dry nicely. Evaporated corn is more saleable than that dried in the sun or stove oven. The fruit evaporator can be used for this and every ear be successfully harvested.

JOEL SHOMAKER.

OUR AGRICULTURAL MACHINERY ABROAD.

The importation into England of foreign agricultural machinery, principally from

America, and intended for transshipment, is constantly increasing. During the past few months the steamships of the Wilson Line have landed in Hull unusually large quantities of agricultural machinery and implements. Practically the whole of it is sent to Russia, which a few years ago was supplied almost wholly with the English made article.

FORESTRY SENTIMENT

IN THE NORTHWEST.

From the St. Paul Pioneer Press.

The hearty welcome given by the people of St Paul, ending with the banquet recently to the visiting Congressmen on their way to the pine forests of the North to inspect the region it is expected to set apart for a national park, bears witness to the deep interest taken by the people of the State at large in the objects of this excursion. It is chiefly due to the enthusiastic efforts of Col. Cooper, of Chicago, that so large a delegation of leading Congressmen, representing widely different sections of the Union, were moved to participate in this tour of investigation. He has succeeded in giving the character of a national movement to what was before a purely local project, initiated by local organizations, which had with difficulty enlisted the co-operation of Congress and the State Legislature in setting apart a park of 35 miles square around the sources of the Mississippi. The aid of Congress is now sought in extending this park so as to include the still virgin forests, which, under treaty with the Indians, have already been provisionally condemned to destruction, and rescue them from the doom which is impending over them. This will require perhaps another treaty with the Indians, under which the timber cutting can be confined to the larger trees and subjected to intelligent forestry regulations.

It ought not to be difficult to procure the consent of the Indians to this, if their consent is necessary to what is merely an economic regulation of the timber cutting. The scheme of a continuous series of

small parks following the chain of lakes connecting the Itasca Park with Leech Lake is already under contemplation by the State authorities, as was explained by Governor Lind at the banquet given to the visitors last night by the Minnesota Forestry and Park Association. But there is no large body of forests now under Federal control, except that covered by the treaty with the Chippewas, and the advocates of a national park will look anxiously to Congress to devise some means by which these forests may be placed under some system of forestry regulation.

Some tracts of it fringing on the borders of the lake should be entirely exempted from the depredations of the axmen and devoted to park and sanitary purposes exclusively. But for the rest it will be sufficient to make the park features of it subordinate to a general scheme of forest preservation or to a system of regulation for the economical cutting of the timber so as to preserve the younger trees and maintain the integrity of the forests on lands chiefly suitable for forest growth. The park project falls in admirably with this larger scheme of forest preservation and reforesting the cut-over lands, which is not confined to any special tracts, but should extend over the whole forest region so far as this can be done in any one of the several ways which have heretofore been suggested.

THE MAINE CAT INDUSTRY.

The Massachusetts Ploughman, which has been studying up the Maine cat industry, learns that there were larger shipments of cats from Maine the past year than for any season previous, over 6,400 cats having been shipped out of the state to all parts of the United States and to foreign countries. One concern alone, the Walnut Ridge Farm Co. of Boston, sent 986 Angoras; Frederick D. Nudd, of Waterville, 486; Mr. Emery, of North Anson, 379; Mrs. Mary H. Ranlett, of Rockland, 280; E. W. Palmer, of Rockland, 114; J. W. Dean, of Troy, 419; besides many others. Besides this large shipment of Angoras,

there are now over 1,860 Angora cats remaining in the hands of dealers in various sections of Maine. It is estimated that there are only 32,500 Angora cats in all America, compared with several million of the common cats. The number of Angora cats in Maine is gradually diminishing, there being at least 1,000 less each season. The demand is so great for them that the farmers cannot keep up with a sufficient supply. Maine people made over \$50,000 last year on their cats. Just think of this when tempted to throw a boot-jack at seceding Tommy.

WITH OUR EXCHANGES.

MCCLURE'S.

The November issue of McClure's gives us Kipling's new poem, "The King." The leading article is one of exploration in the Antarctic region, by Dr. Frederick A. Cook, and is entitled "Two Thousand Miles in the Antarctic Ice." "The Chinese Eastern Railway" is another subject taken up, while a number of pleasing short stories make up a nice number.

SCRIBNER'S.

In the November number Arthur T. Hadley grapples with the problem now agitating the public, the "Formation and Control of Trusts." The autobiographical sketch of Mrs. John Drew is continued in this number and there are a number of short sketches.

THE FORUM

Contains such a number of exceptionally good papers this month that it is impossible to even mention them. Among them are "Spain Living or Dying?" "What the World Owes to France," "The Problem of the American Marine," and "Will Chinese Development Benefit the World?"

THE REVIEW OF REVIEWS.

In the November number gives a character sketch of Cecil Rhodes, by Wm. T. Stead. Mr. Stead is inclined to paint a very flattering picture of the South African financier, whom the public has commonly regarded as a cold-hearted money-getter. "England at War with the Boers" is the name of an exhaustive article, and "The Peace Conference and the Monroe Doctrine" is another interesting topic discussed.

PULSE OF THE IRRIGATION INDUSTRY.

"STORED" WATER IN TEXAS.

CARLSBAD, N. M., Sept. 1619.

Probably never before in the history of any arid section in the United States has it been more clearly developed that "water was the life of the land" than during the past summer at Carlsbad and in its vicinity. During the past ninety days scarcely enough rain has fallen to lay the dust, surely not enough to benefit any growing crops, sugar beets, alfalfa, fruit or vegetables; still with the exception, possibly, of the sugar beet crop, nothing suffered. The alfalfa yield is fully up to the average of former years, exceeds it somewhat in fact, and the fruit shipped from the valley and yet to be shipped, exceeds in quality as well as in quantity that of any preceding year. All this is due strictly to "stored" water, vast lakes, which at the expense of thousands were constructed to hold acres of water to place on land that in seasons like the present would otherwise have become a dry, dusty wilderness, an accumulation of sage-brush and mesquite.

The history of this year is of course not the history of every year in the Pecos valley country. Not by any means. The rain during the summer usually averages fourteen to sixteen inches. This year in many sections of the valley and the adjoining ranges it went barely two inches. In parts of Texas where irrigation is unknown, hot weather, combined with the absence of the usual rainfall, did deadly work among the cotton plantations. A prominent cotton-planter and cattle-breeder from south Texas was here the other day, and in answer to questions as to how his section would average this year with preceding years, said:

"My own case is a typical one. I own several 'black land' farms, and 'black land,' or 'black waxy' as it is termed, is acknowledged to be among the richest soils in the

world. It fully equals in fertility the famous 'adobe' wheat lands of California. In an ordinary season, where the rainfall reaches anywhere near the average, a bale of cotton to the acre is almost the rule, and in some especially favored spots a bale and a half was not an unusual product. This year (he said) fully *ten acres*, on the average, were required to produce *one bale*, and the staple was of a very inferior grade at that.

Now, although "comparisons are odious," as the saying is, they certainly in this case furnish an object lesson so striking that no one, not even the most obtuse or prejudiced can for a moment deny that, although irrigation may not in itself possess all the advantages of copious rainfalls, it approaches them so nearly in the benefits it bestows upon a district that in their absence it may be said to very nearly take their place.

The Pecos valley country is, for the greater part, a grazing proposition, but like all other grazing districts, no matter how rich they may be in natural grasses, their permanence rests chiefly on their ability to produce rich fodder for young or fine stock each year with unflinching regularity. This the great Pecos valley has done and is doing to-day, and although farming and fruit raising pays here, and probably always will, the raising of fine cattle and sheep will always be the industry that with the aid of irrigation will offer the shortest road to wealth and the development of the best resources of the country. ARGUS.

The question of forest preservation directly interests every irrigable section. Water for irrigation has its source, in almost every case, in forested regions, and if these areas are destroyed by reckless cutting or firing the water supply will fail in time of need as surely as the forests are destroyed.

NORTHERN AFRICA.

Northern Africa is a country which is not all unknown to the traveler; it is a land of remarkable interest. There is found there some of the most ancient history of the world. In the valley of the Nile civilization sprang forth and reached a mark which in some features has hardly been surpassed. Yet a man has just returned to the United States who is probably the first to thoroughly explore that country along certain lines. He is the Botanical Explorer of the Agricultural Department, Mr. W. T. Swingle. For eighteen months Mr. Swingle has been traveling about the Mediterranean countries looking for plants and trees, and for the products of the agriculturist or the horticulturist, which might be of value to the farmers and fruit-growers of the United States.

"Especially interesting," said Mr. Swingle, in talking of his work, "did I find the North African countries. They greatly resemble our own Southwest, and like a great portion of it they are arid. Carrying the parallel still farther, they were, like it, once fertile through irrigation. This great area was once part of the Roman Empire, and the Romans seem to have known how to irrigate to perfection. For there is evidence that all of North Africa was as fertile as is the present valley of the Nile. The waters of the rivers seem to have been stored for irrigation in a series of reservoirs, one above the other. The ruins of Algeria indicate a wealthy and populous community. But long since the land has reverted to its natural aridity; dams have disappeared, and irrigation has ceased; yet the ruins of great cities rise from out of the hot, sandy wastes, well preserved monuments, in the dry atmosphere, to the former grandeur of the Romans. Many of the buildings in these cities are almost entire, showing clearly the style of architecture, the triumphal arches, and other types of Roman work, and until one gets into their midst it seems hardly possible that they have

stood uninhabited for long centuries. Where now the burning sand of the desert is swept about by the hot winds, covering and uncovering carved stone and pillars, the green verdure, the swaying palms, and the luxuriant growths of the tropics once held sway under the magic influence of water artificially distributed. The French government is now making some interesting excavations in Algeria, but otherwise no desecration of the wonderful ruins is allowed.

One of the most interesting bits of information which I picked up was that we as a nation are being delightfully imposed upon in our use of Egyptian tobacco. Since the Chicago Exposition and its Midway Plaisance, which brought with it many eastern customs and an American demand for Eastern products we have been using Egyptian tobacco, and especially Egyptian cigarettes, in this country to a considerable extent. These cigarettes, in fact, are considered the finest of imported brands, and cost accordingly. Yet here we are paying two and three cents a smoke for gold papered cigarettes which never saw the light of Egypt. Strange as it may seem, notwithstanding the supposed fine climate of Egypt for growing tobacco, and the extensive irrigation systems of the Nile, where agriculture reaches a high state of perfection, good tobacco cannot be grown in Egypt, and as a matter of fact the Egyptian government has decreed against the growing of any tobacco whatever within its jurisdiction. All Egyptian tobacco is raised in Turkey. The Turks are fine tobacco growers and expert tobacconists. For some reason they adopted the name of "Egyptian" tobacco to sell their goods. The Egyptians, on the other hand, being able to raise only inferior grades, saw that unless something was done, these fine Egyptian brands would soon be discredited; so in order to keep up the high standard of "Egyptian" tobacco, and to retain the prestige and glory which the Turkish tobacco had brought them, the Egyptian government employed the drastic measure of prohibiting any growth of the plant in Egypt."

PROHIBIT SEWAGE IRRIGATION.

The sanitary districts at North Pasadena and Lamanda Park, Cal., have been regularly organized, and members of both sanitary boards elected. An ordinance has been passed making it a misdemeanor for any person, firm or corporation to use sewage in irrigating strawberries, celery, lettuce, radishes, tomatoes, or onions. The ordinance will go into effect immediately. Its violation shall lay a person liable to a fine of from \$20 to \$300, or to an imprisonment of from 20 to 100 days, or both. The ordinance is passed at the special instance of people in and about Florence, who propose to see it enforced in that section. A similar ordinance is

now in consideration by the city, although it proposes to go farther and prohibit the sale of sewerage-irrigated vegetables.

MEXICAN WATER GRANT.

The Mexican government recently granted a concession to Santiago Sanches, authorizing him to utilize the waters of the Rio Grande to irrigate a large tract of land in Nueva Leon.

The landowners on the Texas side of the river are much disturbed over draining it, and the matter will be laid before the Water Boundary Commission for settlement.

It is claimed that the Mexican government has no authority for granting the concession for use of the waters of an international stream.

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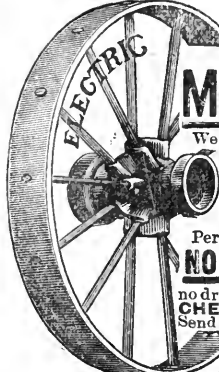
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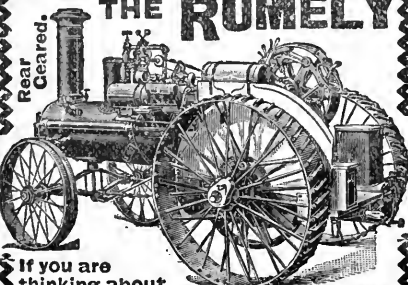
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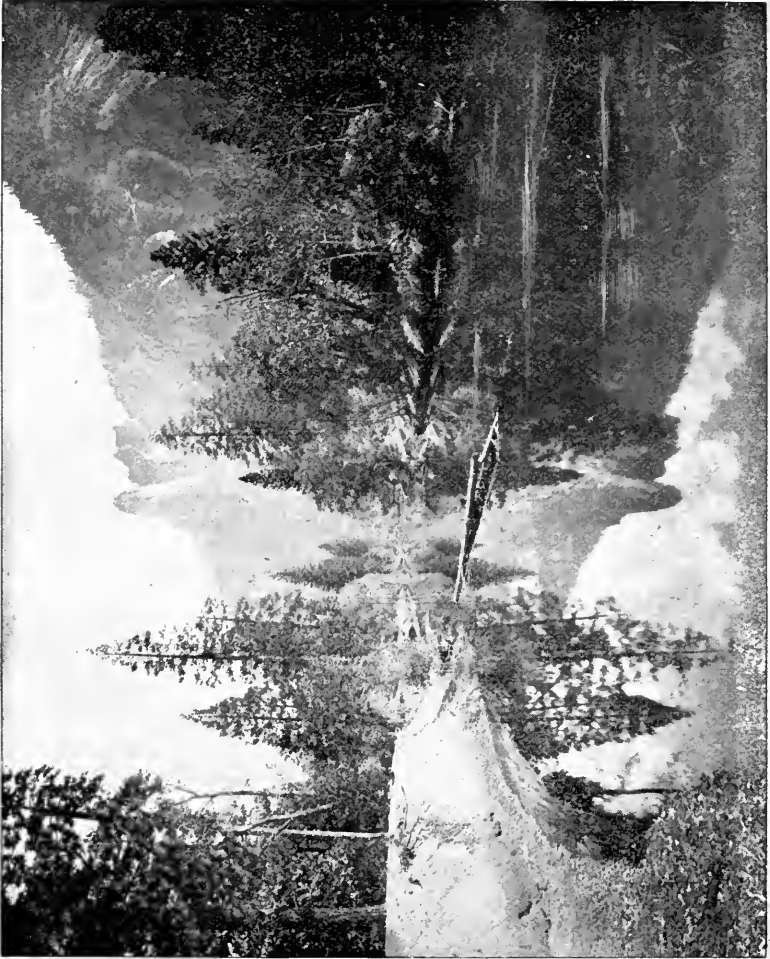
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Scene in California.

THE IRRIGATION AGE.

VOL. XV.

CHICAGO, DECEMBER, 1899.

NO. 3.

THE PROGRESS OF WESTERN AMERICA.

War and Irrigation.

At first thought there would seem to be no connection between the Transvaal War and the irrigation industry, but upon close examination we find the one has a bearing on the other after all. Should the trouble between the Boers and the British continue, and other countries take a hand in the affair it will mean the suspension, for a time at least, of a most stupendous irrigation enterprise—the damming of the Nile and the storing of the flood waters for use in reclaiming arid land. The success of the plan would mean the reclaiming of 2,500,000 acres of land which will be brought under cultivation. England will have “so many other fish to fry” if the Transvaal trouble continues and Russia, France or Germany takes a hand, that she will not be able to retain her hold in Egypt, but will be forced to evacuate and thus the great engineering feat which she has begun will be abandoned for a time, perhaps forever. This would be indeed a serious calamity to the poor peasants of Egypt, struggling under grievous burdens of taxation and adverse agricultural conditions.

The Four Islands.

The commercial possibilities which await the tropical island territories which have come into closer relationship with the United States during the past year, in supplying a permanent and growing market in this country, are suggested by a compilation just made by the Treasury Bureau of Statistics of the importation of tropical and sub-tropical products into the United

States during 10 months of the present year compared with that of the corresponding months of the preceding year. They amount to the surprisingly large sum of 230 million dollars during the 300 days in question, or an average of over a million dollars for each business day of the year, showing that for the full year the total will reach more than 300 million dollars. This compilation, it is proper to add, includes raw silk, tea and rice, and the small proportion of our sugar importations which is manufactured from beets; but even if these be omitted, the total which would be clearly entitled to be classed as tropical products would exceed 250 million dollars annually. Sugar, coffee, India rubber, fibers, tropical fruits and nuts, cocoa, tobacco of the finer grades, spices, gums, indigo, dyewoods and cabinet woods form the important features of this large importation, and all of them articles for which the United States is absolutely dependent, with the possible exception of sugar, upon other parts of the world and for the present at least for the large proportion of our sugar.

Curiously all of these articles can be produced and are now produced to a greater or less extent in the islands in question. Sugar, as everybody knows, is produced in large quantities in Cuba, Porto Rico, Hawaii and the Philippines. Of our sugar importations in the 10 months just ended, Cuba has furnished 633 million pounds, other West Indies 514 million pounds, the Hawaiian Islands 534 million pounds, the Philippine Islands 50 million pounds, while the East Indies have in

the present year furnished a larger share of our sugar importations than any other single part of the world, the total number of pounds from the East Indies alone being for the 10 months ending with October, 1,078,907,548, out of a total of 3,767,756,981 pounds. Coffee, of which our importations are growing constantly and rapidly, amounting to about 850 million pounds annually as against an average of about 550 million pounds in the earlier years of the decade, is successfully grown in all of the islands in question, and at one time was a very important crop in Cuba as well as at present in Porto Rico, Hawaii and the Philippines. Fiber, of which the importations in the present year will amount to 20 million dollars in value, can readily be grown in all of the islands, the Philippines already supplying that most important feature of our fiber importations, Manila hemp, which alone in the present year will amount to about 6 million dollars in value. While two or three of the larger items of our tropical and sub-tropical imports. rubber, silk and tea, are not produced in any considerable quantities in the islands in question at present, experiments which have been made in those islands, especially in tea and silk, indicate at least that their production is possible and may prove entirely practicable with further experiment. Even without these items, the list of importations of tropical products which it is well known can be produced in these islands, suggests the possibility that fully 200 million dollars which the United States has been heretofore expending outside her own territory and population for products which her people must have and do not produce can, in no distant future, be distributed in these islands in exchange for their supplies whose production will doubtless be stimulated by the introduction of American capital and American methods.

The following table shows the imports of tropical and sub-tropical products into the United States in the 10 months ending with October, 1899, compared with 1898, arranged in the order of magnitude:

	Ten months ending Oct. 31.	
	1898	1899
	Dollars	Dollars
Sugar	65,078,909	94,230,666
Coffee	46,527,079	49,116,947

Silk.....	22,000,679	32,615,025
India rubber.....	20,225,724	27,986,145
Fibers.....	14,202,928	17,514,902
Fruits & nuts.....	11,030,171	15,687,583
Tobacco.....	8,788,721	11,237,453
Tea.....	7,822,952	8,625,638
Gums.....	4,450,375	5,129,989
Cocoa & chocolate.....	3,408,022	4,892,006
Rice.....	3,347,290	3,125,300
Spices.....	2,091,451	2,516,900
Cabinet woods.....	1,517,898	1,687,765
Indigo.....	1,712,328	1,679,967
Licorice root.....	1,278,548	1,230,937
Corkwood.....	962,215	1,097,268
Olive oil.....	831,593	1,018,532
Ivory.....	538,344	645,192
Dyewoods.....	1,072,839	645,289
Total	216,888,455	280,624,871

The African Mines. The mining interests of Africa, especially the wonderful gold and diamond mines which have attracted so much attention, are the subject of a chapter in the monograph just prepared by the Treasury Bureau of Statistics, on Commercial Africa in 1899. Much of the recently rapid development of Africa, especially in the southern part where the greatest rapidity of development has occurred, is due to the discovery and development of extremely valuable mineral deposits. The most valuable of these are gold and diamonds, though incidentally it may be mentioned that the iron, coal, and other mineral deposits of south and southeast Africa give promise of great value when wealth-seeking man has time to turn his attention from the gold mines to those which promise less rapid, but perhaps equally certain profits.

That the gold and diamond mines of South Africa have been, and still are, wonderfully profitably, however, is beyond question. The Kimberley diamond mines, which are located in British territory just outside the boundaries of the Orange Free State and about 600 miles from Cape Town, now supply 98 per cent. of the diamonds of commerce, although their existence was unknown prior to 1867 and the mines have thus been in operation but about 30 years.

A True Prophecy. A few years ago the members of the Department of Agriculture at Washington were about the only people who had any confidence in the sugar beet industry. By the masses it was regarded as an experiment to be indulged in by visionaries. But the department made the prediction that in the course of time the United States would

produce all its own sugar, or at least the greater part of it. This prophecy seems in a fair way to be fulfilled, judging from the reports which come to us from the Department of Agriculture from time to time, as to the success of this vegetable. Sugar beets may be successfully grown in so many different sections of the country that as soon as there are more factories to handle the beets, farmers will doubtless turn their attention to this promising crop. New factories are being erected in various parts of the country and the drawback of not having a market for the product will soon be done away with. In the coast valleys of California the sugar beet may be grown successfully without the aid of irrigation, while in Utah and New Mexico it has already been demonstrated that the vegetable may be profitably grown on arid lands if irrigation is used. In fact the sugar beet can be grown on almost any soil which will produce Indian corn, wheat or potatoes, provided, always, that the land is properly cultivated and drained.

**Dewey
and the
Critics.**

We often sneer at France for being fickle, yet is our nation wholly free from this fault?

Two months ago Dewey was hailed everywhere with unbounded enthusiasm—the sailor came home to a welcome seldom accorded to anyone: the presidency was hinted at as a possibility and his admirers presented him with a house in Washington. Since his marriage and his subsequent transfer of the property to his wife, newspaper critics have wailed long and loud and Dewey has greatly fallen in the estimation of his countrymen, some who contributed toward the house fund going so far as to demand that their money be refunded. While his best friends must admit that Admiral Dewey acted injudiciously in so quickly transferring to his bride the gift of the people, yet most too much has been said of the matter for after all, as a bright woman recently exclaimed, "are not Dewey and his wife one?"

**American
Tea.**

Tea-growing in the United States is progressing favorably, though the tea grown here will not yet bear comparison with even the medium grade of the Oriental

products. Tea merchants, after examining samples of the 1899 crop from the plantation of Dr. Shephard of Pinehurst, S. C., say that the tea has improved somewhat, though not yet up to the standard of foreign tea. Their praise is faint, indeed, but they do not ridicule the experiments as they formerly did. They do not say that the tea is "much better" than it was, but that it isn't so "bad" as it was. One of the chief faults found with American tea is that it is too broken and too crudely prepared for market. Dr. Shephard deserves great credit for the efforts and experiments he has made in this direction, in spite of the discouragements and open ridicule with which he has had to contend. The *New York Commercial* is very much interested in the success of this enterprise or rather experiment, and gives interesting accounts of the progress being made. We will await with interest the further development of Dr. Shephard's efforts.

**Irrigation
in the
Rio Grande
Valley.**

The only trouble now existing between Mexico and the United States is that in relation to the irrigation question in the valley of the Rio Grande. This trouble has been going on for a long time and Mexico has filed a claim against this country for \$20,000,000 damages. A law suit to settle the matter will be up for trial Dec. 12th at the United States court at Las Cruces, N. M. Judge Marsden C. Burch has charge of the case for the United States and he has been in Mexico for some time past, collecting evidence for use in the case and also trying to convince the Mexican officials of the good intentions of the United States in this controversy. The desire of this country is not only to preserve the rights of irrigationists on both sides of the Rio Grande, but also to restore to them those ancient riparian rights of which they have been deprived.

**Irrigation
in Former
Years.**

An exchange says that recent discoveries made in the lava beds of New Mexico have brought to light a very complete system of reservoirs and irrigation viaducts, proving that the ancient inhabitants of that section not only understood and practiced

the art of irrigation, but that it was carried on in a very skillful and scientific manner.

"Under the lava which covers hundreds of square miles are found traces of cemented ditches and reservoirs that are marvels of civil engineering. Ditches wound in and out at the base of the mountain ranges, following the sinuosities of the

canals in such a manner as to catch all the storm water before it was absorbed by the loose sand at the mountain's base. Reservoirs at convenient places stored the water, which was led in cemented ditches across loose soil to the various points where it was required. Chasms were crossed by viaducts."

DAYS GONE BY.

O, the days gone by! O, the days gone by!
 The apple in the orchard and the pathway through the rye;
 The chirrup of the robin and the whistle of the quail,
 As he piped across the meadows sweet as any nightingale;
 When the bloom was on the clover and the blue was in the sky,
 And my happy heart brimmed over in the days gone by.

In the days gone by, when my naked feet were tripped
 By the honeysuckle's tangles, where the water lilies dipped,
 And the ripple of the river lipped the moss along the brink
 Where the placid-eyed and lazy-footed cattle come to drink,
 And the tilting snipe stood fearless of the truant's wayward cry,
 And the splashing of the swimmer in the days gone by.

O, the days gone by! O, the days gone by!
 The music of the laughing lip, the luster of the eye;
 The childish faith in fairies and Aladdin's magic ring,
 The simple, soul-reposing, glad belief in everything,
 When life was like a story, holding neither sob nor sigh,
 In the olden, golden glory of the days gone by.

—James Whitcomb Riley in the *St. Louis Republic*.

DEPARTMENT OF THE INTERIOR.

UNITED STATES GEOLOGICAL SURVEY.

F. H. Newell, Hydrographer.

RESERVOIR SURVEYS.

At the present time the subject of water storage is being widely discussed and many questions are asked by correspondents regarding the surveys and examinations of reservoir sites made by the Geological Survey. This circular has been prepared as a reply to such letters.

LEGISLATION.

The organic law from which has grown the present work of the Geological Survey is dated March 3, 1879. It creates the office of the Director of the Geological Survey, and states that "this officer shall have direction of the Geological Survey and the classification of the public lands and examination of the geological structure, mineral resources and products of the national domain." A fundamental function of the Survey is, therefore, the classification of the public lands, a work which cannot be accomplished until a thorough knowledge is had of the water resources, since for the most part the public lands are within the arid region. The Geological Survey has not only to do with the fundamental scientific problems relating to the earth but more largely with present and prospective developments of mineral resources and products. Throughout much of the United States the principal mineral of economic value is water, and the study of the distribution and fluctuations of the water supply is among the most important of the functions of the Survey.

The work of the Survey is not confined to the public lands, for later acts of Congress have extended its operations to the "national domain", which includes all of the territory within the possession of the United States. In every State and territory surveys have been or are being made. The extent of these is governed by many considerations, such as the economic and scientific importance of results and the aid or cooperation of individual States.

From the initiation of this Survey in 1879, much attention has been given to the arid region, its great possibilities having been early appreciated. In 1887 the Director was called upon by Congress to consider the question of Federal recognition of the irrigation subject, and in March, 1888, a resolution was passed requiring the Secretary of the Interior, by means of the Director of the Geological Survey, "to make an examination of that portion of the arid region of the

United States where agriculture is carried on by means of irrigation, as to the natural advantages for the storage of water for irrigation purposes, with the practicability of constructing reservoirs, together with the capacity of streams and the cost of construction and capacity of reservoirs, and such other facts as bear on the question of storage of water for irrigation purposes."

In October, 1888, an appropriation was made for the purpose of investigating the extent to which the arid region of the United States can be redeemed by irrigation and for the selection of sites for reservoirs and other hydraulic works necessary for the storage and utilization of water for irrigation and the prevention of floods and overflows.

In an act approved August 30, 1890, it was specified that reservoir sites heretofore located or selected shall remain segregated and reserved from entry or settlement, and reservoir sites hereafter located or selected on public lands shall in like manner be reserved from the date of the location or selection thereof. In a subsequent act, approved March 3, 1891, it is provided that the reservoirs shall be restricted to the land actually necessary for the construction and maintenance of reservoirs.

By the act of August 18, 1894, a specific appropriation was made, "for gaging the streams and determining the water supply of the United States, including the investigation of underground currents and artesian wells in arid and semi-arid sections." In later acts there has been included the preparation of reports upon the best methods of utilizing the water resources of these sections.

MAPS AND ESTIMATES.

Under the authority thus given work has been carried on systematically by the Division of Hydrography, and each year reservoir sites have been discovered and surveyed. In the discovery of reservoir sites assistance is given by the Division of Topography in the course of the preparation of contoured maps showing elevations of the surface. These maps also furnish information concerning the extent and character of the catchment areas tributary to various streams.

Differences exist in the character of the surveys in various localities. In many places only a reconnoissance has been made, this being sufficient to develop the fact that a suitable basin exists. At the other extreme, detailed surveys of some localities have been made, showing by contours at 1-foot or 5-foot intervals the entire basin to be flooded, and also on a larger scale the site of the proposed dam. Borings to bed rock have also been made—the Survey being in possession of two complete diamond drill machines with all the equipment for work of this character. From the maps and borings estimates of the cost of construction have been prepared, and plans drawn showing the character of structure proposed, the information being complete for making an appropriation for construction. As a matter of course, if

an appropriation should be made, the constructing engineers would modify many features, but the examinations have been carried far enough to afford a close approximation of the cost. A considerable number of reconnoissance surveys can be made during the field season, but large expenditures are required for detailed examinations, so that it has been possible to complete comparatively few of the latter.

The reservoir sites surveyed or segregated have been listed or described in various annual reports of the Survey, beginning with the Eleventh. Reference should be made to these volumes for details. During the last year, 1899, surveys in great detail have been made of three sites on the Gila River in Arizona and of one large reservoir in Hetch Hethby Valley on the head waters of Tuolumne River, California, also of several sites on the Rio Grande in New Mexico. The results of these surveys will be given in the Twenty-first Annual Report, if not in earlier publications.

It is proposed to continue these surveys as rapidly as funds may be available, giving precedence to those where results have the greatest public importance and interest. As a result of several years' experience, this office has a corps of competent engineers, together with instruments and equipments, and is carrying forward the work probably more rapidly and economically than such work ordinarily can be done by private or corporate enterprise. The question of expense has been carefully considered and the methods in use have been adopted to secure the maximum efficiency at a minimum cost, consideration being given, of course, to the importance and the permanent character of the results.

EXTENSION OF SURVEYS.

The Geological Survey is often requested to examine reservoirs in this and that locality, and is asked to do work, the aggregate cost of which would far exceed its available funds. With the amount of money that has been appropriated it is possible to do only a limited amount of work each year, and it has been found economical to follow somewhat closely the progress of the topographic mapping. If the public in general take an interest in the matter and funds are provided, work can be expanded by an increase in the corps of skilled men.

Another question frequently asked, is whether the Government will build these reservoirs. That is a subject upon which this office cannot express an opinion. The duty of the Survey is to ascertain the existence of reservoir sites and the cost of storage works, whether these are ultimately built by individuals, by corporations or by the State or Federal Government. Some of the reservoirs surveyed or examined have already been constructed, others may be, but the most important are of such magnitude that they cannot be built except by the use of public credit in one form or another. It is to develop these

facts that examinations are being made so that intelligent action can be taken by the people.

CO-OPERATION.

In pushing forward these reservoir surveys cooperation is sought wherever practicable, as in the case of the topographic mapping. In several of the States there is an arrangement by which topographic work is increased within a State and mapping is pushed forward more rapidly than otherwise would be possible. This results from the State making an annual appropriation to help defray field expenses. An equal or greater amount is spent in field work by the Geological Survey, and the resulting map is prepared and published by the latter, proper credit being given to the State authorities. Such an arrangement was under consideration in the case of reservoir surveys in California during the recent session of the State legislature. Should cooperation in reservoir surveys be offered by States, and appropriation therefore made, it is anticipated that equal sums will be expended by the Geological Survey to hasten the completion of the work within those States.

SUMMARY.

The relation of the Geological Survey to reservoir surveys may be summed up as follows:

The Survey was created primarily for the purpose of examining and classifying the public domain, including the mineral resources and the waters.

It is specifically authorized to survey reservoir sites and to ascertain the extent to which the arid region can be redeemed by irrigation.

It is making general explorations for the reservoir sites and surveying a few of these in detail each year.

It will extend its operations as fast as funds will permit, the work being more rapidly advanced where State cooperation can be had.

Its officers have no concern with the question whether these reservoirs are to be built by private capital or public funds, their work being to ascertain the facts, such as capacity and cost of reservoirs.

Washington, D. C. November 11, 1899.

THE PREVENTION OF WATER RIGHT LITIGATION.

PAPER READ BY PROFESSOR S. FORTIER,
PROFESSOR OF CIVIL AND IRRIGATION
ENGINEERING IN THE AGRICULTURAL
COLLEGE OF MONTANA, BEFORE
THE IRRIGATION CONGRESS
AT MISSOULA, MONTANA.

Every drop of water that is withdrawn from the great ocean has effect upon the innumerable drops that remain. Likewise every irrigating stream that is diverted from its natural source produces a change in the relation of every other irrigating stream that is left in the natural channel. As it is with the various streams into which the river may be divided, so it is with the irrigators who use that water or any given water shed. They are inter-dependent. This mutual dependence would not be felt if there were enough for all. The surplus flow of the stream would silence the grumbler and conceal the petty acts of the water thieves. Too often, however, a scarcity exists. More ditches have been dug than there is water to fill. The supply is wholly inadequate to meet the demands of the water users. At such times, the smallest illegal diversion is apt to cause friction. The subject, however, is too important to consider the trivial features. Mathematically exact diversions of water are impossible. If the number of water takers reached a score or more, the fact that the one was using twenty-five per cent. more than his share might not be noticed, but if one-half the total number were to use twenty-five per cent. more than they were entitled to, the loss would be at once apparent and might result in a guerrilla warfare along the entire line of the canal or throughout the region watered by the stream.

Whenever the interests of one party encroach upon those of his neighbor, trouble is likely to ensue. Land lines and boundary fences have been the most frequent causes of disputes and law suits among Eastern farmers. To such an extent is this true, that the saying, "Good fences make good neighbors" has become proverbial. Such suits are uncommon in the West for the Western irrigator is larger-hearted than his grandsire of New England. He is tolerant of stray stock and cares little for a narrow strip of land along a boundary fence. It is only when an attempt is made to deprive his fields of the needed amount of water, that he declares war against the illegal user.

Nor is this to be wondered at. He is defending his home. The comfort and happiness of those who form his home circle are dependent in no small degree upon the irrigating stream. Delay may mean partial ruin. The wheat field, which if watered at the proper time would yield fifty bushels to the acre, may hardly pay the expenses of cultivating and reaping. It is a pardonable offense to seek to defend one's just claim to water from the upper valley thieves and the low land irrigating hogs, but the long-handled shovel or the Winchester rifle is not the best weapon to use.

A water controversy which affects the interests of a large number of irrigators is civil war in miniature. The decision of the court like the decisive battle is only the culminating feature. There may be years of estrangement, ill-feeling and disputes as well as hardships and sufferings before a decision is reached, and many years are necessary to reunite a community, once arrayed against each other.

The cost in money to each litigant, although usually great, is small compared to his other losses. Peace and contentment no longer dwell in his home. The friendships of a lifetime are severed. Social duties and customs are abandoned and all united efforts in behalf of the community are no longer possible. To the occupants of the farmers' dwellings which dot the quarter sections of this land, friendly neighbors mean much. They are isolated from the rest of mankind and when they quarrel among themselves then are they lonely indeed.

I have intimated that the loss to the irrigator through disputes over the divisions of water and the interminable law suits which follow in their train, cannot be estimated in dollars. The loss to the fever stricken household cannot be measured by the doctor's bill. But these unexpected payments are nevertheless a drain upon his resources. The profits of the farmer, even in a region like the West, where the soil is prolific and the prices of farm products high, are comparatively small. If it costs him, therefore, as Professor Mead told us yesterday, as much for litigation in defending his claims against later appropriations and users as it does for the construction and maintenance of his entire system of ditches, he cannot but feel this additional burden, this double taxation.

Furthermore, after having experienced for years the evil effects of water disputes, and the excessive costs of a court decision, the irrigator has no assurance that this decision will be final. If by the introduction of grossly exaggerated testimony regarding the actual volumes of water diverted from a stream and the land surface which each waters, the court, through the absence of all reliable data, grants to some particular ditch many times more water than the owners can use and much more than the ditch can convey; such a decision cannot stand the test of time. It is neither respected nor complied with, and serves but one purpose, it paves the way for future litigation.

Such decisions cannot be final for another reason. It is seldom

that all parties entitled to water are included in the decree of the court. Since there is no law to compel an interested party to join the suit it is rarely possible to have all represented either as plaintiffs or defendants. There is usually a third party, viz.: the outsiders. And each individual outsider reserves that privilege of bringing suit at any time against all the others if need be. This keeps the judicial mill continuously at work, for there are always fresh grists to grind.

I have not come here to belittle the irrigated West, for I have the most implicit confidence in its future. I believe that no section of the Union can compete with us in the quality and quantity of the products of the soil. Such a statement, however, does not imply that we have no hindrances. There are complicated problems yet to be solved upon whose right solution depends our destiny, and it is the duty of every well wisher of the West to strive to remove, if possible, the causes that retard its progress.

We are all interested in Federal Legislation in behalf of irrigation, but spending our time in begging money and lands from Congress is not conducive to home interests. One of the surest means, it seems to me, of getting the good will of Congress, is to show the Nation what we can do with the land and water we now possess. The agricultural interests of Arid America can only be prosperous when the welfare and rights of each individual irrigator are carefully considered and protected. Contented and prosperous homes are the right kind of building stones for the future structure.

Now a careful diagnosis of the actual conditions in most of the States and Territories would reveal the following facts: The water resource for the most part are unknown; no careful observations have ever been made of the behavior of streams; no records are available to show how much water has been appropriated and used, and how much still remains unappropriated in the channels of each stream. The carrying capacities of thousands of irrigating ditches are unknown; water has been diverted for nearly half a century with no record kept of what became of it or what purpose it served; the majority of the head-gates are not fit to control water, and few measuring devices have been inserted: through the absence of an efficient administrative system, some ditches receive too much water and others too little; guess-work in the division of water begets dissensions among the users. Comparatively few water rights have been adjudicated and those that have been settled by the ordinary courts have cost much more than the decisions are worth, and lastly but not least, the irrigated West has spent millions of dollars in water suits, and net returns from this investment are not represented by more wealth, more lands or more water, but by ten fold more water suits.

Now there must be a remedy for this state of affairs and that remedy, I assure you, consists in wise State Legislation. It will not do for our law makers to indicate in a slipshod manner how men shall

appropriate water from a public stream and then leave them to quarrel among themselves as to each man's share. Such a course is not only unbusinesslike, it is unjust to those whose industry has transformed the desert into grain fields. Water is too valuable for any Western State to give away without regard to quality and without exercising its prerogatives of supervision and control. State supervision and control though form the double-headed bug-a-boo of Western people. Yet it is possible to train this monster to become the friend of the irrigator.

The four forest reserves of Montana aggregate an area of over five million acres. The work of the supervisors and forest managers did not begin until August of 1898, and Mr. Collins whom I see before me is authority for the statement that in four months of that season, this small force had extinguished some sixty small fires and prevented the occurrence of a single running fire within the limits of the reserves. This much for the National supervision of forest reserves and if each State would police the streams in as effectual a manner, the irrigator far down in the valley might feel assured that he would get his due allowance of the water derived from the snow that lies deep in the forest reserves.

For thirty-five years the farmers of Montana have been diverting water from the public streams with little or no knowledge of the actual amount diverted or of the volume left in the natural channels. In many instances they have begun with small ditches, which were increased as more land was reclaimed. During all this time that State has made no effort to determine its appropriated and unappropriated water supply. Is it not time we were taking stock? The merchant keeps tab on the number of yards in the roll of carpeting. When a portion is sold, the number of yards remaining is written on the tag. It is time the State had a tag on its streams. In scores of instances more appropriations have been granted and more ditches constructed than there is water in the stream to fill. If disputes and litigation arise, as the inevitable result of attempting to dispose of much more than the total flow, the State is directly responsible. It will not do to scatter permits to divert water, like permits from the State capitol and allow grab-rule to dominate. No better system could be devised to foster litigation. When the summer flow of a stream is all appropriated and utilized the State through its proper officer should announce that fact, in order to protect priority owners and to show subsequent takers the limitations of their rights. The placing of a mark at different points of a stream to indicate the division line between the legal utilized flow and the surplus flow, would keep many an irrigator out of court and save his money for a nobler purpose.

There is an urgent necessity in most of the Western States today for more stringent regulations governing the appropriation and diversion of water. Such regulations cannot well be too strict. For the

one who complies with all the requirements under a well planned system is tolerably well sure of a final decree for the amount diverted.

For nearly a decade the irrigators of Wyoming have been delivered from the evil effects of irrigation litigation. They have lived in peace, not on account of the angelic sweetness of their dispositions, but because the State has endeavored to remove all cause of disputes and controversies. The cardinal principle of their system may be summarized in the old proverb "An ounce of prevention is better than a pound of cure." Frequent disputes have been averted and peace maintained by stringent regulations and close inspection regarding the appropriation and diversion of water as well as by careful measurements of the quantity diverted in different seasons and the areas of land which these streams water.

The reason that our sister state has adjudicated so many water rights with so small an expenditure of money, is due to the fact that from the day State-hood was granted, up to the present time, she has worked along one well defined system. Every acre of irrigated land, and every second foot of water measured by State officers have been done for a definite object, namely: to protect the rights of the irrigator and to enhance the value of his home by granting him a secure title to his share of the neighboring stream.

In view of the importance of this subject, this congress it seems to me, should urge the necessity of state legislation regarding the settlement of water rights apart from litigation, and the just division of all appropriated waters, after the rights of claimants have been determined.

Some may say, why urge the arid states to exercise control when district or community control is preferable. To such I would say that however wise may be the provisions of the district law it can never take the place of state supervision and control. Communities like municipalities may elect to manage their own water supplies, but to segregate the waters of a state between a large number of districts which shall be entirely independent of a governing or central bureau is too much like the introduction of the feudal system in Western America. We have to look ahead but a few years to see the limitations of even state control over inter-state and international streams.

Men may differ as to questions of detail but I believe a large majority of Western people are in accord on the following propositions:

(1) The creation in each state of a central bureau of irrigation to which all data pertaining to this subject should be forwarded and from which information could be obtained.

(2) The appointment of competent parties to collect and collate the physical facts pertaining to the irrigable lands and the appropriated waters with a view to the final settlement of all water rights.

(3) The establishment of a special tribunal to grant water titles for a nominal sum on the basis of carefully determined facts rather

than on the conflicting evidence of a large number of volunteer witnesses,

(4) The organization of an efficient administrative system to divide equitably the utilized waters of the state.

Now all this might be effected at small cost to the state at large. A transcript from each county of all records of appropriations and diversions of water as well as of all court decrees would form the nucleus of the center bureau.

In the matter of collecting the required data, the most urgent need at the present time is a well defined system in which all individual and corporate water users would co-operate.

As to the number of irrigating ditches in this state nobody knows. We may have 2,000 and then again we may have 6,000 but whether the number be small or great each ditch should have a properly designed and constructed head-gate. If any head-gate did not answer the purpose it should be the duty of some state officer to compel the owner or owners to renew it.

In addition to effective head-gates the state should prepare general plans and specifications for measuring devices and one of these devices should be inserted near each place of diversion at the expense of the owner and under the supervision of the state.

When proper means are provided to control and measure water, it is a comparatively easy thing to make the necessary measurements and record the flow. Assuming that there are 4,000 diversion ditches in this state, and that weekly observations are made at each measuring device by local parties from June 15th to Sept. 15th of each year and the results forwarded to a central office, over 62,000 measurements would be the combined result of one season's observations.

Few can estimate the value of such a record when carried on for a number of years. Such information would not only form the basis of the final settlements of water rights but after decrees had been rendered the same system could be used to aid in a just division.

If Wyoming has erred in adopting irrigation laws that are new to America, it has been in rendering final decisions on the measurements of one season. The valuable records pertaining to the flow of Western streams collected by the U. S. Geological survey during the past ten years, show the wide variations of the same stream in different years. The prevailing order seems to be a year or two of comparative drouth, followed by a like period of plenty and then several years of average water supply. In other words it would require about five years' flow to form an average.

Nor is this the only objection to over-hasty water-right adjudication. Many of the canals have been built in recent years and the 20, 30 or 50 percent waste water or seepage from their channels and the newly watered lands, is often locked up for years in the porous material of the side hills and the upper mesas. It is well nigh impossible to

determine aright the volume that should be decreed to any one ditch apart from the remaining ditches on the same stream.

In view of the difficulties to be overcome and on account of the intricate relationship of land and water, it would not seem to be wise to grant titles on the observations of one season. If this be true, it only shows the necessity for more thorough investigation. It is not so important that the water right owner receives his title this year or next. If more accurate data can be obtained by waiting a year then delay perhaps is advisable. The prime essential is that when water titles and water are once granted they shall be absolutely secure.

Meanwhile, let us hope that while legislatures are framing the laws and their appointees are ascertaining the facts, the irrigation will not be reduced to the condition of the Frenchman who, at the termination of the suit, exclaimed, "J'ai perdu mon tout mais J'ai gagné le proces." (I have lost my all but I have won the case.)

MY SERENADE.

I have a cavalier,
 At dusk he draweth near,
 To wait outside my wicket.
 I hear him draw his bow,
 He playeth soft and low,
 Hid in the maple thicket.

The listening leaves are stirred,
 The dreaming flowers are heard
 His strain from out the shadow,
 The brood moon, white and still,
 Climbeth the dusky hill,
 The mists dance in the meadow.

My faithful cavalier,
 At dusk he draweth near,
 To wait outside my wicket.
 I hear him draw his bow,
 He playeth soft and low,
 My dreamy little cricket.

—Dorothy Deane in *Kate Field's Washington*.

BOER WAR LIKELY TO STOP THE WORLD'S GREATEST ENGINEERING EFFORT.

OVER TWO MILLION STRUGGLING PEASANTS
DIRECTLY AFFECTED.

One possible result of the Boer war that has generally been overlooked is that it may put an end to the greatest engineering effort which has ever been begun in the world—the damming of the Nile. Should those complications ensue that have been foreshadowed, the intervention of one pretext or another of Russia, France and Germany, about the first thing to happen would be the forced evacuation of Egypt by the British. Her majesty would be too fully engaged in other directions to hold the country where she had only been “tolerated,” as the Frenchmen say with gritted teeth. With the withdrawal of England, the Nile improvements would cease at once, and an end, perhaps only a temporarily end to be sure, would be put to the Nile enterprise.

Nothing more serious or more pitiful could happen. The stoppage of the work on the Nile dams would be a calamity involving the progress of the entire Egyptian people, of whom there are over 9,000,000. It would affect directly over 2,000,000 peasants, who will be put back just as many years as the work is interrupted. Its early completion means to these 2,000,000 the lifting of a burden of taxation under which they are struggling without hope of relief from any other source.

To the world at large the successful issue of the Nile work will mean the readjustment of physical geography on a scale never before attempted by man. The reclamation of the desert of Sahara could alone be put in the same category. It is not alone that 2,500,000 acres of land will be brought under yield; that over 200,000,000 will be added to the land values of the Egyptian people; that the population of the country will be practically doubled in a few years; but that a greater area of the surface of the earth will be changed, be made over, as it were, than has ever been affected before in the recorded history of the human race since the time of Noah. There.

will be nothing like this change, except the conditions that resulted in primeval times when the earth underwent one of its terrible convulsions.

Where a barren rock, sandy waste now exists, there will, on completion of the Nile dam, spring up a vast inland sea with a surface area of over 200 square miles. The sea, or lake, will extend back into Nubia from the Egyptian frontier for a distance of about 130 miles. To the north the entire character of the Nile and Nile country will be changed for a distance of 600 miles. the changes reaching clear into Cairo, and beyond into the delta. and to the Mediterranean coast. For it is one of the marvels of this wonderful work that the water imprisoned behind the dam at the little town of Assuan will bring about the recalamation and cultivation of vast tracks 700 miles away in the delta to the north. At present only about one-third of the land lying between the two mouths of the Nile is under cultivation. It is by long odds the richest in Egypt, probably in the world. A comparatively few years ago it was all a marshy waste.

In 1861 there was completed under French supervision what is known as the "barrage," a dam at the apex of the delta, just above Cairo. The barrage, a comparatively unimportant piece of work, had taken twenty-four years to build. It was intended to raise the water level for navigation purposes during the low Nile. Though it had cost thousands of lives, and taken a quarter of a century to construct, it proved but a limited process. So insecurely had it been planned that in 1863 the sluice gates had to be hurriedly revised to prevent the whole structure from being swept away and washed in sections to the Mediterranean. It was reinforced by the French engineers in charge and managed to do part of the work intended for it, but only a part. It was never strong enough to serve any great area in the delta until the English came into exclusive control in 1883. Then Sir Colin Monrieff, the English diplomatic agent and actual ruler of Egypt, took the barrage in hand. Under his administration the dam was built up, and made as effective as its early faulty construction permitted. Gradually the growing area in the delta was increased until today something over a million acres are growing the finest cotton in the world. What was formerly a sullen unclaimed waste is now yielding \$30,000,000 annually in crops.

It is related that the barrage, worthless as it is as an engineering work of permanent value, almost cost the world the existence of its most ancient and inspiring monuments—the great pyramids. The construction of the work was undertaken while Mehemet Ali, "the great," was khedive of Egypt. After he had decided on the dam, he placed Mongel Bey, a French engineer in charge.

"Where am I to get the stone for the barrage?" asked the Frenchman.

"There," said Mehemet Ali, pointing to the pyramids. "From

those great useless heaps. Use them up, every block, if need be."

Mehemet Ali, it is related, was not a gentleman to be trifled with. He was an autocrat of the kind who figure in the "Arabian Nights." The engineer was literally between the devil and the deep sea. As an European he knew what would happen to him if he destroyed the pyramids. The entire civilized world would call down maledictions on his head and his name would be ever infamous where he would have it great. On the other hand was Mehemet Ali, with all the Egyptian scorn and disregard for the great antiquities that abound in the oldest country on earth. Even to this day the Egyptians care nothing for these hoary monuments except as they serve to attract tourists and backsheesh. To reason with Mehemet, therefore, on the score of sacriligious vandalism was worse than useless. So Mongel Bey got his wits to work. He came to his master the next day and said that elaborate calculations had convinced him that it would cost more to transport the pyramid stones than it would to quarry the living rock out of the adjacent hills.

"Very well, then quarry it," said the practical Mehemet tersely, and the pyramids were saved to the world by the Frenchman's ingenious lie.

From the first year that the English found themselves in control of Egypt under the "occupation" they determined on an extension of the irrigation system. Land in Egypt constitutes the great source of taxation and wealth. Every acre under cultivation in the country is worth \$105 and pays on an average \$4 per acre in direct taxes. The average annual yield when water is plentiful is about \$25 an acre. Every acre that is added therefore means an addition of \$4 per year to the national treasury, or what is of more importance to the poor peasants who till the soil, every acre reclaimed from the desert means a proportionate lowering of the general tax rate. It is estimated that the addition to come through the construction of the dam will reduce the taxation of the Egyptian peasants by one-fourth. At present only 10,500 square miles of territory, out of a total area of over 400,000 square miles comprised within the limits of Egypt are arable. The arable area comprises simply the ribbon-like strip along the Nile. Practically all the rest of the country is a howling desert. The work now under way will add 2,500 square miles to the "Nile" country. Of this about one-half will be added outright, changed from waste land to garden. The other half will be changed from "one crop" land to three and four crop land. The "one crop" land lies along the Nile out of reach of the waters now distributed by the irrigating canals. It receives the overflow of the Nile and high water only. As the waters recede the peasants hastily plant a crop of fast-maturing vegetables in the rich deposit left by the stream. Under the system that will come with the completion of the great engineering work, there will be

plenty of water all the year round for this land and three or four crops may be planted and harvested.

While the English started their planning for storing the Nile waters that now escape into the Mediterranean at flood time, in 1883, it was not until last year that the work was actually started. Now it is being pushed with all possible vigor, an army of 15,000 workmen being engaged on the task. Most of these are peasant laborers who are paid not over 15 cents a day.

All sorts of plans for recovering the desired water supply were submitted to the government by American, English and French engineers. What is conceded even in England by unprejudiced experts to have been the best plan was proposed by an American, Cope Whitehouse of Newport. Mr. Whitehouse, who has spent many years in Egypt, discovered a great irregular depression in the desert about 60 miles from Cairo to the southward. He proposes that this depression capable of storing a surface area of 250 square miles of water, should be utilized as a reservoir. Joseph's canal, the great irrigation ditch dug out of the sand by the patriarch, leaves the Nile at the town of Assint, 160 miles south of Cairo. It feeds and brings life to the Fayum, a low-lying oasis to the southwest of Cairo, containing hundreds of thousands of acres, all carefully cultivated. Mr. Whitehouse proposed by means of a ditch ten miles long, carried through soft soil, to tap Joseph's canal, store the Nile water at flood in the depression he had discovered, and by means of gates release it as required for irrigating the delta and the "one crop" land.

The plan was rejected by the Englishmen in control of affairs, for the reason, it has been openly said, that they had no desire to divide honors with an outsider.

Instead, the Assuan dam plan was undertaken. The foundation stone was laid on Feb. 12, 1899. It is to be completed under the contract on July 1, 1903. The dam will be built of granite ashlen, quarried from the same ledges out of which the obelisk, in Central park, New York, was cut thousands of years ago. It will be a mile and a quarter long, with the approaches 76 feet high and 35 feet wide at the top, where there will be a fine drive and carriageway. A thousand million gallons of water will be stored behind this monster structure. To support this enormous weight, at a level of 46 feet above the water on the other side of the dam, special means of construction had to be planned. In consequence this dam is not only by far the greatest in the world, but it is unique in other respects. The greatest difficulty that had to be overcome arose out of the fact that a solid masonry dam could not be built. To confine the Nile at high flood was impossible. Therefore, the dam had also to be a waterway, so that the river could be allowed to run through the structure practically unimpeded at certain periods. To make this possible the dam will be built in the shape of a bridge with piers set close together. When the flood

has subsided, but while the river is still at its highest, gates between these piers will be closed, making the structure solid and confining the water as effectually as would a solid masonry dam.

When the parching summer months come, the imprisoned water will be released as fast as needed. The supply, however, will come not from the top, but from the bottom, where lies the deposit which the river brings down from the Abyssinian mountains and which, deposited on the sandy soil, makes the Nile farm the richest ground in the world, needing no artificial manure.

To augment the work of the Assuan dam, another dam 450 miles lower down the river at Assuit will be built. This will be simply an "elevating" dam, destined not to store the water, but to deliver it to the irrigating canals between Assuit and Cairo, 150 miles away, at a higher level. This dam will cost \$4,000,000. Its construction will go hand in hand with the construction of the Assuan dam. Mr. Whitehouse sees in the building of this lower dam a plan on the part of the English to steal his reservoir, to which the Egyptian government has always refused him title. The Assuit dam will throw a vast volume of water into Joseph's canal, and as there is no outlet for it, Mr. Whitehouse argues that the English engineers mean to add to their storage by filling the Wady-Rayan, as his depression is known. In consequence he is arranging to present through the United States government a claim for damages, he having pre-empted the site under the Egyptian land laws.

The contractors for the Assuan dam, Aird & Co. of London, are to receive no money until the completion of the work, when they will be paid \$800,000 for thirty years. Careful calculations place the cost of the work at \$10,000,000. Under the plan of yearly payments it will practically cost the Egyptians nothing, as the crop yields from the reclaimed lands will pay \$50,000,000 land tax annually, while the land tax on the new area will be close to \$8,000,000 yearly. Figuring on this basis the Egyptian government will therefore have a net revenue after paying the contractors of more than \$7,000,000, or the tax rate will be reduced in proportion.

All these enormous advantages would be lost indefinitely with the firing of the first gun that heralds war against England by the European powers opposed to her. Left to itself the Egyptian government would never complete the work or would do it in such a way as to make it another Cairo "barrage." England's position in Egypt is a peculiar one. Her own government does not profess that she has any legal rights there and under pressure she would undoubtedly withdraw to defend the vast territory where she has a legal standing, leaving "Egypt to the Egyptians" and the dams to Father Time.—*Paul Latzke in Daily News.*

IRRIGATION IN THE EASTERN STATES.

S. S. BOYCE, TOTTEVILLE, N. Y.

The most important question confronting the farmer in the Eastern States today, North or South is how to obtain a regular moisture supply for his crops. The question of deep and thorough pulverization of the soil is a settled one, that of an abundant supply of manure is also comprehended, and fully so.

All the requisites of successful agriculture are therefore at hand, excepting that of regular moisture supply. Fertility, warmth and moisture are the essentials, and the warmth nature alone supplies, and the farmer selects a location where the desired degree of temperature is found. The amount of moisture can also be determined by the normal rainfall and the selection of soils which naturally hold moisture, but notwithstanding all the care of selection and of the furnishing of an abundance of humus in the soil to hold moisture, no season passes but the farmer loses 25 to 75 per cent. of the yield of his crops by the spells of drouth.

Turn where we may, and to any crop that is grown, to every report of the results and the word "drouth" dots the reports as cloud shadows do a landscape. As an instance few crops require less than 150,000 gallons of water per acre to enable them to properly develop to maturity. This requires a rainfall of half an inch each week during a season of growth, but as not more than one-fifth of the rainfalls can be used, the rainfall to be an ample supply must be ten inches each month. This occurs at times and places, but not often, and well it is that it does not for it is not regularly distributed through the month as required. There should be an application of $1\frac{1}{2}$ inches per week in April, 2 inches per week in May, $2\frac{1}{2}$ inches per week in June, and 3 inches per week in July, to give the crop the best growing condition. Instead of this there are times when there are not 2 inches a month, not even 1 inch. For instance, the rainfall in South Carolina for the month of April, 1896, was but 1.31 inches. May 2.74, while one-half the State had less than 1 inch rainfall for April, '96. One-half the State had less than 2 inches during the month of May, '96. In June and July, '95, one-half this State had less than 3 inches per month. In August, '96, one-half the State had less than 4 inches.

At the same time, and to show that much larger rainfalls are not

injurious, the rainfall in South Carolina is frequently 9, 10, to 12 inches per month. In July, '96, one-half the State had over 8 inches, and in one-third the State over 10 inches.

The reports of the increased annual rainfall is no criterion of what actually takes place in any season at different places. The rainfall of nearly all the Eastern States is sufficient, could it be distributed at regular times and in regular amounts. But while this is an impossibility, must the farmer look on idle and helpless and see his toil but a toil of disaster?

While we cannot insure enough water from the clouds at proper times, we must irrigate. While we cannot prevent an excessive rainfall we must furrow our plant in a manner that the surplus may go harmless away.

No one who stops to think for a moment, can deny this great necessity for a more regular moisture supply, but the question is how shall the people be led to think a minute, and how shall the importance of this question be impressed upon them.

To those who realize the great importance of the matter, the question is how to get the water supply and how to apply it. The answer to both inquiries is exceedingly simple when the practical working of a windmill pump or artesian well, or the directing of some water from a nearby stream is once seen. Everyone has watered a plant by sprinkling it or pouring some water at its base, and every one has seen how green and luxuriant is the herbage in the path of a small flow of water from a spring. These are illustrations of irrigation.

Every farm must have a water supply. Let it be increased in a furrow or ditch upon the higher part of the field, and when this is done the entering wedge of a complete system of irrigation is furnished, and each farmer can chose for himself the manner in which he will increase it.

For the year 1896 I possessed an inch stream of water at the highest point of my grounds. My neighbors on either side had none. I had crops perfect and in succession, exact to a dot, they had none till the rains came in July. The increased profit per acre was sufficient to pay the cost of watering ten acres. That inch stream of water was sufficient to furnish one inch of water over one acre each 25 hours, and was, with the little rainfall that came, sufficient to irrigate ten acres of ground thoroughly. The best means of applying water is to run it along in a smooth cut course ditch or furrow upon the ridge of a field, and make openings each 25 feet and let in the water for an hour or two and then close the opening and carry the water further along. When one acre is once experimented with, the farmer will readily be able to devise methods for larger fields.

TOTTENVILLE, N. Y.

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

THE AGE wants to brighten the pages of its Diversified Farm department, and with this object in view it requests its readers everywhere to send in photographs and pictures of fields, orchards and farm homes; prize-taking horses, cattle, sheep or hogs. Also sketches or plans of convenient and commodious barns, hen houses, corn cribs, etc. Sketches of labor-saving devices, such as ditch cleaners and watering troughs. A good illustration of a windmill irrigation plant is always interesting. Will you help us to improve the appearance of THE AGE?

MONEY IN CABBAGES.

Cabbage is a profitable crop for the farmer and market gardeners of almost every section. The gardeners residing near Salt Lake City, in Utah, claim to get an average of 12,000 good heads from an acre. As the market price is never less than five cents and more frequently ten cents per head, it requires but little figuring to show that the crop brings from \$ 00 00 to \$1,000.00 per acre. The business of raising cabbage for market is suited to the general farmer as well as the gardener, and the demand for good cabbage and its products of sourkraut and pickles is usually far greater than the supply. No expensive tools are necessary for growing and handling, and the secret, if there is any for producing good crops, can easily be mastered by any man who studies the soil and its elements of productiveness.

A mellow, fertile soil is best suited to successful cabbage growth, but any rich, well tilled plat, when properly fertilized will return good dividends on the investment. Early cabbage is the most profitable and requires the very best culture and highly stimulating fertilizers, to insure satisfactory results. A fertilizer containing plenty of potash should always be used for both early and late crops. One good mixture, used by those most successful con-

sists of phosphoric acid 7 per cent, potash, 9 per cent and nitrogen 4 per cent. This mixture when put on the land at the rate of about 1,500 pounds per acre, will show most surprising results. Early cabbages may be produced profitably on light soils by the use of these fertilizers, but later varieties as a rule require heavy land, good application of fertilizers and the best cultivation, to produce 12,000 saleable heads per acre.

There are many good varieties of cabbage, of the early, medium and late classes. It always pays to plant the best of each kind, if the fact can be ascertained. Among the standard varieties are the Wakefield for early, Drumhead for medium and Flat Dutch for late. But, the first essential with any variety is good seed. The seedsmen have first rate seed, which usually sells at about 30 cents an ounce. If a cheaper grade is offered the experienced grower will not purchase. It never pays to get cabbage seed from packages or bags handled at grocery or other stores. The best seeds are obtainable only from those who make a business of furnishing nothing but reliable seed to growers direct, every year. One ounce of seed will generally furnish enough plants for a home garden, say 1,500 good plants, while one half pound will grow plants for an acre.

Some people have good success in starting plants in small boxes in the house. My plan is to make a cold frame for the earliest varieties and sow the medium and late ones in the open ground. A cold frame may be made very cheaply by digging a hole two feet deep and six feet square. Fill in one foot with fresh stable manure that has been stacked long enough to heat thoroughly, then add six inches of soil and sow the seed, covering lightly. Cover the bed with a cotton cloth, surrounding it of course with a frame work of boards or timbers. If the bed is kept moist the plants will come on early. Later ones may be had by burning a brush heap and digging up the land, while warm and sowing the seed. Keep it bunched with brush until frost is over.

Plants should be set about eighteen inches or two feet apart, either way. If the furrows run north and south and the plants are set on the west side the roots will retain moisture longer than by any other plan. Where irrigation is practiced the young plants should be kept moist for a few days until thoroughly established. Cultivation should be frequent and thorough, using small shovel plows and weeders. If the worms are troublesome a few applications of wood ashes or the liquid made from ashes and soft soap, pretty strong, will kill them. When ready for market the heads may be broken from the stems. If to be kept over they may be buried by putting in trenches head down, leaving the roots sticking out. Sourkraut is saleable throughout the winter. It may be made by shredding the cabbage fins, and putting in a barrel, using about one pint of salt to four gallons of cabbage, and weighting until it gets eatable, usually about three weeks.

JOEL SHOMAKER.

PROFITS IN KAFFIR CORN.

Kaffir corn is a new and valuable seed and forage plant, coming from South Africa. It has been grown in some of the dry sections of the United States for the

past ten years, and reports are favorable, as to yield and feeding qualities. The distinctive varieties of red and white have produced from 35 to 58 bushels per acre in Kansas, while the best yield of corn planted in the same field, was but 45 bushels. An acre of red Kaffir corn will produce from four to six tons of fodder, which can be used in the silo, or fed dry to advantage and profit. The seed of both varieties makes good meal for bread and cereal products and the whole grain is splendid feed for poultry. When cracked and fed with other foods the Kaffir corn possesses valuable fattening qualities for horses and hogs. Different analyses show that the seed is similar to corn, except that it is not so rich in protein.

The Kaffir, like other corn does best in rich loamy soil, but by proper plowing, careful cultivation and suitable fertilization the crop may be profitably grown in most sections of our country. It is a great drouth resister, and is therefore suited to all semi-arid sections, and will make a crop where the rainfall is short, when all other full season cereals fail. The soil should be well plowed, thoroughly pulverized and put in the best possible condition. As the plant produces heavy seed heads it requires abundant food of potash and nitrogen. If a fertilizer containing about 9 per cent potash, 8 per cent phosphoric acid and 4 per cent nitrogen is used, at the rate of 500 pounds per acre, and liberally applied in the spring, it will prove beneficial. Every farmer can obtain full information about these fertilizers and how to mix them from his seedsman or by securing publications from houses handling fertilizers.

The seed is very small, but weighs 56 pounds to the bushel. Six pounds will plant an acre if grown for seed, while double that quantity is necessary where a heavy yield of fodder is desired. A corn planter is one of the best implements for putting in Kaffir seed, but the press grain drill may be used satisfactorily. Rows may be thirty inches apart and the stalks

stand from 4 to 9 inches apart in the row. This will give a good grain yield and produce plenty of fodder. Where forage alone is wanted the seed may be drilled, and the stalks mown when in blossom, and a second crop cut later in the fall. It should not be planted until the weather is warm and the soil in good condition for germinating the seed, which rots easily if the soil is wet and cold. Seed may be purchased from any of the established houses, at about \$5.00 per 100 pounds, the price increasing for smaller lots.

Cultivation of Kaffir corn is much the same as that required by the old sorghum. The roots always grow near the surface and deep cultivation is not desirable or advisable. The plants are very tender and small for the first few weeks of growth hence weeds must be kept down. Stalks will generally reach a height of four feet, and the seed heads will stand upright, resembling sugar cane. The leaves are much thicker than corn blades and the plant can stand a long dry spell without suffering any material loss. The tassels are rich in pollen and fertilization takes place more quickly and under more adverse conditions than that of corn. If irrigated the water should be used very sparingly and not left to run too long in one furrow. The surface between rows should be kept slightly stirred until the tassels begin to appear when cultivation should be stopped.

The corn can be cut with knives the same as ordinary maize, and put into shocks until ready for use. Some growers use a header and merely cut off the seed, leaving the fodder stand for pasture. The best plan is to cut the stalks, allow them to cure well, tie in bundles and haul to the barn or feeding corral. The heads may then be cut off with knives, and threshed or fed whole to the stock. Wherever tested the feeding values have been very satisfactory. I have used the corn for fattening poultry and hogs and have noted a very appreciable increase in milk when fed to the cows. As a substitute for corn, in districts where the dent varieties do not

mature, the Kaffir certainly has very strong claims. No farmer will lose anything by giving this new plant a thorough trial, on any tillable soil.

JOEL SHOMAKER.

ALFALFA OR LUCERN.

For the past five years the Utah Experiment Station has been carrying on a line of investigation to determine at just what time in its growth alfalfa should be cut for best results, composition, annual yield per acre, and feeding value all being taken into account. In connection with this work the feeding value of such well known roughage crops as timothy hay, corn fodder, and red clover has been compared with that of alfalfa.

For this experiment a field of alfalfa was divided into three equal pieces, one being regularly cut when the first blooms appeared, the second when in full bloom, and the third when half the blossoms had fallen, these being denominated early, medium, and late cutting respectively. Incidentally there was made a comparison of the first, second, and third crops.

The details of this investigation are reported in Bulletin No. 61 of the Utah Station, a copy of which may be obtained by addressing the Director at Logan. Below are given the more important facts, together with the conclusions that may be legitimately drawn from the results:

1. The largest annual yield of hay per acre is obtained by the method of early cutting and the lowest by the late, the average result standing as follows: early cutting 100, medium 92, and late 85.

2. The early cut alfalfa contains the highest per cent of protein and fat, the most valuable food constituents, and the lowest per cent of crude fiber, the most indigestible portion. The former decreases constantly while the latter increases rapidly from early bloom to the full maturity of the plant.

3. The proportionate amount of leaves to stems is greater at early bloom than at any subsequent time, and both leaves and

stems contain a greater per cent of protein and a less per cent of crude fiber at this time than at any later period in the growth of the plant. The relative proportion of leaves to stems in the different cuttings is as follows: early, 42 to 58; medium, 40 to 60; late, 33 to 67.

4. Alfalfa leaves as compared with stems are very much richer in protein, fat and nitrogen-free extract, and they contain a much smaller proportion of crude fiber. The per cent of the protein and fat grows constantly less and that of the crude fiber greater from the time of early bloom to maturity. The average composition of all cuttings and crops shows the leaves to contain 150 per cent more protein than the stems, 300 per cent more fat, 35 per cent more nitrogen free extract, and 256 per cent less crude fiber.

5. The more important nutrients, protein and fat, have the highest per cent of digestibility in the early cuttings, and it grows less and less with the age of the plant.

6. In the feeding tests, the highest gains were made from the early cuttings and the lowest from the late, the results standing proportionately as follows: early cutting, 100; medium, 85; and late, 75.

7. The variation in the amount of the different cuttings eaten per day was very slight, being the highest for the early cutting and the lowest for the late, but the quantity of dry matter and also of digestible matter required for a pound of gain was decidedly lowest for the early cutting and highest for the late, the relative amounts of dry matter standing as follows: early cutting, 100; medium, 131; and late, 166.

8. The annual beef product per acre was largest from the early cuttings, not only in the general average but in each separate season's test, and that from the late cuttings was smallest, the proportional products standing as follows: early cutting, 100; medium, 79½; and late, 69½.

9. Taking all points of comparison into consideration, both separately and

collectively, including everything that pertains to the largest yield and highest feeding value, the tests favor cutting alfalfa for cattle-feeding when the first blooms appear.

CROP COMPARISON.

10. The first crop gave the largest yield in each of the five tests and in fourteen out of the fifteen cuttings, while the third crop gave the lowest for every test and in every cutting but one. The average acre-yields for the five years, including all cuttings, stand in the following relation: first crop, 100; second, 78; and third, 39; for the early cuttings alone, first crop, 100; second, 83; third, 66.

11. In the average composition of all cuttings for three years, the nutrients of the three crops vary but little. The second has slightly the highest per cent of protein and fiber; and the third the most fat and nitrogen free extract.

12. The third crop has the largest proportion of leaves to stems; but the per cent of protein in the leaves is highest in the second crop, and next highest in the first. The leaves of the first crop contain the most fat and of the second the least.

13. The third crop produced a higher average rate of gain in the feeding tests than the first or second and also higher than any of the separate cuttings. The amount eaten daily was also highest of all, but the dry matter and digestible matter for a pound of gain were the lowest. In a pound per pound comparison the gains stand as follows: first crop, 100; second, 81; third crop, 126; dry matter for a pound of gain, first crop, 100; second, 115; and third, 69.

14. The beef product per acre, taking the average result of all cuttings for the five years, was very much the highest for the first crop and decidedly the lowest for the third, standing as follows: first crop, 100; second, 61; and third, 45; but taking the early cuttings alone they stand, first crop, 100; second, 80; and third, 69.

15. Pound per pound, taken as a whole, the results show the highest feeding value

for the third crop and the lowest for the second.

16. The average annual beef product from early cut alfalfa was 705.61 pounds per acre; it required 9,575 pounds of timothy to produce an equal weight; 11,967 pounds of red clover, and 10,083 pounds of shredded corn fodder.

A LARGE CROP.

Returns made on the onion crop of the United States this year show that in what is known as the commercial onion districts, the total yield will be 4,368,000 bushels, against 3,280,000 bushels last year. The crop as a whole has cured well, and there is a prospect that dealers will enter the Winter with liberal supplies of fine stock. This, according to the trade here, is in decided contrast with last year when much of the crop was inferior, and farmers and dealers lost heavily through rot during the late Autumn and Winter.

A good many onions are moving, and farmers show a very general disposition to sell. They believe it is better to accept the present relatively low prices and clean up their big crops than to hold indefinitely with the practical assurance of shrinkage in bulk and deterioration in quality and possibly continued low prices.

The imports during the season of 1898-99 amounted to 771,960 bushels, against 488,853 bushels in the preceding season. The exports last season reached a total of 164,902 bushels, against 100,148 bushels in 1897-98.

FORESTRY INSPECTION IN CANADA.

Washington, Oct. 5 (Special).—The Department of State has received the following from commercial agent Beutelspacher at Moncton:

"An inspector of timber has been created by the Dominion Government. With the view of preserving the remaining forests upon Dominion lands and Indian reserves from utter destruction by fires and other destructive agencies, and of encouraging

the reproduction of forest trees and also as settlement is rapidly progressing in all parts of Manitoba and the Northwest Territory, with the object of making an immediate inspection of the country, to ascertain what tracts should be set apart for timber reserves before they are encroached upon by settlers, the position of Chief Inspector of Timber and Forestry has been created. The headquarters of the inspector will be at Ottawa and his salary will be \$2,500 per annum."

MISSOURI'S CORN CROP.

There is a phase of corn production in Missouri which is not generally appreciated. This State used to furnish a very large amount of corn for outside consumption. It figured conspicuously in the five or six corn surplus States. But while corn crops have been growing in the aggregate, Missouri has been selling less and less corn. Last year the corn crop of Missouri was 190,000,000 bushels. It is a matter for marvel that Missouri is credited with the selling to the rest of the world only 5,786,395 bushels of that enormous crop. That corn brought \$1,796,882.

The crop of flaxseed in the State for that year came to almost as much. Missouri marketed last year cotton to an amount within \$500,000 of the value of the corn sold. The eggs of Missouri hens last year supplied the homes of farmers and yielded besides \$3,333,533, twice as much as the corn brought. The chickens which were shipped away after home consumption yielded \$4,905,609, about three times as much as the surplus corn.

These comparative figures are impressive. They lead up to the interesting question: What becomes of Missouri's 200,000,000 bushels of corn?

In just two items of the States surplus for last year is found the answer, and it is gratifying in a high degree. These two items were.

	Head.	Value.
Cattle.....	911,725	\$34,964,654
Hogs.....	3,612,636	36,278,500

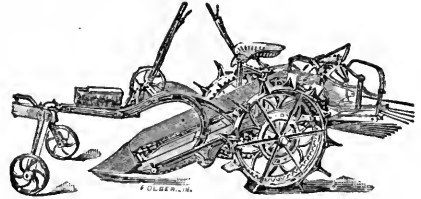
Practically the whole corn crop of Missouri went to market on the hoof last year. Some counties not only consumed within their borders all of the corn they raised, but corn was brought from other States, notably from Iowa, and turned into meat. There are counties in Missouri where today corn is selling for feeding purposes at from 3c to 4c a bushel more than it would bring if it were placed on the cars and shipped to St. Louis or Chicago.

When the Missouri farmer learned to feed all the corn he raised he added from 50 to 100 per cent. to the value of that crop. The 190,000,000 bushels of corn raised last year, if it had been marketed by the farmer, would have yielded him perhaps \$30,000,000 after he had taken out what was needed for consumption on the farm. But this corn crop was the main factor which made possible the sale of \$71,000,000 worth of cattle and hogs by the Missouri farmers. Of course, that magnificent total was not all gain. The hogs were raised on the farms, it is true; but a considerable proportion of the cattle was brought from the ranges of the West and Southwest, and doubled in value by the feeding received on Missouri farms. It is safe to say that the surplus corn crop of Missouri last year was increased in value from \$30,000,000 to \$50,000,000 by being turned into cattle and hogs before it left the farm.

POTATOES AS A MONEY CROP.

Taken one year with another it is doubtful if any one single crop grown in this country produces more actual money to the grower than potatoes. This is so

notwithstanding the fact that, taken as a whole, the most primitive methods are still employed in the growing and marketing the crop. As against this general condition there stand out here and there with



special prominence those cases where potato growing is reduced to an exact science and where the best and most improved appliances are used in the labor connected with producing the crop. These people have learned that the way to produce the the greatest profit is to reduce by every means the expense of production. They have learned, or are learning, with the manufacturer, that the expensive element of hand labor must be reduced to the minimum if the resulting product is to leave a margin of profit.

To dig or harvest a crop of potatoes cleanly, easily and rapidly, in the nick of time when the weather is at its best, is a very expensive and laborious job when the work has to be done by hand. Happily for the farmer or special potato grower there are now machines that will perform this labor in the most perfect and economic manner.

A machine of this kind possessing special merit, and which has been long and favorably known to the public, is the Hoover Digger, manufactured by Hoover, Prout & Co., Aves, Ohio. This machine is built upon honor and sold upon its merits. Write these people for catalogue, prices, etc.

PULSE OF THE IRRIGATION INDUSTRY.

NOT A SPECULATION COMMODITY.

The time has gone by in the West for irrigation water to be used as a commodity for speculation. In the early days the title to water supply or the prospect of getting it was used as a means to enhance values and in many cases to sell land to strangers themselves eager to invest; but now water is needed to legitimately irrigate land so that it will yield its products which must be sold in the face of constantly-increasing competition. Water, therefore, should no longer be used as a speculative medium. It should be made available to the consumer at the actual cost of the construction and operation of the necessary distribution works, and without cost for reservoir storage. It has been generally demonstrated, during the past ten years, that there is but little profit in private storage enterprises, for, while the advantage to the community is great, the owners of the plant do not reap the full benefit. The practicable and fair method and the only one which will be absolutely successful is the building of reservoirs by either the General or State Governments, with the free use of the waters stored to the land-owners. The proposition is exactly similar to that in which the public has the free use of and benefit from the improvements made by the Government on some harbor, the dredging of some river for navigation, or the establishment of some light-house or danger signal.

A UNITED DEMAND.

Every great project of any age and in any country has always been attained through united effort. "In union there is strength!" "United we stand, divided we fall!" These mottoes are peculiarly appli-

cable to present conditions in the West. For many years the whole Western country has been trying to get irrigation through one method and another. That the methods employed have not been as entirely satisfactory as the benefits which arise from irrigation would suggest is shown not only by the fact that over 70,000,000 acres of productive land subject to irrigation development are yet arid, but by the evident reluctance of capital to enter this field. After much wrangling and cross-fire fighting for the past ten years, the leading men, newspapers, congresses, commercial and organized bodies in the West have "gotten together" on an irrigation policy. Granting that the West is a unit in favor of irrigation, and a unit in favor of a definite irrigation policy, there is yet the opposition of the entire East to overcome, so that the absolute necessity for unity of action and demand is evident. The Los Angeles Times, than which there is no more capable nor resolute advocate of Western development and irrigation, calls attention to this policy and the great necessity for entire harmony of purpose and action in working to secure advancement through irrigation.

The policy referred to is that storage reservoirs should be built by the national Government under the River and Harbor appropriations, as recommended by the Engineer Corps, and that the public grazing lands should be leased, but without cession of the title to the States, and the rentals devoted to irrigation development. Heretofore the West has been unable to secure any Eastern recognition along these lines because it has been divided and antagonistic, one section wanting one thing and another something else. But now or-

ganization is telling and the West is practically "together" on this subject. With the West united, the conversion of the East is not such a problem. It requires, as the Times says, only that the vast possibilities of the wealth lying latent in the arid lands of the West, and requiring but irrigation to be made productive, should be strongly brought to the attention of the industrial, commercial, and manufacturing classes and organizations of the East.

The "national" movement has already secured good headway in the West and is gaining ground constantly as people awaken to the importance of the policy, but the Times urges that it is a mistake to do anything at this time to weaken the movement, and it deprecates the idea of a California convention to devise some means for State irrigation which will in any way conflict with the demand for national aid. It also opposes a plan whereby the title to forests in California would be granted to the State University in trust, to be leased, and the revenues devoted to specific purposes. In fact it stands firmly against all schemes for State cession, saying for California what is true to a more or less extent in all the Western States and Territories.

"It will not do to assume that the foothill lands of the Sierra Nevadas will be forever devoted to grazing. The time will come—when water for their irrigation has been provided—that these mountain slopes will be dotted with orchards and vineyards and picturesque rural homes, such as cover the hillsides of France." In other words, the public lands should be held by the Government as a sacred heritage for those who may come to the West looking for homes, and which, under a wise irrigation policy, they will find responsive to their toil and industry.

Fruitvale Water Co., of Hemet, Cal., was incorporated under the laws of the State of Cal. Nov. 5, with a capital stock of \$50,000. This Company will water about 3,000 acres of the very best fruit land in Riverside Co. They will derive their supply from the great artesian belt at the foot of San Jacinto Mountain. The directors of the Company are: P. J. Perrine, Pres.; Karl S. Carlton, Sec.; T. H. Sullivan, Treas.; D. N. Downy, J. P. Kirby.

Many methods have been employed for carrying water to growing crops. In Egypt and India even now can be found the Persian water-wheel. A series of earthen pots are strung on an endless rope and revolve on a wheel with a horizontal axis. The lower end of the rope goes down into the well, and as the wheel revolves the pots fill, emptying into a trough as they come to the surface and tip over. Bullocks or camels keep the wheel in motion.

The mote is another invention much used in India. Two bullocks raise a leather bag from the well by a rope and pulley. The old fashioned pole and bucket, seen on some American farms, is used for short lifts on the Nile banks. A very primitive way of raising water is by placing a trough made of a small tree trunk on a pivot. One end is dipped into the water, the trough straightened and the water runs out the other end.

In 1860 there were 70,000 masonry wells and 380,000 earthen ones in the land lying near the Ganges river, and these wells irrigated nearly 1,500,000 acres of land by means of primitive lifts. At present the Ganges irrigation canal irrigates this tract, though many of the old wells are still used.

ODDS AND ENDS.

GROSS RECEIPTS OF POSTAL DEPARTMENT.

The Post Office Department has made public a statement of the gross receipts for September, 1899, as compared with the receipts for September, 1898, at fifty of the large Post Offices.

The receipts for September, 1899, show a total of \$3,702,850, a net increase of \$299,952, or 8.8 per cent. over 1898. The greatest increase is shown at Albany, 39.4 per cent. Increases are shown at all offices, except Washington, D. C.; Lowell, Mass.; Worcester, Mass.; Peoria, Ill., and St. Joseph, Mo.

At New York the receipts for September, 1899, were \$759,337; 1898, \$715,110

The figures are valuable as a barometer of the business and industrial condition of the country. Mr. Bingham, of the finance division, thinks that the total receipts for the entire fiscal year ending June 30, 1899, will show an increase over 1898 of about 7 per cent.

The receipts for the year 1898 showed such a remarkable increase over 1897 that the Department feels justified in predicting that the increase for the past year will be unprecedented.

IRRIGATION RULES.

The Oceanside, (California) Weekly Blade prints the following "Seven Irrigation Rules:"

1. The more cultivation the less water is required.
2. Irrigation furrows should generally not be over three inches deep.
3. Do not let the water lie around the stems of plants.

4. Do not over-irrigate; two thorough soakings a month are usually sufficient.

5. Do not water trees or vines when in blossom, nor until the fruit has properly set.

6. Irrigate preferably on cloudy days or at night.

7. Do not apply water when the soil is hot.

MACHINERY FOR HAVANA.

The Link Belt Manufacturing Company of this city is about to make a shipment of conveying machinery to Havana.

A NEW COMPANY.

The Mexican Pump and Irrigation Company of Kansas City has been incorporated with a capital stock of \$30,000. Incorporators—Frank D. Pelletier, M. J. Pelletier, Charles E. Fearons and others.

AUSTIN LOSES ELECTRIC POWER.

The great dam across the Colorado river here, which was constructed by the city a few years ago at a cost of \$1,000,000, has sprang a big leak and the waters in the lake formed by the dam (1:1) receding. This, together with the prolonged drought has caused the municipal electric light and power plant to shut down, and the city is without lights and electric street car service.

No rural section of the country are so prosperous as those which possess successful irrigation, yet there are 70,000,000 acres of land in the West now arid and worthless, but capable, under complete irrigation, of raising certain and enormous crops.

THE PLANTER'S DEPENDENCE ON GOOD SEEDS.

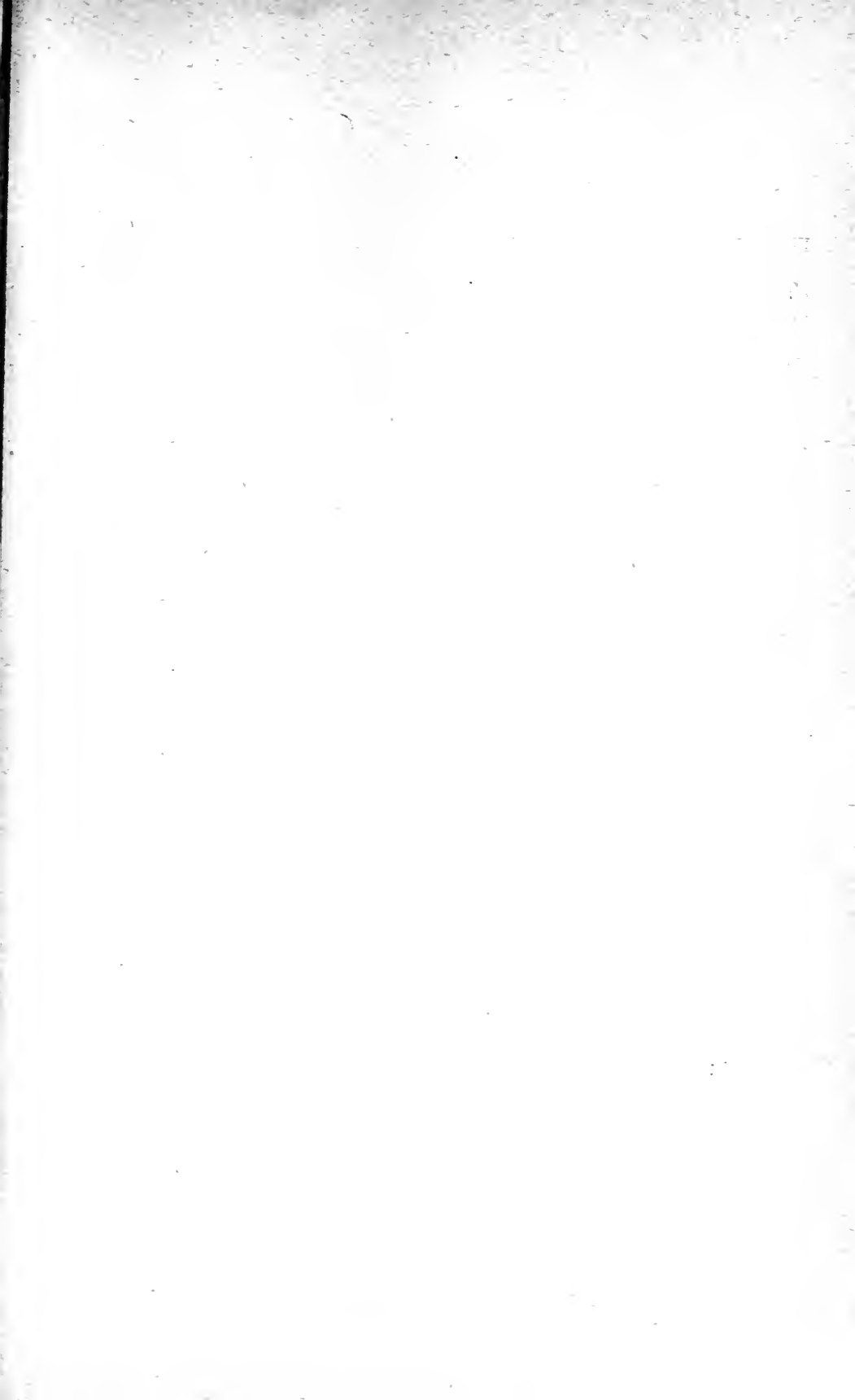
Without good, fresh, fertile seeds, good crops are impossible. It is, then, of the most vital importance that you should exercise the greatest possible caution in selecting the seeds you are to plant the coming season. Since you cannot determine their fertility or freshness by sight, the only certain way to insure yourself against worthless seeds is to buy only those that bear the name of a firm about whose reliability there is no question. There are no better known seedsmen anywhere, and none who have a higher reputation for integrity, than D. M. Ferry & Co., of Detroit, Mich. Ferry's Seeds have been a synonym for good seeds for many years. Thousands of gardeners who continue to plant them season after season, do so with the full confidence that they will uniformly be found to be of high vitality, and most important of all, true to name.

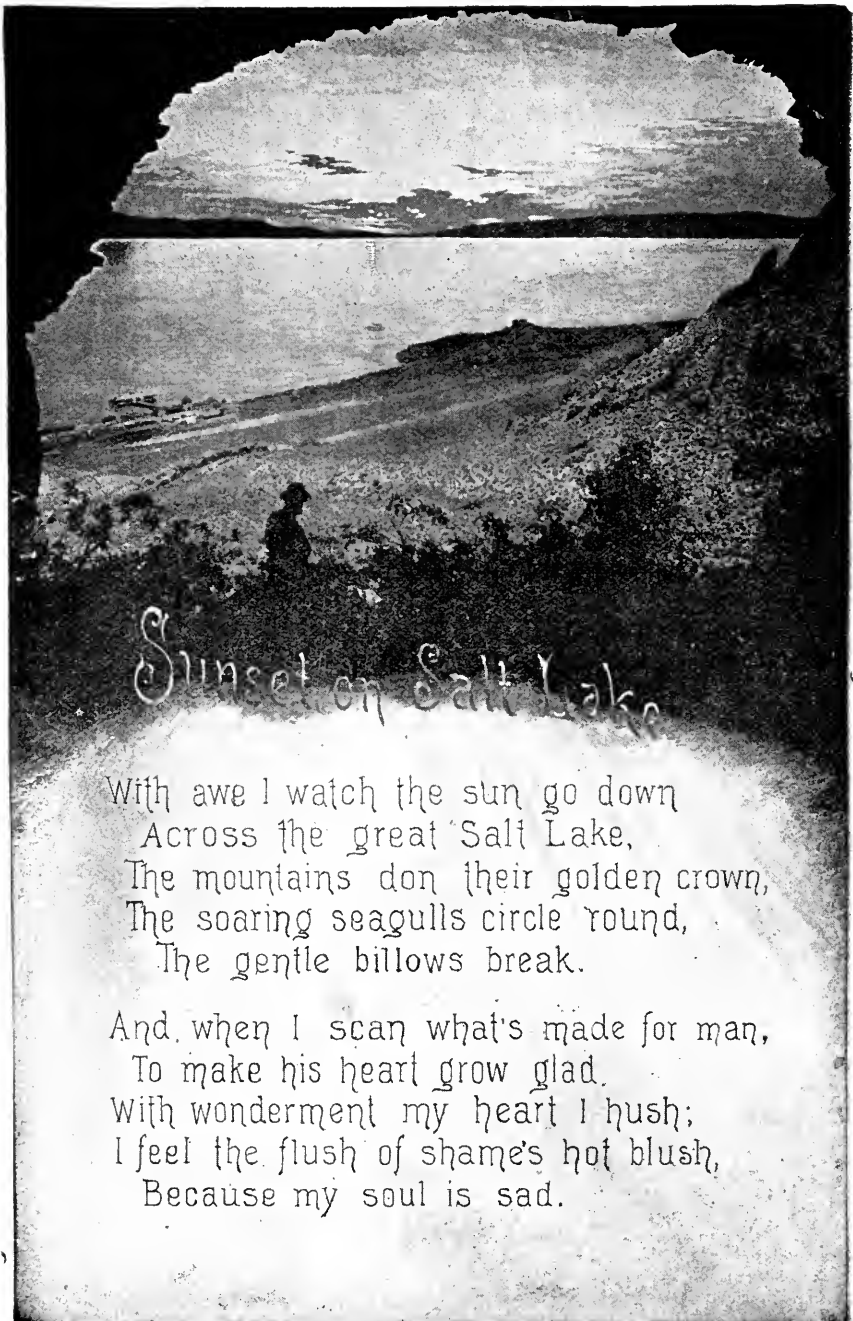
Ferry's Seed Annual for 1900 is fully up to the standard of former years and will be welcomed by all who have learned to regard it as a thoroughly reliable and practical guide to planting. A copy may be

obtained free by addressing the firm as above.

Land monopoly is hardly a question to frighten the West as yet. There is no dearth of land. With between seventy-five and a hundred million acres of public land waiting to be reclaimed, irrigated and cultivated, the West need not yet worry about what land has passed into private hands. Let it turn its attention to that remaining and unite to secure its reclamation by the National Government.

Congress appropriates millions of dollars for the building of levees, ripraps and dredging mud to comparatively little purpose; the waters every now and then come rampaging down and break over the levees, causing death and destructing. But the same money, spent by the same Government and by the same competent corps of engineers, to build storage dams and irrigation ditches, would prevent floods by storing these waste waters, and would give employment to thousands of laborers, and, at the same time, create a home for every one of them.





Sunset on Salt Lake

With awe I watch the sun go down
Across the great Salt Lake,
The mountains don their golden crown,
The soaring seagulls circle round,
The gentle billows break.

And when I scan what's made for man,
To make his heart grow glad,
With wonderment my heart I hush;
I feel the flush of shame's hot blush,
Because my soul is sad.

THE IRRIGATION AGE.

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NO. 4.

THE PROGRESS OF WESTERN AMERICA.

New Year's Day

New Year's Day is invariably associated in our minds with the formation of good resolutions, the starting of the diary, the opening of the account book which shall reiterate in black and white that "A penny saved is a penny earned," and that if we "Take care of the pence the pounds will take care of themselves." These things are associated with the opening of the New Year as inseparably as is holly with Christmas tide. To all of our readers—those who have "resolved" and those who have not, the AGE offers most hearty greetings and wishes that for all of you 1900 may be a year of good things—a year of happiness and prosperity.

The Year 1899.

The year just passed has been one of the most prosperous, financially, that has been experienced for many long years, and coming, as it did, so close after the period of "hard times" made it doubly welcome. Crops were good, therefore the farmer has rejoiced; manufacturing industries have been unusually active, therefore work for the toiler has been plentiful and idle men are scarce. Probably no month witnessed such a volume of trade as did November, and if 1900 is as prosperous as 1899 has been, most of us will have no cause for complaint. The past year, in addition to being a successful business year, was also one big with events. It was one of those periods in which everything seemed to "happen." As one writer puts it, we are going forward with such mighty force: the

world is striving so eagerly for something better and nobler than, taken in connection with the "wars and rumors of wars," the millennium begins to assume shape. But despite the fact that many reforms are being brought about and many evils corrected, there are still so many abuses crying for correction that it will be some months yet ere the lion will be a suitable bed-fellow for the lamb. Wars are still in progress: the strong oppress the weak; capital and labor are antagonistic: yet the world is more tolerant, more charitable, wiser—we recognize more clearly than ever before the great ruling force that is back of it all, bringing mankind up year by year to a higher plane. In the words of the old hymn "God works in a mysterious way His wonders to perform."

Irrigation Exhibition at Paris.

The *Denver Republican* says: "Prof. Elwood Mead, the well known irrigation expert, will doubtless make a most interesting feature of America's irrigation exhibit at the Paris exposition, and beneficial results will follow the introduction of the western farmers' best ideas in Europe.

The term "arid America" is rapidly becoming less applicable than of yore, the rapid strides of irrigation bringing the so-called arid states into a condition of productiveness. This fact is little known in Europe, and for this reason an exhibit that will give foreigners some idea of the scope of irrigation in America will prove of incalculable benefit in encouraging immigration of the best sort. European

farmers who are tenants of the well to do class cannot be induced to come to America, believing that all the farming lands have been taken up, and that the immigrant does not have the same opportunities of getting wealth at this day as he did before the wagons of the pioneers had crossed the Rocky Mountains. He is of the opinion that with the taking up of the fertile lands of the middle west the farmer immigrant's chances for gaining wealth vanished.

An irrigation exhibit that properly shows the wonderful change that has been worked in many of the arid states will convince the thinking foreigner of his error. The best class of European farmers will thus be induced to settle in the far western states, when they realize that, with water properly applied from streams, they can raise larger crops with greater ease and surety than the immigrant who settled farther east and who is not always blessed with bountiful rains.

Aside from its value in thus encouraging desirable immigration, the proposed irrigation exhibit will prove an object lesson to the shortsighted Americans who imagine that everything west of the Mississippi river is a desert of sage brush and cactus. Thousands of persons who do not know the resources of the United States will flock to the Paris exposition, and the irrigation exhibit will achieve one of its best results in opening the eyes of these people to one of the greatest wonders of their own country."

**Forest
Preservation.**

The following paragraphs appeared some time ago in the New York *Commercial* and should be pondered by everyone interested in the welfare of the agricultural districts:

When a man announces himself as a candidate for Congress it is customary for the people to inquire how he stands on certain public questions. Does he believe in bimetallism or is he friendly to a single gold standard? Is his record that of a protectionist or has he advocated the open door policy for this Government? What would he be likely to do if confronted with a proposition to subsidize American shipping; to extend the sphere of Ameri-

can influence in foreign parts; to create a stancher navy or to increase the numerical strength of our army? These are vital questions, to be sure, and no man is fitted to represent a constituency who has not decided views upon them all. But there is one subject which national candidates before the people are apparently supposed to know nothing about, and yet it is perhaps as important as any other one thing in which we as Americans have an interest. We refer to the subject of forestry and forest preservation. Just now English economists are greatly exercised over the probable exhaustion of that country's coal supply. The life of the nation is at stake, they say, and naturally every effort is being made to prevent waste. Does anyone believe that if the English could recreate their coal deposits by a system as simple as that which would insure to us the preservation of our forests, it would not be done?

* * *

The Agricultural Department will render every aid to individuals who take an interest in tree planting. But the Agricultural Department cannot legislate. Congress can. In a recent circular Secretary Wilson declares that few farmers realize the value of forests to those engaged in agriculture. In the humid portions of America, where nearly every farm has its wood lot, the total area of woodland is more than 200,000,000 acres. These natural windbrakes temper the weather and modify local climatic conditions to a marked degree. Woods of commerce are being rapidly destroyed in America by the inexcusable and wanton wastefulness of those who can see no danger until it becomes a matter of present and pressing emergency.

Unions. About the only trade or occupation which has neither "union" nor "trust" is that of farming. Associations of various kinds have been formed by the farmers for the purpose of mutual improvement and benefit, more especially of an educational nature, but so far unionism has been known to them as is the "trust" by the indirect effect it has had upon them. Capital and labor is so at variance that it seems as if a crisis

must be not far off. Wise and good men have vainly tried to adjust things so that the two might work harmoniously together for their common good. Their aims are, in reality, the same if they could but be made to realize that. A man who has recently tried to harmonize these two factors is E. J. Smith, founder of the New Trade Alliance in England. Under the title of "A Living Profit and a Living Wage," Mr. Smith writes an interesting article in the January *Forum*, relating the success of an experiment in England. He makes the somewhat socialistic declaration that "We as manufacturers have no more right to determine the wages of our work people than the work people have to determine our profits." Mr. Smith's theory--and it is a theory which has been put to practical and successful test in England--is based upon two cardinal principles: (1) selling from the well-ascertained cost of production and (2) co-operating with the work people in securing a fair profit. "Manufacturers would not fight trades-unions were they not convinced that the unions ask more than they ought to have; trades unions would not fight manufacturers if they knew that they were asking for the impossible." Therefore the thing to do is to establish mutual confidence. The movement inaugurated by Mr. Smith has so far been very successful. At present it controls about £50,000,000 capital, and numbers among its adherents about 500 employers and 30,000 work people.

Pure
Water
for
Chicago.

Chicago is now in a position to defy the critics who have heretofore cracked jokes concerning her drinking water, and the newspaper humorists will have to confine their attempts at wit to the Chicago girl's feet, the microbe no longer be a resource, since the completion of the great drainage canal. Seven years ago, Sept. 3, 1892, this great work was begun and the main channel of the canal, 28.05 miles long, was practically completed last November. The congressman who inspected the work at that time said that this engineering feat would solve the water problem of Chicago for the next 50 years. After seven years of work and the

expenditure of \$33,000,000 the canal was finished and the water turned in to it Jan. 1, 1900, the city beginning the new year with a fair prospect for unpolluted drinking water. The water from Lake Michigan flows through the canal connecting it with the Chicago river, then the Desplaines, finally emptying into the Mississippi, carrying with it the sewage and filth that has hitherto polluted the city water by being emptied into the lake. The action of natural forces, air and sunlight, will purify the waters of the Mississippi, so that the sewage carried by its waters will do no injury to inhabitants of St. Louis and other cities along its banks.

The following item from an exchange will, no doubt, be news to many of us, as it is hard to realize that we are the greatest sugar eaters in the world. This is what the exchange tells us we are, and every year sees an enormous increase in our consumption per capita, some placing this increase as high as 12 per cent. per annum: In 1884 we consumed 53.4 pounds per head, but 10 years later this had risen to 66 pounds. The question of deepest interest to us is as to where we shall get the 4,894,156,800 pounds which our people must have annually. This is what has given Germany such a keen interest in our acquisition of the Spanish islands, for she wants this immensely valuable market. So long as the island remained under the misrule of Spain they could not compete successfully with her, and her sales of beet sugar to us went up by leaps and bounds. As it was, we took two-thirds of the sugar raised in the Philippines,—a fact of which most people are ignorant,—and in some years as high as 93 per cent. of that raised in Cuba. We have tried raising sugar ourselves, but so far have only produced a very meager proportion of what our people require. The average yield of the Louisiana canefields is only 707,951,878 pounds, and the utmost produced by our beet factories is but 90,491,670 pounds; so that altogether we have not more than 10 of the 66 pounds that our people want. Hawaii is now American soil, and it produces 431,217,118 pounds a year. Porto Rico is also Ameri-

can soil, and it produces 81,582,810 pounds a year. Altogether, this makes 1,311,243,474 pounds, or about 16 of the 66 pounds our people want. We shall have to look to Cuba and the Philippines for the remaining 50 pounds, or else buy it from Germany. The Philippine crop has been estimated in times of peace at 135,000,000 pounds. No doubt that, as soon as we have established peace there, and Americans see the great opportunities, the sugar crop will be increased many fold, as will be the case with Cuba, especially, as we shall make such arrangements as will admit the sugar of those islands on more advantageous terms than German beet sugar. The English formerly beat us as sugar-eaters, but we

have passed them. The French, in spite of all their appetite for sweets, eat but 30 pounds of sugar a year; the Germans, 23; the Spaniards, 11; Russians, 10, and the Italians, 7.

At even so low an average as two cents per pound our expenditures for sugar will exceed \$100,000,000 a year, or about \$2,000,000 a week. It is highly important that this enormous sum go as far as possible in directions from which we will be most likely to receive some return good. If our own citizens can not raise this sugar at home, let us encourage them to do the work in the Spanish islands, so that American money will still go to Americans.

Praise, and the world will heed you;
 Blame, and it heeds you not;
 For a word of praise in the memory stays,
 Never to be forgot:
 Or, if chiding be remembered,
 It is only for its sting,
 But loving words, like songs of birds,
 Are forever echoing.

Look for the fragrant roses,
 Not for the thorns and weeds,
 For the crimson sky, when night is nigh,
 And the golden sun recedes,
 Glistens the Starry Dipper,
 Sparkles the Milky Way,
 Through midnight trees, the clear eye sees,
 Glimpses of dawning day.

Kisses, but not upbraidings,
 The smile, but not the frown,
 For the love must be deep that afloat will keep,
 If harshness press it down;
 Like the falling dews of Summer,
 Or the welcome autumn rain,
 Kind words may flow from the lips, and go
 To the skies of the heart again.

Praise, and your friend will hear you,
 Blame, and he heeds you not;
 For a word of praise in the memory stays,
 Never to be forgot;
 But if chiding be remembered,
 It is only for its sting,
 And loving words, like songs of birds,
 Are forever echoing.

—Julia May.

GREAT SALT LAKE DISAPPEARING.

IRRIGATION SYSTEM OF MORMONS DEPLETING THE STREAMS THAT FEED IT.

Before another century nears its end the Great Salt Lake, the mysterious, tideless inland sea cradled 4,000 feet above the level of oceans, may have disappeared into air. For three decades its shore line steadily has been contracting, its depth continually growing less, until today its ultimate destiny is written so legibly that none deny the approach. The declaration that the waters are being wafted into the atmosphere is no figure of speech. Evaporation is the foe which in certain course of time, under prevailing conditions, is going to transform the vast expanse of water into a huge salt plain.

Ages ago, thousands of years the geologists say, the Great Salt Lake, then a sea covering the greater part, possibly the whole, of the great basin began to subside, but strangely enough the agency which now is hastening its disappearance is distinctly of human origin. Of more astonishing purport still the Mormans, who made the valley of the Jordan widen from a narrow strip of green to miles on miles of fields of unexcelled fertility, are themselves the people who have sacrificed the lake. That they may exist, that their rich tracts may continue to bear, they deliberately are cutting off the source of fresh water supply of the mountain sea. Stagnant and helpless the lake is coming to lie at the complete mercy of a pitiless sun.

Not many years ago geographers and descriptive writers took a fancy to expressing the belief that the Great Salt Lake was fed not alone by the four rivers which empty into it, but by hidden springs at its bottom. As long as no one took the trouble to question the assertions they were accepted as facts, and by many persons are still credited. If there were springs at intervals along the bed of the lake it would not matter so much whether the rivers continued to pour their contents into the basin, but no springs exist. They were called into the pages of text books and into the accounts of travelers to explain why the lake is so exceptionally salt. It sounded much better to say that nature, by one of its freaks, had opened up the crust of the earth at this point and sent volumes of briny water bubbling forth, something after the style of geysers and sulphur springs, than to make the simple statement that the saltness, as with the ocean,

was due to the process of evaporation on a body of water lacking a drainage outlet, and that its excess was the consequence of altitude. Plainly enough, if the inflowing water be diverted to other uses before it reaches the lake, there will come a day when the salt deposit, which is the result of the long continued warfare between sun and water, will stand exposed, its blanket gone.

The Mormons, more, perhaps, than any class of settlers in the arid districts of North America, have mastered the science of irrigation. They have been studying and experimenting for over half a century. In all the time since they entered their promised land they have labored with the end of making a little water do the most possible good.

Unfortunately for the Great Salt Lake, the lessons in economy, in the usage of irrigation rivulets have not served to keep pace with the increase in population and the consequent necessity of the continued reclamation of arid land. All the water for the irrigation of the Jordan Valley—the Great Salt Lake state of the Mormon Church, as it is denominated—must come from the rivers which feed the lake. They are the Jordan River itself, connecting the fresh water Utah Lake with the larger body; Weber River, which has its source in the foothills of the Uintah Mountains and flows northward, winding close to Ogden before it empties into the lake; Ogden River, a smaller stream which parallels the Weber for the latter half of the journey; and the Bear River, which drains the Great Lake at the north.

The Bear River is subject to irrigation demands of the Gentiles as well as the Mormans, since more of its course is through Idaho than Utah, but the Weber and the Jordan are wholly within Mormon sphere of agricultural influence. While the Gentiles divide the city populations of Utah with the Mormons, they do not compete with them in the farming districts. They own the mines in the mountains, but these need no water for irrigation. Hence it is that the Mormons have themselves to thank for the lake's recession.

It has come to pass that at the driest season of the year the Weber discharges but a tiny streamlet into the lake. The Jordan and the Bear both drain lakes, which in turn are fed by mountains streams, hence their flows are larger than that of the Weber, though insignificant in comparison to what they once were or what they would be again should the irrigation canals and ditches cease to claim their contents.

It would seem at first thought that the fate of Utah Lake would be identical with that of the Great Salt Lake. The federal government, indeed, was seized over ten years ago with the fear that the lesser body soon would be dried up, though no concern was expressed for the possible effect upon the saline reservoir it keep filling.

When the Great Lalt Sake is gone it will be missed as a wonder and as a salt factory; for little else. Its waters destroy vegetation

instead of nourishing it. Should the fresh waters of Utah Lake, however, be evaporated or disappear into the earth, thousands of square miles would cease to be habitable.

A decade ago a sequence of dry winters so decreased the volume of the snow-fed mountain streams which are tributary to Utah Lake that State and national authorities were seriously alarmed. The outcome was that the Utah Lake region was made a government reservation, an act which has kept irrigation companies from drawing water either directly from it or from its feeders. In itself it has become a mighty reservoir, the Jordan performing the functions of a canal in carrying its Eden-making flow through the valley. The tapping of the Jordan all along its course, while fatal to the Great Salt Lake, does no harm to Utah Lake. As long as the streams flowing into the latter are not attacked, the influence which is lowering the former will not directly affect the fresh water body.

Nevertheless, the cause which makes a scarcity of water throughout northwestern Utah, forcing the dwellers to infringe upon the Great Salt Lake supply, is one which has an effect upon every lake and river. From the proximity of snow-capped mountains it would seem that mountain streams would furnish all the water necessary for irrigation. The snow, however, does not melt until the season of crop-planting is past, and when the freshets come down they frequently do more damage than good. The average of snowfall, too, is less upon the Wahsatch Mountains than upon either the Colorado or Wyoming ranges.

Once the rivers have found their way into either Utah or Great Salt Lake, or on the way thither have spread out into basins, the assailing influence is that of evaporation. The Great Salt Lake is 4,200 feet above sea level, and its southern feeder lake is 100 feet higher. At this altitude the evaporation is something enormous even with fresh water, while the action of the salt increases the dissolution a hundred fold. If water could be preserved, once it has been directed to a reservoir, Great Salt Lake might hold its expanse of 1870—then 2,360 square miles—for unnumbered years to come.

Yet its eventual fate would be unchanged, for it is decreed that the Great Salt Lake is not to endure upon the face of the earth. On the mountains which rise from its shores it has written the story of its fall of 1,000 feet. Although it is given to no one to know the number of centuries which have witnessed the dwarfing process, the fact itself has been made so plain that he who gazes may be enlightened.

The successive steps of the descent from mightiness to comparative lowliness are graven on the ranges of mountains, which are within sight of the lake on three sides. The fronts of some of the mountains have the appearance of having been formed by piling truncated pyramids, one on top of the other. The different shore lines of the past

stand out as distinctly and as evenly as if a surveyor's line had been run along the face of the ridges.

The terrace effect has one of its best illustrations along a spur of the Oquirrh range at the south of the lake. When the body of water was a sea in truth, these jutting mountains may have been a long, narrow island. Either that, or else they were entirely submerged. In the latter event the surface has fallen more than 1,000 feet, how much more no standard is left by which to judge. The line of the top terrace is near enough to the summit of the range to permit the theory that once there was a still higher level, above the crest.

That the belief is not illogical is shown by a comparison of the appearance of hilly islets in the lake, with the mountains back from the shore line. Frequently an island shows a single terrace, on the line, generally, of the lowest of the markings of the coast range. The level of the second terrace comes above the top of the hill, furnishing proof that the island, at least, was once far under water.

No imaginary description can give an adequate idea of what must have been the size of the primeval sea. Its area, if scientific estimates be accepted as facts, certainly included Bear Lake at the north and Utah Lake at the south. To the east the Wahsatch Mountains and their right-angled spur, the Uintah range, interposed an impassable barrier, but to the west it may have spread over the entire territory of the present Great American Desert.

Many geographers have asserted that originally it filled the entire great basin of which the desert is but a part. Southward, winding its way between the Oquirrh and the Wahsatch ranges, it could have stretched away until its waters lapped the sides of Mount Nebo, whose snow-white head is visible from the shore of the lake, although its foothills are a day's journey away. It is well within the range of possibility that the sacred tiled mountain itself may have been an island in the bosom of the sea. Some persons even have dared to say that Mount Baldy, away to the southwest, was once part of a coast range. More probability attaches to the statement that Lake Sevier is another remnant of the great sea. If the body did extend this far to the south it has left no evidences on the mountains, which, however, are of a formation less apt to be moulded by the water than those farther to the north.

The greatest mystery about the tideless ocean lurks in the manner in which it subsided. By the mountain markings it would seem that some unknown agency made its force felt at regular intervals, turning out a portion of the contents of the basin with the precision of a man emptying a bucket. The power never was exerted in its entire force, else there would be not so much as a strip of water remaining. If it was of volcanic origin, its application in all probability was made on the region to the northward and northwestward of the shore, each disturbance opening a wider and a deeper way to the sea

That the lake drained at one time into the Pacific Ocean long has been a general belief, though geologists as a rule have insisted that the opening did not exist when the surface was at its highest level. They have asserted for the most part the conviction that the body of water was as free from outlet then as now, and that the sinking of the earth's crust to connect the lake with what are now the Snake and the Columbia River was the first sign of decadence. A few have demurred and have pointed out that the lake was a fresh water body in the prehistoric era, a state which would not have obtained long had there been no rivers to drain its flow into the ocean. The issue is one which apparently must ever go unsettled.

At a rough estimate the first depression lowered the lake upwards of 300 feet, assuming that the highest terrace was the highest lake level, letting loose a torrent which must have torn its way through mountains as if they were reeds, leaving plains where lofty peaks had been, digging into the bowels of the earth, perhaps quenching for the time being the subterranean fires which set it free—until finally it bored its path to the Pacific, 2,000 miles from the starting point of its mad career.

None may guess the interval between the first depression and the second. The mountain handwriting tells of three separate falls, but gives no limit of the time which elapsed before one followed the other. After the third outpouring a different disturbance must have raised the boundary walls and blocked the former outlets. Three gateways may have been closed at once: there is no saying that the freed waters followed identical routes to the ocean. Indeed, the contrary is more within the range of probability. The volcanic theory fits nearly every hypothesis.

Within the present half century a radical change in area and coast line has been accounted for on the basis that the internal disturbances still continue, and that a part of the shore is as apt to sink downward tomorrow as it was in the days before humanity had begun to keep its record.

The lake became salt after its final egress was cut off. Were outlets to be formed at this late period, it would remain salt for ages, so deep has become the salt bed in the centuries since stagnation has been the fate of the waters above. A few months ago a professor who made a series of experiments, in the interest of the salt industry of the lake, announced that if every other source of salt supply in the world were cut off, the Great Salt Lake would be able to furnish the ingredient as long as the world should endure. In that statement he made no calculations for the possibility that the lake itself should cease to exist, but even in that event, it is estimated that the solid deposits on its bottom would be sufficient to prevent salt hunger anywhere on the earth for as long a period as the mind can grasp.

From these illustrations better than from figures one is able to

gain an appreciation of the time which must have passed since the last disturbance closed the northern gate and walled in the then fresh water lake. Although the area of that period evidently many times exceeded that of modern times, it may be asserted with certainty that Bear and Utah Lakes had by that time become separate from the main body, or were by that convulsion set free. They have remained fresh because they have been drained into the Great Salt Lake. From the fact that Utah Lake today is but 100 feet above Salt Lake, it is apparent that the larger body has fallen less than that distance since the last of the three great outpourings of its contents.

The proof that it has been much lowered since then is found in the numerous salt deposits within ten and twenty miles of the shore, showing that the salt sea once lay above the spots.

It did not take the lake long to become intensely saline after it was locked in. For its expanse, it was shallow even then, not more than 160 feet deep at its deepest place, probably not that. The maximum depth today is sixty feet, and the average is not half that figure. At some points one may wade a mile and more from shore without getting in water over the knees. It was as if a huge and shallow basin had been spread out in the sun. The ratio of evaporation, far greater than at sea level, hurried the chemical action and in a comparatively short time the fresh water lake was a salt sea. What may have been the effect of the alkali in the surrounding soil is problematical. Some persons have credited it with being the fundamental cause of the exceptional salinity.

In the proportion of solid matter in its contents, the Great Salt Lake is surpassed only by the Dead Sea. In the former the ratio is 86 parts of water to 14 of solids, in the latter 76 parts of water to 24 of solids. The Atlantic Ocean contains 96.5 parts water to but 3.5 parts solids, emphasizing the abnormal quantity of salt in both the inland reservoirs.

As the salinity increased the amount of evaporation increased, and it is likely enough that to this cause alone the lake owed the gradual fall which brought it down to an area of 1,700 square miles—seventy-five miles long and between twenty-five and thirty miles broad—its surface during the earlier half of the present century and at the time the Mormons came into the Jordan Valley.

About 1850 the lake began to rise, reaching in a few years the area of 2,360 square miles, which it retained until 1870, when irrigation ceased to be desultory and became a system. The lake's rise has given rise to much discussion, and furnished some excuse for the inference of a hidden feeding stream. In general the phenomenon is laid to a series of unusually wet seasons, which not only increased the volume of the streams emptying into the lake but also did away with the necessity of irrigation.

Since 1870 irrigation has been taking yearly more and more of the

water, until the length of the lake has decreased from eighty miles thirty years ago to barely seventy, while its width at no place is greater than twenty-five miles. At some places the shore line has receded five miles within as many years.

The Mormons, however, do not fear the lake will ever disappear. It is one of their sources of wealth, the pumps which draw the water from the lake to the evaporating squares which dot the shore often going night and day. It would be more difficult and more expensive to mine salt than to pump water and leave the rest of the manufacturing to the sun, hence they have faith that the Lord will not inflict the blow upon them. They need river water for irrigation, therefore they take it; they look to lake water for some of their income, therefore they expect that the divine power which they believe, led them to their holy land, will see that the lake is kept filled. The contradiction in their action and their faith they do not appear to notice. They certainly looked to none but themselves to settle the irrigation difficulty.

To the older generation of Mormons the lake is a sort of fetic. The pioneers regarded it with actual reverence, and though they were not its finders they never would consider that any who preceded them had part in the honors of the discovery. They made their own claims good by bestowing upon it the name it bears.

The Great Salt Lake has been discovered for the first time by as many different persons as have most parts of Africa. Before any one actually visited it news of the existence of a body of bad tasting water had been carried by the Indians over the mountain ranges on either side. The historian of the West, Hubert Howe Bancroft, takes pains to say that the Frenchman, Baron La Hontan, who explored or pretended to explore the lower and central Mississippi country in the latter part of the seventeenth century, drew upon his imagination when he wrote that his Indian guides told him of the "bitter water" as far as the sunset. Mr. Bancroft, however, advances no proof of his assertion. Although Baron La Hontan wrote many fairy tales he told the truth in many instances, and this may have been one of them. The tale is plausible enough.

The Great Salt Lake was in the country of the Comanche Indians when the Spanish friar, Escalante, came almost to its shores in the next century, and he learned they had been rulers there for several generations. The Comanche influence extended far to the eastward, and nothing would be more natural than that the gossip of the "bitter water" should travel to border tribes and by them be transmitted to the river dwellers.

Escalante gave civilization the first definite knowledge of the Great Salt Lake. In 1776 he was stationed at Santa Fé, the outpost Spanish Settlement of the middle north. The commandant desired to learn if a route could be found between Santa Fé and the post at Mon-

tery on the Pacific coast. The friar volunteered to be an explorer and early in the summer set off at the head of a party. Instead of going west he went north, an error which prevented his reaching Monterey, but which brought him, early in September, to the shores of Utah Lake. He found its shores inhabited by the Yuta Indians, who told him of the warlike Comanches to the north and of the salt lake.

"The other lake with which this communicates," he wrote in his diary, "occupies, as they tell us, many leagues, and its waters are injurious and extremely salt. He who wets any part of his body with this water immediately feels an itching on the wet part."

Escalante did not go on to make proof of hearsay, but turned to the southward and made an effort to scale the Sierras. He failed and returned to Santa Fé. Apparently his discoveries at the north roused no curiosity. He did not go back and no other Spaniard followed in his earlier footsteps.

Nearly fifty years passed before a white man stood upon the shore and tasted the water to prove that the Indian legend was true. The man was James Bridger, an American trapper and hunter, whose party had been encamped for the winter of 1824-25 at Bear Lake. Bridger had heard the Indians tell of the "bitter water" and perhaps had paid some attention to them. His discovery was the result of a wager that he could follow Bear River to the body into which it emptied. He hardly would have made the bet had he believed his journey would be a long one. He left his friends and went down the river in company with Indian guides. When at length he returned he told his white companions he had discovered a branch of the ocean. He held to his conviction until the following year, when he and three other members of the party circumnavigated the lake in skin boats, finding that it had no outlet.

Skeen Ogden, another hunter, whose name remains as that of the important railroad junction point north of Salt Lake City, led a party of Hudson Bay company trappers to the shore of the lake in that same year, and after that it was frequently visited by the members of this hardy, wandering class.

It was not until 1832 that Captain Bonneville, a second La Hontan, came upon the lake. He was so anxious to magnify himself that he was not content with giving his own name to the actual lake but bestowed it also upon the prehistoric sea, which he was the first to see must have existed. Washington Irving paid the adventurer the undeserved tribute of keeping the title, Lake Bonneville.

General John C. Fremont, the "Pathfinder", showed as much vanity as Bonneville. He spent several months in the Salt Lake Basin in 1843, navigating the lake in a rubber boat. In his published work he afterwards claimed his boat was the first to cut the heavy waters. He landed during his first trip on one of the numerous small islands in the lake, evidently expecting to be rewarded for his stiff climb to the

summit of the rock by the sight which he would see there. He found nothing to satisfy him, and he gave to the island the name Disappointment. It held the title until the Mormons changed it to Castle Island.

Fremont went on his way, and the lake again was left to solitude.

On a Friday morning in 1847 two men rode through a canon close to where Fort Douglas now stands and from the heights of the plateau gazed over the wide expanse of lake and valley below. One of them threw wide his hands, both bared their heads, and the elder of them spoke.

"The Lord be praised," he said. "He has led us to the promised land."

The devotees were Orson Pratt and Erastus Snow, Mormon elders, who had left Brigham Young and his pioneer detachment and ridden a day's march ahead to see what was beyond the mountains at their front. Twenty-four hours later a flag was floating from Ensign Peak, the name of Immigrant Canon had been bestowed upon the pass, and the men of Young's detachment were making camp. The following day Brigham Young bathed in the lake and, on emerging from the plunge, gave it the name of Great Salt Lake. Hitherto, except by Bonneville, it had been referred to only as the salt lake.

The happening which has made the lake next to sacred in the estimation of the Mormon people was that of the following year, after Brigham Young had gone back to the Mississippi Valley and returned with the rest of the men, the women, and the children. The crops were planted and were coming up when a plague of black crickets descended upon the valley. The invading army marched in from the west, a solid phalanx with miles of front. All vegetation disappeared before its advance. In vain the emigrants plowed ditches ahead of the column, pouring into them oil and inflammable brush which they, fired as the head of the cricket army tumbled down the declivities. Millions of the insects died, but the fires burned themselves out, and the undaunted remainder of the ravenous throng trod over their scorched bodies to the green fields beyond.

At the end of thirty-six hours of conflict, when the settlers were in despair, the flutter of wings was heard in the direction of the lake. In a moment the air was as white as the earth was black, and thousands of great gulls were settling down towards the feast spread for them on the ground. According to the Mormon chronicles the gulls ate until their crops protruded, then disgorged the dead insects, and began over again. The winged gluttons saved the crops, eating the last of the crickets at the close of the second day. From that day to this it has been a criminal offense to slay a gull, and in consequence the birds have become exceedingly tame, while the lake has kept the credit of being the abiding place of the winged saviors.

Bird life abounds about the shores of the Great Salt Lake, including an abundance of wild geese and swan, which, however, have no

fish to live upon, as the water is so densely salt that it is death to all but a species of shrimp. Water insects thrive upon its surface, and upon them and the shrimp the birds feed.

The lake had been a long time an adjunct of Salt lake City before the Mormons set about to profit from the opportunity for salt making. In late years the industry has increased to such a degree that it is not improbable that the water pumped out has contributed somewhat to the lowering of the lake. The process of salt-making is simplicity itself. Pipes are run out into the lake and the water is pumped ashore, where it is distributed to the depth of several inches over prepared oblong beds, formed by banking the mud up into little walls. After evaporation, when the water is gone and only the white sediment remains, men are put to work shoveling it up into a heap in the center. The product is unrefined salt, which is loaded upon flat cars, run out upon the salt flats by a convenient switch track and shipped away.

Within the last five years numerous artesian wells have been dug in Utah, but they have not increased the irrigation supply of water to any marked extent, as their use is confined closely to the spots immediately about the wells. Their value is for gardens and small orchards. The Jordan Valley is green and fruitful, but the shadow over the Great Salt Lake grows darker.—*Chicago Tribune*.

IRRIGATION IN CALIFORNIA.

INSTRUCTIONS TO SPECIAL AGENTS AND EXPERTS OF THE UNITED STATES DEPARTMENT OF AGRICULTURE IN THE INVESTIGATIONS RELATING THERETO.

(An Address Delivered by PROF. ELWOOD MEAD, Expert in Charge.)

GENTLEMEN:—

The study of the irrigation laws, customs and conditions of California, in which your services have been secured, is the most comprehensive inquiry into these questions yet undertaken in this country. This and the importance of the interest with which your inquiry will deal, gives to the facts you are to gather and the reports and conclusions based thereon an exceptional interest.

The experience of your members, the wide range of conditions to be dealt with, and the fact that the sole purpose of this investigation is to promote the conservation and use of wasted waters, and the more profitable reclamation of lands now arid, by lessening controversy and litigation over water [rights, protecting investment in canals and reservoirs, and giving added security and value to irrigated farms, will cause the results of your labors to be studied with as much interest and advantage in other arid states as in California.

What you will do in California, is however, being also done in other states, and for the purpose of comparing results it is desirable that, so far as may be, all these investigations shall pursue the same general plan, discuss the same general problems and follow the same order in their treatment. Because of this and because each of you in this state will act indepently in the collection of data and formulating your conclusions, it is important that there be a preliminary understanding regarding both the nature of the subjects to be dealt with, and the general form of your reports thereon. As an aid to such understanding and concert of action, the following suggestions are submitted.

Preliminary thereto, a brief statement of the steps already taken, and the relation the the work you are to do bears to the work being done elsewhere, seems proper.

The appropriation made by the last Congress for the investi-

gation of irrigation problems by the United States Department of Agriculture is being largely expended along two lines:

First. Investigations of the duty of water in irrigation, including in such studies methods of distribution, conservation and use.

Second. Collection of facts showing character and efficiency of the different state irrigation laws, and of the legal and financial questions growing out of the distribution and use of streams.

Two bulletins dealing with the second class of problems have been published, and in co-operation with the State Engineer and State Agricultural College of Utah, the work of preparing a third, which will deal with the irrigation system of Utah is well advanced.

In July last a petition was presented to Dr. A. C. True, Director of the Office of Experiment Stations, of which office the irrigation investigations form a part, signed by many representative citizens of California, asking that their state be made, for the present, the leading field for the second branch of this investigation, urging as a reason therefor the importance of the interests involved and the nature of the problems to be dealt with. The following abstract from this petition states what these problems are believed to be.

"We respectfully submit that nowhere in America are there irrigation problems more important, more intricate or more pressing than California. Neither are there any whose study would be more greatly instructive. We can offer, we presume, examples of every form of evil which can be found in Anglo-Saxon dealings with water in arid and semi-arid districts. Great sums have been lost in irrigation enterprises. Still greater sums are endangered. Water titles are uncertain. The litigation is appalling. * * * * *

Among the things necessary to be known before we can hope for well considered legislation upon the conservation and distribution of our waters are the following:

First. The amount of water in the stream.

Second. The duty of water in the different irrigation basins.

Third. The claims upon the water, collected by streams and not by counties as now.

Fourth. The nature of water-right titles.

Fifth. The adjudicated claims upon the waters.

Sixth. The lands now irrigated and susceptible of irrigation.

Seventh. The possible increase of water for beneficial use by storage in each system.

Eighth. The extent to which the irrigable area can be increased by better methods of distribution and use."

The work you are undertaking complies substantially with that request, but we have been enabled, through the aid and co-operation of the State Forest & Water Association, to broaden its scope beyond what the funds of the Department alone would have permitted. The work you are to do has, therefore, both a National and State sanction.

It has for its underlying purpose the creation of the best possible conditions for extending the area and promoting the success of irrigated agriculture. I believe that public opinion in both the state and the nation will be largely influenced by the results of your labor, and that it will have an important bearing on our future progress and the ultimate character of our irrigation laws.

PLAN OF WORK.

At the outset eight streams will be included in the investigation. These are the Yuba, Kings, Susan, Salinas, Los Angeles, Santa Anna and Sweetwater rivers and Hemet Creek. On each the endeavor will be to secure all of the facts showing the operation of the present irrigation system and the causes which contribute to or modify the success which has been achieved, and to include:

First. Abstracts of the records of claims to water; character of these records, including the number of claims, total volume claimed, places where recorded, and the ease or difficulty with which the validity of any claim can be determined.

Second. The nature and extent of riparian rights.

Third. Rights to water for other purposes than irrigation, namely, mining, power and domestic uses.

Fourth. The method by which the amount and character of water rights are determined, accessibility and completeness of the record showing the nature of the established rights.

Fifth. Character of litigation over water rights, its cost, the causes thereof, its influence on irrigation development, and the principles established by decisions rendered in cases arising on the stream being studied.

Sixth. Rights for storage and underground waters, how acquired and how they are affected by rights to the surface flow of streams, and how the use of underground waters influences the stream's discharge.

Seventh. Nature of an appropriation of water. Who is regarded as the appropriator, the ditch builder, the land owner on which water is used, or is the land itself the appropriator? What is the measure of its amount, the size of the claim, the capacity of the ditch, or the area irrigated?

FIELD INVESTIGATIONS.

Eighth. Collection of data showing discharge of stream, or measurement of its discharge where no such data can be had. Study of volume of return or seepage water and its availability for being again diverted, and influence on value of irrigator's rights.

Ninth. Size, number, location and capacity of ditches and other distributing works established, and irrigated duty of water obtained.

METHODS OF DISTRIBUTION.

Tenth. Collection of data showing how water is divided among different ditches from the same stream. Collection of data showing

how it is distributed among users. Nature of water right contracts between canal owners and water users. Collection of facts showing what contracts have proven satisfactory, and what forms of contracts have given rise to controversy, and the reason therefor. Collection of facts showing rates for sale or delivery of water, and the methods by which these rates have been established.

REPORTS.

Eleventh. While the facts gathered will largely modify the nature of their presentation and will vary somewhat in each instance, it will greatly aid in the study of your conclusions if they deal with the same issues and in the same order. The following scheme is suggested.

(a). The foundation of any system of administrative laws is the method of establishing rights to the stream. In your discussion of the results in California, the first question to be considered is whether or not the present method of filing and recording claims to water is satisfactory. If not, what should take its place?

(b). Is the present method of adjudicating rights satisfactory? If not, what should replace it.

(c). What has been the influence of the doctrine of riparian rights on the success of irrigation, and what modifications of this doctrine are suggested?

(d). Is the present system of stream control, or lack of it, and of dividing water between the different ditches which divert the common supply satisfactory? If not, what form of administration or control should take its place?

(e). Should there be a State Engineer, and what should be his duties?

(f). Should there be a central office of record of claims or titles to water in place of the present separate county records, and what supervision or control should be exercised over rights to be acquired hereafter.

(g). What steps should be taken to secure the fullest conservation and use of water which now runs to waste; the discussion of this question to include state or national control and aid, the legislation needed to define rights to stored water, and to determine who is entitled to the water thus stored.

It is understood that this outline will not touch all of the complex and important problems which your investigations will disclose and with which your reports will have to deal. It is, however, believed to state some of the leading ones which legislators and users of waters are now confronted, not only in California, but in every other arid commonwealth.

IRRIGATION IN PERU.

By GUY E. MITCHELL, Secretary National Irrigation Association.

Senor Ramon Estacia, who is a visitor to this country from Peru, can talk very interestingly about his home under the Equator, the land of the Incas and associated with Pizarro and his Spanish Conquistadores. "I am in the United States," said Senor Estacia, "to study the results of your plunging civilization and to note those American inventions which would help us in my country. The discovery of America destroyed Peru as it did Mexico. The Peru of today is a small part of the ancient empire. At the time of the Conquest, the Spaniards found the land in a high state of cultivation. While naturally in large part a desert, owing to very scant or no rainfall between the mountains and the coast, the natives by the superior wisdom and foresight of their Incas had brought water immense distances and rendered arable vast stretches of country. The ancient irrigation of Peru was very wonderful.

"Water was conducted by means of canals and subterraneous aqueducts executed on a grand scale. They were built of large slabs of freestone nicely fitted together without cement. The water supply came from some elevated lake or natural reservoir in the heart of the mountains and was fed at intervals by other basins which lay on the route along the slopes of the Sierra. Passages were cut through rock (and the Peruvians had no iron tools) almost impassable mountains were turned; rivers and morasses were crossed and apparently impossible feats of engineering were accomplished simply to secure water for the irrigation of fields and gardens. Some of these canals were very long. That of Condesuyu was between 400 and 500 miles in length.

"By latent ducts or sluices, the life-giving fluid was led to the tillable lands along the line of the canals. In some instances the land was flooded, while in others the water was made to run in furrows between the rows of growing maize, tobacco and other crops. Each occupant of land was allowed a certain quantity of water by the law of Empire. Overseers for the government had charge of each district and saw that every man received his proper amount, and that the canals were kept in repair.

"That the government understood the danger of floods and took steps to prevent them is shown by some of the works still extant. Notable is the still visible tunnel near Casamasca. While the waters of this lake were used for irrigation, the heavy rains and melting snows

of the mountains would cause an overflow. To protect the irrigation works and the settlements along the route, a tunnel was excavated in the mountains to give an outlet, in another direction, to the waters of the lake when they rose to a height to threaten inundation.

“At the coming of the Spaniard the land everywhere teemed with evidence of agricultural wealth,” said Senor Estacia, reflectively. “Today the greater part of this paradise has reverted to its original arid condition. Here and there where some old dirt-filled and long forgotten tunnel leaks a little moisture, the rank vegetation of our tropics, in contrast with the surrounding arid wastes, shows the power of irrigation.”

This gives rise to the reflection that the Spaniards, wherever their star of chivalry or rapacity for wealth led them, have destroyed and never created. Their coming has always been a curse to the people they conquered. Chivalric and recklessly brave, they yet considered the civilization and population of the New World as but barbaric and pagan and fit only for destruction.

But these native tribes, people, governments—benighted and heathen—had battled with Nature, learned the secret of success and conquered under the most adverse circumstances. They made use of mountain lakes and natural reservoirs, wherein were stored the waters of the rainy season and the melting snows, to be used during the dry season.

We have today in California, Colorado, Arizona, New Mexico, Utah and the northwestern states, millions of acres of land, the productive capacity of which is beyond compute, which can and will be reclaimed eventually. Great mountain gorges forming natural reservoirs, can be used for storage purposes, and the land, useless today, will become an empire of agricultural wealth, worth far more fabulous sums than the rich mines adjacent to them.

THE MAXIMUM DUTY OF WATER.

THE EXTENT TO WHICH TILLAGE MAY TAKE THE PLACE OF IRRIGATION.

(Read Before The New Farmers Club Topeka, Kansas, Dec. 29, 1899.)

By F. H. KING.

In the manufacture of butter from milk, it is a matter of prime commercial importance to know just how much butter-fat that milk contains, and what is the maximum amount of butter that fat is capable of producing, for only this knowledge can show how closely the manufacturer is working to his possible limit of profit, and how great his losses may be. For like reason, it is very important to know what is the minimum amount of water which, under stated climatic conditions, can meet the needs of a given crop, producing a paying yield. It is important, because only such knowledge as this can show how economical or how wasteful our methods of tillage may be, and how nearly we are realizing the largest profits which are possible to the business.

Much effort has been given at the Wisconsin Station determining by rigid methods how much water must be used by certain crops in coming to maturity, when placed under the best conditions. This has been done, because it is a part of the knowledge which is needed to show under what climatic conditions irrigation may, and under what it may not, be practiced; because it is needed to show how far into the sub-humid districts agricultural operations may be pushed without the aid of irrigation; because it will help to teach how far we may hope, by the practice of the best methods of tillage, to dispense with irrigation, and avert disastrous results during seasons of drought.

Our studies indicate that the minimum amount of water which can produce a ton of water-free dry matter in corn is 2.4 acre inches; potatoes 3.4; barley 4.1; peas 4.2; oats 4.4 and medium clover 5 acre inches. These estimates include the necessary losses of water from the soil and from the plant, and the dry matter is that produced above ground, not including the roots or stubble left in the field.

Calculating from the data of our trials, and a normal ratio of grain to straw, 20 bushels of wheat per acre would require 6 acre-inches of water and 12 inches should produce 40 bushels.

To secure 40 bushels of barley per acre 8.56 acre-inches of water are needed; 60 bushels of oats would demand 9.4 acre-inches and 11.75

acre inches should permit of a yield of 70 bushels of shelled corn per acre; while 8.27 acre-inches are needed for 400 bushels of potatoes.

One, two, three and four tons of clover hay per acre, according to our observed rate of consumption, call for 2.08, 4.16, 6.24 and 8.32 acre-inches of water respectively when the hay is cured to contain 15 per cent of moisture. Corn silage containing 70% of water will require 16.9 acre-inches of water for 12 tons per acre, and 26.2 acre-inches for 20 tons.

These figures must be regarded as showing the minimum amounts of water which will bring the crops named to full maturity, so as to produce the yields specified, only under conditions of no loss by surface or under drainage, and where the evaporation from the soil itself is as small as it can well be. It must be further understood that the soil at seeding time already possesses the needful amount of water for the best conditions and that, at the end of the growing season, it is yet so moist that no check to normal vigorous growth has occurred. Further than this the soil must have possessed all of the essential plant foods in abundance.

Let us next consider what the available rainfall is in various parts of the United States, what yields per acre are realized from it, and what may reasonably be expected, under the best treatment.

To make the discussion as concrete, definite and pointed as possible let us draw our data from the states of Illinois, Indiana, Iowa, eastern Kansas, Maine, southern Michigan, Missouri, Minnesota, New York, Ohio, Pennsylvania, Vermont and Wisconsin. In these states what is the amount of rainfall available for crop production?

It is evident that from the mean annual rainfall of these states must be deducted the annual run-off as not available for crop production. But if the water borne away in the drainage is deducted from the rainfall the difference will be too large, for very many showers are too slight to be of any service whatever; and not only this, but very light rains often do positive injury by destroying the effectiveness of earth mulches, which have been developed by tillage, causing a loss of a portion of the deeper soil moisture with that which fell as rain. It is further necessary to consider the rainfall of the growing season of the specific crop under consideration in order to know whether tillage alone will make possible large crops unaided by irrigation.

The first crop of clover, for example, must be largely made by the rains of May and June, in the states named, while the crop of potatoes will be more largely influenced by the rains of June to October. The period for barley would extend from May nearly through July; oats from May to the middle of August; and corn from the middle of May to the middle of September. For the growing season of the barley and oats I have estimated that two inches of rainfall are lost by percolation, and for that of corn 1.5 inches. The in-

effective rains I have taken as those where less than .2 inches fell during any 24 hours, and have used the man, observed at Madison, during the period 1887 to 1897.

The average rainfall during the barley, oats and corn periods in the 13 states named is 11.616, 13.375; and 14.779 inches. These amounts are diminished by drainage and ineffective showers so as to leave the mean effective rainfall for barley 8.625 inches; for oats 10.19 inches; and for corn 12.01 inches. For eastern Kansas the effective rains for these crops are not far from 9.04 inches for barley; 10.44 inches for oats and 12.49 inches for corn.

These effective rains, could they be used with the same economy as we used water in our experiments, should produce yields of 40.2 bu. of barley, 64.97 bu. of oats and 71.51 bu. of shelled corn per acre.

It will be seen that these computed yields, although much larger than average yields, are, nevertheless, very close to what is expected from well managed lands in our best seasons, when there has been an average rainfall, well distributed during the growing season. The average yields for the thirteen states in question, as given in the 10th Census Reports, is 22.08 bu. per acre for barley, 30.17 bu. for oats and 34.38 bushels for corn, amounts only about one half of the 40, 64 and 72 bushels expected in the best years, and computed from our observations and experiments as possible.

The small average yields reported from so many states, and agreeing so closely as they do, must be looked upon as expressing conditions naturally unfavorable to large yields and conditions which the best of management cannot hope wholly to counteract without the aid of irrigation.

The facts are we are here confronted with results which are, in a very large measure, due to the long intervals between effective rains. This uneven distribution of rain is so general that when the yields over wide areas are compared the small yields due to faulty distribution of rain so far outweigh those from areas where the amount and distribution is just right that small averages are inevitable. Nor is this condition of things strange; for, since the rainfall is in no way controlled by any factor operating to cause precipitation, either when it is needed or in the amount which the particular crop at the time demands, it cannot be expected that such a regime of chance could, no the average, develop the conditions favorable to large yields.

The average yield of hay per acre in the thirteen states named was in 1879 only 1.156 tons per acre. Nearly all of this hay is made during the months of May and June, when the mean effective rain is 5.14 inches, which, according to our studies, should produce a yield of 1.188 tons of hay. If the second crop of hay were included in the 10th Census average it could hardly carry the yield up to 1.5 tons per acre and yet we have, during four consecutive years, on the same piece of ground, in rotation with other crops, by supplementing the rainfall at

times when it was deficient, taken from the ground 4.044 tons per acre in 1896; 4.434 tons in 1897; 4.032 tons in 1898 and 4.242 tons in 1899.

From what has now been said it must be clear that the productive capacity of the soils now cultivated in the United States is little more than one half what it might be were it possible to fully control the matter of soil moisture. It must be clear therefore that the maximum duty of water and the extent to which tillage may take the place of irrigation is one of the most fundamental questions concerning the material welfare of this country.

It may be well to put the question first in this way. To what extent must tillage take the place of irrigation?

Were it desirable to irrigate all agricultural lands lying in humid climates, it would not be possible to do so, on account of the insufficiency of water for the purpose. The truth of this proposition will be evident if we deal quantitatively with the problem.

Humphreys and Abbott have placed the mean annual discharge of the Mississippi at 19,500,000,000,000 cubic feet, while the catchment area is placed at 1,244,000 square miles. Assuming that these quantities are correct, then the mean annual run-off for the whole Mississippi basin would be 6.747 inches. But not all of this run-off is available for irrigation, were it desirable to so use it, for during a large part of the time this water is flowing away when the season does not permit of its being used, and it is impracticable to impound it and hold it until it might be used. If we take the mean daily discharge of the river as $\frac{1}{3\frac{1}{5}}$ of its annual amount, and allow that the whole of this is available for irrigation purposes during the irrigation season, it is capable of watering but about .1 of the catchment area at the rate of 2 inches of water once in 10 days.

To emphasize this point still further we may bring together in close review the extent of irrigation as it is today practiced in the various parts of the world, and quote the statement of Wilson: "The total area irrigated in India is about 25,000,000 acres, in Egypt about 6,000,000 acres, and in Italy about 3,700,000 acres. In Spain there are 500,000 acres, in France 400,000 acres, and in the United States 4,000,000 acres of irrigated land. This means that crops are grown on 40,000,000 acres, which but for irrigation, would be relatively barren or not profitably productive. In addition to these, there are some millions more of acres cultivated by aid of irrigation in China, Japan, Australia, Algeria, South America, and elsewhere."

These figures seem enormous as we read them, and so they are, but they leave an exaggerated impression on the mind which needs to be corrected, for very few realize the magnitude of the volume of water which must be handled in raising a crop by irrigation. In order that we may not mislead in this direction we wish to make the correction. Let us suppose that the amount of land which is actually under irrigation at the present time is four times the 40,000,000 of

acres which have been enumerated above. Now, were this supposition true, and all of these acres were brought together in one solid square, it would have but 500 miles on a side. But to cover such an area as this with 2 inches of water once in 10 days would require more than three Nile rivers flowing at maximum flood—a river 50 feet deep, 1,156 miles wide, running three miles an hour.

Such statements as these must make it clear that to whatever extent irrigation may, in the future, be developed there must always remain a many times greater extent of land whose moisture must be conserved rather than supplemented and hence that methods of conserving soil moisture must always take rank of first importance among agricultural operations. There is perhaps no country in the world which can furnish more forceful illustrations of the extent to which tillage may take the place of irrigation; of the effectiveness of soil mulches in conserving moisture; and of the ability of vegetation to spread its roots widely and deeply in a comparatively dry soil for its water supply than portions of California and the state of Washington.

Twenty years ago, when the soils of these states were more nearly in their virgin condition than they are today, wheat was extensively grown by "dry farming" and good and even large yields per acre were realized and yet, in the San Joaquin valley, the mean annual rainfall ranges from 5 inches in the far south to 12 inches in the north, and this amount all falling between Nov. 1 and May 1. In 1879 the average yield of wheat per acre was 6 to 13 bushels in the south and from 13 to 20 bushels in the north; the average for over 1,800,000 acres being 16.1 bushels. To one accustomed to the disastrous results which follow droughts of two or three weeks in humid climates it is hard to realize how it is possible for a wheat crop to be carried from the first of May to full maturity without a drop of rain and without irrigation; and yet in the last of July, 1895, as we traveled southward and approached Merced from the north a very sandy belt was passed which was white and glistening in the sun, and which drifted as badly as much of apparently similar land in Wisconsin, and yet on these coarse sands wheat was being harvested which would give larger yields than would be expected on such lands in Wisconsin with a summer rainfall of not less than ten inches. But here the crop had stood and matured from early May until the end of July without irrigation and without rain.

If we consider the "dry farming" sections of the state of Washington, where most of the wheat grown has been the spring varieties, sown in April, and sometimes as late as May, and harvested in August or early in September, we shall have the growing season more nearly the same as that in the corresponding latitudes of the humid parts of the United States. Here, too, the rainfall in amount is very nearly the same as that of the district to the south for the corresponding period of time, but the rains begin a month earlier and continue a

month later, so that the amount for the year is from 8.4 to 13.5 inches, or about 33 per cent more, while the mean yield per acre was 23.4 bushels in 1879, as against 16.1 bushels in California. There is here in Washington, as in California, a dry period of some 60 days, in which the crop is forced to come to maturity.

It appears, therefore, from the observations and experiments regarding the number of inches of water which may be used in producing a ton of dry matter, and from practical experience in arid climates, that on deep, fertile soils, well managed, good paying yields of wheat may be realized where the amount of rain is as small as 7 to 8 inches and large yields when it reaches 12 to 15 inches.

But like amounts of rainfall are not equally productive and three notable examples may be cited. The first is the San Joaquin-Sacramento valley, the second in eastern Washington, to which reference has just been made, and the third is a broad belt lying just west of the 97th meridian stretching through the western Dakotas, Nebraska, Kansas and on into western Texas. These areas received very nearly the same amounts of rainfall for the year, but the distribution of it in time is very different. In California the rain all falls in the six months, November to April, inclusive; in Washington it is from October to May, inclusive; while in the 97th meridian region much the larger part of the rain falls during the months between April and September. The eastern region, therefore, has its moisture well distributed through the growing season, while both of the western areas mature their crops in from 30 to 60 days on continuous nearly rainless weather; and yet, if we compare the yields of barley, oats, rye and wheat in the three districts taking the Tenth Census figures for California, Washington and Kansas for comparison, the yields are largest in Washington and smallest in Kansas, standing as follows:

	Washington bu. per acre	California bu. per acre	Kansas bu. per acre
Barley.....	36	21	12.5
Oats.....	41	26.8	19
Rye.....	14	9	12
Wheat.....	23	16.1	9.3

As the soils in the three regions are notably fertile, and were in 1879 very close, on the average, to virgin conditions, the differences in yield can hardly be attributed to differences in plant-food other than as influenced by soil moisture; and as the quantity of rain which falls in Kansas during the growing season, April to September, inclusive, is 11.5 to 16.8 inches, while that in Washington is only 8.4 to 13.5 inches, it appears plain that in some way the available moisture is more effective on the Pacific border than it is in the 97th meridian region.

It would be of very great practical importance to understand fully the causes which permit so small an amount of rain as that of eastern

Washington, falling, so much of it, before the growing season, to ensure the maturity of such large crops under so clear a sky and in spite of so long and continuous a period of drought, while in western Kansas 25 to 33 per cent more rainfall, well distributed through the growing season, produces less than one-half the yield per acre. The yield is certainly less than one-half, because the averages used for Kansas are too large for the western section of the state, whose rainfall has been brought into comparison.

While we are a long way from possessing the needful data for the solution of this problem, some of the factors are evident enough and may be stated here. In the first place, the rains of the sections of California and of Washington under consideration fall in the cooler portion of the year, when the air is more nearly saturated and when the wind velocities are small, while the sun is much of the time obscured by clouds. All these conditions conspire to permit a large per cent of the water which falls upon the ground to enter it deeply, without being lost by evaporation, while a deep, retentive soil serves to prevent loss by drainage.

In western Kansas on the other hand, where the rain falls largely in the form of showers in the heated sunny season of the year, and where the wind velocities are high and the air extremely dry, it is plain that a much larger per cent of water falling as rain must be at once lost by evaporation from the surface of the soil, before it has had an opportunity to enter it deeply enough to be retained by soil mulches.

In the second place, a frequent surface wetting of the soil, such as takes place in Kansas, tends strongly to hold the roots near the surface, where with scanty mulches they are certain to suffer severely whenever a period of 10 days without rain occurs; and if, under these conditions, the plant is able to send new roots more deeply into the soil, they can find there but a scanty supply of moisture, because there have been no winter rains sufficient to produce percolation. Then, again, after such a 10-day drought, with the surface roots now become inactive through a dying off of the absorbing root-hairs, when the next rain does fall, unless it is a very heavy one, the major part of it will be lost by evaporation from the soil, in the case of crops like wheat, oats, rye and barley, long before the plants are able to put themselves in position to take full advantage of it.

In California and eastern Washington, the case is radically different. There the water gets well into the soil before the crop is put upon the ground. Moisture enough is present to produce germination, and the roots develop first near the surface, when there is ample moisture present; but later, under the rainless conditions, it is quite likely that they advance more and more deeply into the ground as the moisture in the upper layers of the soil becomes too scanty, and thus day by day the effectiveness of the soil-mulch is increased, while the

roots have only to advance so far as is needful to allow capillarity to bring them the water they need from the store which the soil has retained. With these physical principles and conditions to throw light upon the problem and with the other fact that 6 inches of water, when the crop can have it to use to the best advantage, is enough to produce 20 bushels of wheat to the acre, we can see its outlines with sufficient clearness to feel sure that more study in the field would give us its full solution. As the matter now stands, the case is sufficiently clear that we may not conclude, because 9 to 12 inches of rain in California has produced abundant crops of wheat that a similar rainfall in the sub-humid belt ought to produce like results. It should be sufficiently evident also, that even with the best modes of tillage we can hope to adopt, there will still be much more water required per pound of dry matter produced all through the sub-humid region, than is demanded under the conditions of the lower San Joaquin valley.

Let me address myself specifically to the question To what extent may tillage conserve soil moisture? We have succeeded the present year in carrying out a field experiment under normal field conditions which appears to demonstrate that a piece of uncultivated fallow ground lost by evaporation at the surface, 7.96 inches of water, or 63.49 per cent more than adjacent soil cultivated 3 inches deep once per week, enough for 50 bushels of oats per acre. This saving appears to be very large and may not be correct but it is supported by laboratory trials published in the Annual Report for 1898 that a 3 inch mulch on a similar soil diminished the evaporation 63.13 per cent.

In another series of experiments which will appear in our next Annual Report, just leaving the press, we have measured the loss of water, by surface evaporation, from four columns of soil 10 feet long and of two types, one a sandy loam and the other a clay loam, and have determined the final distribution of moisture in them in 6 inch sections as it was found after a period of 314 days. On one column in each set was developed a soil mulch 3 inches deep, while the surface in the other was left unstirred. The columns stood where they were continuously dry in front of a ventilating stack which maintained a continuous strong draft across their tops. During the 314 days of exposure the sandy loam, unmulched, lost 4.638 inches of water and the mulched surface 4.314 inches or at the rate of 1.463 inches and 1.369 inches respectively per 100 days. The clay soil unmulched lost during the same period and under the same conditions 9.639 inches and the mulched 6.57 inches, or at the rate per 100 days of 3.04 inches and 2.07 inches respectively.

The sandy loam was a little wetter in the lower 6 inches at the close of the experiment than when it started, from downward percolation, but in both columns 9.5 feet below the surface water had been lost upward. The clay loam was 1.38% drier in the lower six inches

of the mulched cylinder and 3.17 per cent drier in that of the un-mulched one.

There are several very important principles demonstrated by these experiments. (1) Water in ordinary soils may rise to the surface from depths as great as 10 feet so that in climates like California, having a wet and dry season, if there is enough rainfall to charge the surface 10 feet with capillary moisture much of this may become available to crops, even if their roots do not penetrate to that depth. (2) The coarse textured soils, while they may not retain as much moisture, will not lose it as rapidly, by surface evaporation, nor so deeply, as the finer grained soil will. (3) When the surface of even unstirred soil once becomes very dry the loss of water upwards through it becomes very slow. I hope during another year to repeat these experiments but to periodically wet the surface to imitate the conditions of humid rather than of arid climates, and I expect to demonstrate that although frequent wetting of the surface has taken place the soil will in the end have become much drier in the deeper layers.

I have this winter succeeded in measuring a capillary rise of water exceeding 44 inches on the level in 24 hours through a height of a little more than 6 inches of coarse sand with its surface kept wet when the same sand, with the surface air dry, failed to lift an amount equal to one half inch. These facts go a long way toward explaining the high duty of water in California and Washington and their much lower duty in humid climates. They teach, with the force that nothing else can, the great importance of the dry soil mulch wherever soil moisture is deficient. They teach that if in the sub-humid and semi-arid regions of the United States moisture can be gotten into the soil by any means in sufficient quantity to produce a crop it may be preserved there by soil mulches long enough for crops to utilize it, if only the proper conditions for development in the moist soil exists.

The old system of intertillage introduced by Jethro Tull in England, and modified by Hunter and still later by Smith, at Lois-Weedon, has much to recommend it on fertile soils, in which there is a deficiency of soil moisture, as is the case in the sub-humid regions of this country. Tull was a close observer, and early learned to appreciate the great advantage of thorough tillage, not only in conserving soil moisture, but also in developing available plant-food. He strongly advocated planting in drills, so as to admit of thorough and frequent stirring of the soil and with the aid of the horse.

Hunter modified Tull's system by laying out his fields in strips about 9 feet wide, every other one of which was sown, while the intermediate ones were left naked and were frequently cultivated through the season, and kept free from weeds. In the fall of the year the bare strips were sown, and the others, which had borne the crop, were plowed up and tilled in a similar manner. His method amounted to a system of summer fallowing, as that practice is now generally

understood, except that it possessed one important advantage: namely, his strips being so narrow, and hence so numerous, that both the moisture saved by the tillage and the nitrates developed became available to the plants growing along the margin. Further than this, a part of the rain which fell upon the strips, both by its lateral capillary movements and by the development of roots into this unoccupied ground, contributed to the growth of the crop as though it had been partially irrigated, or its rainfall had been increased, which in fact it had.

The Rev. Mr. Smith, at Lois-Weedon, in Northamptonshire, raised wheat very successfully by still a different modification of Tull's idea. His practice was to sow about one peck of seed to the acre, by dropping the grains 3 inches apart in three rows 1 foot apart, and leaving a space of 3 feet wide unplanted between each group of three rows. These strips were thoroughly tilled until the wheat was in bloom, and kept free from weeds. He even went to the extent of trenching the naked strip, bringing up some of the subsoil and putting the surface loam into the trenches. By his thorough tillage, thorough aeration and conservation of soil moisture, he was able to maintain a yield of 18 to 20 bushels per acre without manure.

These cases of old and now generally abandoned practice are called up here because they involve a principle which, when correctly applied, is of great importance in sub-humid climates, where water for irrigation is not available. The principle referred to is that of using the rain which falls upon an acre of ground to produce a crop on one-half of that same area. For this, as a matter of fact, was the essential thing which the Lois-Weedon system did. It is evident enough that in a country where the rain which falls is only one-half the amount which is needed to produce remunerative crops, if that water can be brought to use on one-half of the area, then a fair crop on one-half of the ground may reasonably be expected.

The important matter, then, is to devise a system of planting for the various crops which shall permit the rain which falls upon the unused area to be brought within reach of the plants growing upon the occupied ground. For all crops which are grown in hills or in rows, like maize, potatoes, and various vegetables, the problem is simple enough, as it resolves itself into the single question of how many plants can be nurtured upon the ground with the available water, allowing for unavoidable losses. This fixes the distance between the rows and the distance between the hills in the row. In countries where there is an abundance of water, or where irrigation is practiced, plants may be brought so close together that the limiting factor is amount of sunshine, or available plant food in the soil or air about the plant; but in sub-humid regions, the limiting factor is water alone, and the distance between plants must be made such, if necessary, that the roots of one will not encroach upon the feeding ground of another. Hence it is

not unreasonable to expect that where there is a deficiency of water in the soil, the small grains may be sown in narrow strips of 4 to 6 drill rows, 9 inches apart, separated by naked strips 30 inches wide, which may be cultivated to yield up their moisture and developed nitrates to the growing grain on either side, and thus mature heavier crops of well-filled grain than would be possible if the seeds were scattered evenly over the whole surface and on the lighter soils in humid climates none of which could be cultivated.

Such a practice as is here suggested is manifestly summer fallowing, but in a very different way, and for quite a distinct purpose, from that usually had in mind. Of course, it would not be urged, except on soil and in climates in which there is an insufficient supply of soil moisture to mature the crop under ordinary methods of handling. The method, however, had a rational basis for sub-humid climates and for the lighter soils of small water capacity in the more humid climates; but it cannot be hoped that it will, under these conditions, give as large yields per acre when figured upon the whole area as the close planting on the soils better supplied with soil moisture. Neither can it be expected that crops can be raised as cheaply by this method as by the ordinary methods. All that can be asserted, or can be reasonably expected, is that better crops can be raised by it in sub humid climates, than can be raised by the ordinary methods. It is not an easy matter to adapt the method either to growing hay or to maintaining pastures of the ordinary sort.

Tillage to conserve soil moisture, like water for irrigation, cannot be applied except at an increased cost of production. Hence, to cultivate a field where there is nothing to be gained from it is to be avoided. In the early part of the growing season, when the soil is so fully charged with moisture that a small rain easily causes the soil granules to coalesce and destroy the effectiveness of mulches, it is often desirable to repeat the cultivation or harrowing as often as there has been a shower of sufficient intensity to establish good capillary connection between the stirred and unstirred soil.

It is often of the greatest importance that this re-establishment of the mulch should take place at the earliest possible moment, not only because of the rapid loss of water from wet surfaces, but because of the fact that, when the surface soil has reached a certain degree of dryness while the deeper soil is yet wet, the moisture of the surface layer so strengthens the upward movement or soil moisture into that layer that not only is all of the rain held at the surface, but a very considerable amount of the deeper soil water is brought there also. Our studies have proved, both by observation and by repeated experiment, that wetting the surface of the ground may leave the deeper soil actually dryer than it was before, and if the new mulch is not early developed the rain may leave the surface four feet dryer than it would have been had the rain not occurred.

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

THE AGE wants to brighten the pages of its Diversified Farm department, and with this object in view it requests its readers everywhere to send in photographs and pictures of fields, orchards and farm homes; prize-taking horses, cattle, sheep or hogs. Also sketches or plans of convenient and commodious barns, hen houses, corn cribs, etc. Sketches of labor-saving devices, such as ditch cleaners and watering troughs. A good illustration of a windmill irrigation plant is always interesting. Will you help us to improve the appearance of THE AGE?

THE EAST AND THE WEST.

The normal condition of the average farmer throughout the East is one of inquiry as to weather conditions. His face is upturned to the sky, he watches the appearance of the clouds and asks anxiously: "Will this rain hold off for a day more?" or, "I am afraid these are only wind clouds," as the case may be. He must wait for rain in order to plow or to plant, or he cannot plow or plant because of rain. The greatest proof of the value of irrigation lies in the fact that no farmer who has practiced it, is ever willing to change to farming under conditions where he is dependent upon natural and unevenly distributed rainfall. The farmer who has his moisture supply under his control, knows what he can do, and goes ahead and does it with almost as much certainty of results as the contractor projects and builds his house. The satisfaction to the farmer of knowing that the labors of a half a season will not be rendered void because of a week of untimely drouth, is one that cannot be fully appreciated except by those who have tried both systems.

The ordinary farmer is looked upon largely as a man who plods along without responsibility, worry or thought. As a

matter of fact, his worries, where he is dependent upon the elements, are constant, and far in excess of those of many business men. Never a season goes by that he does not hope and pray for rain at some time to save some partially matured crop, or fidget and stew about in impatience and fear lest his crop already made should be ruined before it can be harvested or cured. The brow of the irrigator is sure to have many less lines and furrows across it than that of the farmer who does not know the control of water in his agricultural operations.

A VALUABLE FORAGE PLANT.

A plant of great value to the West, and particularly on alkali lands, is the Australian salt bush. On the poorest and most arid and stubborn soil and that strongly impregnated with alkali, this plant makes a vigorous and excellent forage growth. The California Experiment Station has made extended investigations of salt bushes for many years and is now cooperating with the United States Department of Agriculture to introduce the plant throughout the West without cost to the farmers. The best species—artiplex semi-baccanta, imported from Australia—thrives under a great variety of conditions, from

extreme aridity to irrigation, as show by the California experiments, and seems to combine a remarkable number of virtues, including great frost resistance, late growth, drouth resistance, succulence, palatability and heavy yield, sand-binding qualities and the habit of spreading freely. Farmers desiring to know more of this plant or obtain seed would do well to write to the Secretary of Agriculture at Washington.

PROFIT IN CUCUMBERS.

Cucumber growing is a much neglected yet very profitable industry. Market gardeners seldom harvest less than 150 bushels, and some claim to get 500 bushels from an acre. The early crop usually sells at from \$1.00 to \$2.50 per dozen, and the late ones bring about half that price. A bushel of pickling cucumbers averages 200 specimens. I have seen professional growers who said they took 100,000 pickels from an acre. If sold on the market, the income will average \$200.00, but if put up in barrels and made into the marketable pickels of commerce, the crop is worth double that amount. Southern growers report an average of 500 crates of 80 to 90 specimens to the acre. These crates are sent to the northern cities, and sold at \$1.00 to \$5.00 per crate.

The cucumber requires a light sandy soil, plenty of sunshine and moisture, and good care in growing and harvesting. The ground should be free of weeds and plowed in the fall or winter. For early crop the planting should begin as soon as danger from frost is over. If hills are made about four feet apart either way, and cultivation given before the vines begin to run, the growth will cover the ground. A good plan is to dig holes one foot or more in depth, with spade or shovel, where the hills are to be, and fill partly with rotted leaves or vegetable mold. Then scatter a handful of fertilizers containing 8 per cent. potash, 8 per cent. phosphoric acid and 3 per cent. nitrogen. The seed should then be planted in loose surface soil,

placed over this, at the rate of six to eight seeds to the hill.

When the plants are up and growing nicely they should be thinned to two in a hill, and cultivated with shallow plow or regular garden weeders. If given too much water in irrigation, or the land is not well drained to carry away excessive rainfall, while the plants are young, the crop will be a failure. Cultivation while the dew is on the vines or just after a rain will cause the leaves to rust and blight. An application of cotton seed meal, or one tablespoonful of nitrate of soda sprinkled around the plants and hoed in will prove beneficial, as a top fertilizer. If the plants are troubled with insects a slight spraying with arsenical compounds, in the same proportion as used for the aphid or apple trees, will prove effective.

Cucumbers for pickles may be planted as late as the middle of June in most localities, and the later varieties should be five feet apart, with two plants in a hill. There are several good varieties, for a better description of which the seed catalogues are the best books of reference. The Early Frame and White Spine are favorites for quick growth, maturing in about 60 days. The Long Green, Jersey Pickle and several others are standards for pickling. They should be cut from the vines every second or third day, using a sharp knife or shears for the purpose. Picking should never be done while the vines or leaves are moist, as the fruits will be lessened from such handling. If the pickles are left on the vines until they begin to ripen, the yield will be light.

To make good salt pickles the small specimens of uniform size must be selected. Mix four quarts of salt in two gallons of water and put in the barrel first. Then carefully wash and pack in the cucumbers and add four quarts of salt to each two bushels or 400 cucumbers. Put the head of the barrel over them and weight with a rock or something of about twenty-five pounds. If the barrel should leak any replace the brine, at the rate of four quarts

of salt to two gallons of water. Keep the pickles under this solution. When ready to put in vinegar, take out and wash off the salt, soak for 24 hours, changing the water two or three times, then warm up in some vessel and soak again. After they are good and fresh, put in another keg or vessel and cover with vinegar, which has been heated. Let the pickles stand for a week and they are ready for use or the market. Such pickles are retailing at the stores for from ten cents to twenty cents a quart.

JOEL SHOEMAKER.

FACTORY TALK IN TEXAS.

A wave of industrial enthusiasm has swept over Texas during the past year and its effect is now to be seen in every section of the State. The enterprising citizens of the State are talking factories everywhere, and in several towns the talk has brought forth material results.

Nearly every issue of the *Post* records some movement by a Texas town to secure an industrial plant. Hillsboro has reported a plan that promised to result in a \$50,000 cotton mill. Wharton told of a proposition to erect a \$200,000 sugar mill in that section, the centre of the finest cane producing country in the world.

Citizens of Cameron met to complete arrangements for the erection of a cotton factory, over 50 per cent. of the \$100,000 stock required having been subscribed. An item from Franklin was that a broom factory would be erected there and put in operation within a short time. The town of Rusk reported a contract closed for the erection and operation of a cotton and woolen mill. The proposed organization of a cotton mill company at Navasota was also noted.

This one day's record of six new industries started or contemplated in six different towns is indeed a gratifying exhibition. What is of especial interest in this connection is the fact that each of these factories will be built by home capital.

At Cameron, where a \$100,000 cotton

mill will be erected, over 100 farmers have promised to take stock. The Rusk mill will be built by the enterprising business men of that town, and 140 subscribers have stock in it. The Hillboro factory will be organized wholly by local capital, the shares being only \$25 each.

It is such development as this that is wanted in Texas. The citizens of the State—the men who are directly interested in its progress—must bring about the industrial awakening that is so essential for the future growth of our towns and cities. The building of factories is undoubtedly a profitable undertaking and there is no need to rely upon outside money to start the manufacturing boom.

Factories create wealth and set in motion the wheels of progress. They add to the value of every line of business already established and they make possible many new enterprises. They give employment to thousands of laborers, and give a better market for agricultural products.

Let the Texas towns continue to show their interest in this line of work, and the progress and prosperity of the State will be assured for all time to come.—Houston (Tex.) *Post*.

The Southern Association of Commissioners of Agriculture while in session at Atlanta, suggested that county officers throughout the South be compelled by the laws of their respective states to make reports from time to time on the condition of growing crops. This would be an excellent idea if there were any probability that such reports could be depended upon. Anyone who is familiar with the sectional rivalries in remote districts will doubt, however, the practicability of the plan. It is pretty certain that one county would not permit another to excel it in making estimates and incidentally advertising local resources dependent upon fertility of soil. Exaggerated reports would be a natural result, and these are precisely what the planters do not want, as they would necessarily have an adverse effect on prices.

PULSE OF THE IRRIGATION INDUSTRY.

SUBTERREANEAN RIVERS.

The great subterranean rivers of the West which slowly wend their silent way, hundreds of feet beneath the earth's surface, have their counterparts on the other face of the globe. The Caspian Sea is fed by many subterranean streams. These streams, like those of our own arid region, take their source in the mountains which are covered with perpetual snow. The water from this melting snow percolates downward to a deep-lying, impenetrable strata, where it begins its underground passage to the sea. Nearly the whole of Persia is naturally desert. There is scant rainfall and the rivers are so few that irrigation from this source is very limited and serves only a small portion of the country. Centuries ago the Persians stumbled upon the idea of tapping the underground streams or springs at the bases of the mountains and the transition of the Persian desert into a land of great fertility is due to this constant source of water supply. But the water has been obtained only through the most indefatigable labor.

A well is sunk in the foothills to a depth anywhere from 100 to 300 feet. When this taps the vein of water, another shaft is sunk a couple of hundred yards farther down the slope, which is in reality a gentle descent of the table land from the mountains. A canal or subterranean aqueduct is then excavated between the two shafts. At a similar distance farther down another shaft is sunk and likewise connected with the second; and so the canal or *conneough* as it is called, is carried for miles. As the *conneough* is given just fall enough to al-

low of a free flow of water it gradually approaches the surface until, when it draws near the land to be irrigated, the stream comes forth a pearling, bubbling brook, dancing in the brilliant sunshine as it rushes on to its mission to redeem the sterile waste places of Nature. For miles it goes through what was at one time a desert but which under the magic influence of this elixir of life, becomes a garden of the gods. It feeds fountains around which in languorous indolence repose the dark-eyed beauties of the harem; it furnishes the baths, those luxuries of the Orient; it waters wonderful gardens where in dazzling profusion, bloom throughout the year, the rose, chrysanthemum, narcissus; tuberose, dahlia, white lily and aster, besides fantastic shrubs and rare exotics, heavy with rich perfumes. Here grow to perfection the apple, peach, pear, nectarines, pomégranite, filbert, melon and grape, and many unknown tropical fruits in such abundance as to bewilder the traveler.

Where the soil admits of percolation, the land is flooded in small squares from lateral ditches. On such land, barley, wheat and other cereals are grown to great perfection. Again, irrigation is accomplished by a network of ditches and furrows. The mills which grind the grain are run by the current of the great irrigation ditches.

The cities of Persia secure the water necessary for domestic use from these ditches. The capital, Teheran, has no less than twenty large artificial streams flowing through it, constituted in the manner described from the underground currents.

The land lying adjacent to these canals is entitled to the use of the water, the amount being regulated by law. Each district is under an overseer whose duty it is to see the proper application of the water and that there is no waste.

Wealthy private individuals have also constructed ditches for their own use, furnishing the water to their tenants; but land contiguous to their canals is entitled to certain water rights even if not belonging to the owners of the ditches. Title to the use of water is inherent in the land and each section of land is certain of its water supply.

When the immense amount of labor involved in sinking shafts and connecting them by underground tunnels is considered, together with the fact that only the most primitive methods are yet in vogue, the Anglo-Saxon can but marvel at the patience and industry displayed in the accomplishment of such gigantic but necessary tasks. Some sections of Persia, especially those along the natural rivers, could add to their irrigated area by the use of storage reservoirs; but the greater part of the country has no flood waters to store, the melting snows but serving to keep alive the underground streams. Even in this despotic, tyrant-ridden country, it has been found best, nay, necessary to maintain government supervision of irrigation waters, which is the life blood of the nation. With a loose system of water control, the land would again be desert.

GUY E. MITCHELL,
Sec. Nat. Irri. Ass'n.

LIKE OUR OWN WEST.

The American Southwest is a new country, but it seems there are other countries with conditions very similar. A man who has been traveling in the interests of the West and Southwest is Mr. W. T. Swingle, a special agent of the Department of Agriculture. He has been spending something like eighteen months in the countries of the Mediterranean, and he finds in North Africa conditions of soil and

climate almost identical with those of the American arid West and Southwest. These countries in which he has traveled being of very ancient civilization, he finds growing there many things which will undoubtedly prove valuable acquisitions to America. Among other things Mr. Swingle has succeeded in shipping the minute animals which pollinate the Smyrna figs to California fig-growers and establishing these insects in our own country. This is something the Department of Agriculture has been attempting for years, and it now insures the fertilization and production in California of the famous Smyrna fig, the finest fig on the market.

Mr. Swingle has also selected and shipped from Algeria a large number of date palms to New Mexico, Arizona and California, it being Secretary Wilson's intention to establish an American date industry. He has also procured seed of the scarlet vetch, a legume, which in Algeria grows to a height of seven or eight feet, and also a grass known as halfa, valuable for use in the manufacture of fine book paper. Another legume which is used for plowing under is fenugrec which he saw yield as much as twenty tons per acre of green stuff.

Although much larger, the Sahara closely corresponds to some of our western desert land. It is being irrigated to some extent by means of artesian wells, which result in oases of considerable size. Under irrigation and the great heat of the desert enormous yields are obtained.

Mr. Swingle admires the camel as a beast of great utility and believes it could not but prove a success in certain sections of this country, if introduced under proper conditions. Camels, he says, will live on anything; they will eat scrub, bushes and thorns, and they can carry across the burning desert each from a quarter to a half ton burden.

At one time Rome controlled all of Northern Africa, and Mr. Swingle observes that their reservoir systems must have been very efficient, as he found vast ruins of splendid cities, which, with other works,

now crumbled away and standing desolate among the burning sands, show that the whole country was in a state of great fertility and supported a dense and wealthy population. The French Government is now making excavations among these ruins and bringing to light many wonderful things.

In view of the fact that peppermint has proved of great service in the detection of defective plumbing, it is of interest to learn that this herb is of benefit to sanitary well being in another direction. The *London Daily Telegraph* in a recent issue says: "Peppermint is reviving the drooping spirits of the depressed agriculturist. So profitable has the Sutton Urban District Council found its cultivation that it has determined to add two more acres to the area at present devoted to that fragrant plant. The body mentioned has paid great attention—more than most local authorities—to the utilization of sewage, and peppermint is one of the products of the land where this is turned to profitable account. Last year there were 4 acres under cultivation. When the plant is cut and dried the leaves are distilled and the oil thus obtained finds a ready market. The yield of this odorous liquid was 119 pounds."

ODDS AND ENDS.

SHE KNEW THAT WAS WHAT MADE HER HOUSE BURN DOWN.

"Women are the most unreasonable creatures in the world," said the fire insurance man to his wife.

"Some women," she corrected him.

"Well, we won't quarrel about it, but let me tell about that old lady in Slabtown who had her house insured three weeks ago," he went on. "She had a \$1,500 policy on it, about all it was worth, really, and we were only getting \$12.50 a year for carrying it. Last night it burned down to the ground, and to-day she was

ni to see me. She was fairly sopping in tears, and angry besides."

"I thought," she sobbed, "that if I had my house insured it wouldn't burn down. You told me that, I am sure."

"Oh, I beg your pardon, my dear lady. I couldn't have said that," said I.

"Yes, you did, or I never would have had it insured. I've been living in that house for fifty years, and it never was insured before, and it never burned down before. And it wouldn't have been insured now if you hadn't have put me up to it."

"Yes, you did too," she insisted, "for what is the good of insuring a house if it is going to burn down, I'd like to know?"

"There's a good deal of good. For instance, you will get \$1,500 from the insurance company, which you wouldn't have got, and you have only paid \$12.50."

"When do I get it?" she sobbed, as if she wasn't going to get a cent.

"Just as soon as we can get matters in shape and report the loss to the company."

"Well," she said, sniffing as she went out, "I suppose I will, but if I had known it would have burned down, just the same, I never would have had it insured, never."

PRACTICAL DEMONSTRATION.

"What are you doing there?" said the passer-by as he leaned over the fence to speak with the farmer who was clearing a piece of new ground.

"Lifting the mortgage."

Then came one of those strange coincidences that we encounter along the pathway of existence. A dynamite cartridge exploded, fragments of a stump filled the air, and it required no exaggerated stretch of imagination to think that the mortgage was being most effectually lifted.—*Detroit Free Press.*

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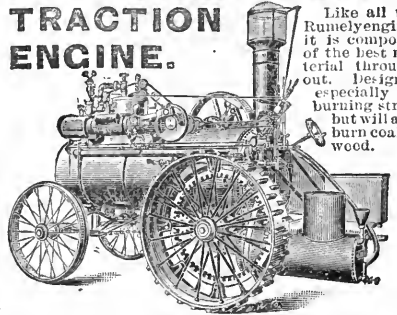
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THE IRRIGATION AGE.

VOL. XV.

CHICAGO, FEBRUARY, 1900.

NO. 5.

THE PROGRESS OF WESTERN AMERICA.

The question is often asked "Why do the boys leave the farm?" It is pointed out that no worker is more independent than the farmer: that no life is so healthful; and yet the boys flock from the farm to the city. A report, recently made by Prof. John F. Crowell of New York, before the Industrial Commission of Washington, will throw some light on the subject. He compares the wages and living conditions of the various industries and says: "We want to know why it is that the returns of the various industries are so unequal. I have taken a few figures from the census of 1890. The amount of capital invested in agriculture was \$16,000,000,000, and 8,466,365 workers were engaged. The value of the combined properties was \$290. In manufactures the product per capita was \$893. In mining it was \$740. These figures, in the eyes of the farmer's boy, are a decisive argument in favor of abandoning the farm for the factory. The farmer has to adjust himself to prevailing prices. A proper distributing system is his urgent need today. This can be effective only through the European markets. The productiveness of the farm is limited. But the manufacturer can govern his supply as market quotations may indicate. These difficulties are increased by too large a burden of taxation."

Prof. Crowell cited the Dutch farmer of Southern Pennsylvania as a striking example of the successful farmer. The Scandanavian immigrant, he said, was more successful than the American agri-

culturist because frugality and economy is bred in his bones as it were, and he lives on less than his American neighbor. Prof. Crowell praised the schools which train the youth of the country into farmers on a small scale.

The White Man's Burden. The famine in India, which has resulted from the failure of the monsoon, threatens the existence of nearly 15,000,000 natives, for whose relief the British Government has ordered \$3,500,000 to be expended. To cope with the emergency, however, will be a serious task, fraught as it is with almost insurmountable difficulties on all sides. Do what it may, the Government is powerless to effect much, and should not, therefore, be held responsible for the frightful mortality which must result. The great trouble is that white men willing and able to undertake the task of distributing relief are not to be found, and the work must be intrusted to natives.

The native Hindus have no regard for the property rights of others. This is especially true of the buniahs, or native merchants, to whom the work of relief is largely confided. Of course, men presumed to be honest are chosen, but honesty among buniahs is as rarely found as is ice upon a pond on a warm morning in July. The result is that the buniah waxes rich and fat, while his distressed fellow countrymen die of starvation, for the buniah applies to his own use most of the relief funds intrusted to his care.

Those unacquainted with the facts of the

situation are prone to censure the British Government for the awful distress which occurs in India whenever the moonsoon fails. Great Britain is, as a rule, none too careful of her colonies so far as the needs of the colonists are concerned. But in this instance she is little to blame. We have entered the field of Oriental colonization ourselves. A little further experience in the matter may lead us to appreciate the difficulties which beset the white man in his dealings with dusky barbarians, as well as the climatic trials with which the natives of the tropics have to contend. Ex.

Honor to
Whom Honor
Is Due.

The 15th of February will mark the retirement of Susan B. Anthony from the presidency of the National Woman's Suffrage Association, an office which she has filled for the past thirty years; it will also be her 80th birthday. Miss Anthony has made the cause of women her life work; in order that it might ever be first in her life, she put aside all thought of marriage and devoted her entire time and energy to the one end of bettering the condition of her sex. She has borne many things for the cause: if she has not been persecuted she has been ridiculed, which is really much harder to bear with dignity. She has been such a familiar figure in this country and her name has been so long identified with the woman's suffrage movement that the two are almost identical. In the newspaper comments, so much stress has been laid on her peculiarities and foibles that the great things she has achieved have been almost overlooked, until now, when nearing the end of her active career the public reviews her work and finds how much she has accomplished. The woman who sneers at woman's suffrage and says she has no patience with Miss Anthony's work, forgets or never knew, that she could not even draw a check, as she now does, had it not been for the work done by this gifted woman. She found women chattels—she has made them almost men's equals in the eyes of the law. Mrs. Carrie Chapman Catt is said to be favorably regarded as Miss Anthony's successor in office.

No Cause
For
Alarm.

The *New York Commercial* says that the complaint of some of the Western railroads that the farmers are not shipping their grain as promptly as they usually have done is not exactly a discouraging symptom. On the contrary, it is quite significant as showing that the farmers have money in bank and are not obliged to hurry their crops off to market. There is no better indication of general prosperity than to see the Western farmers sitting around the fireside waiting until the markets for their products suit them. As for the railroads, while they take due notice that the farmers are not hurrying their grain to market, they are likely to view the matter calmly, for they seem to have all the business they can attend to without the grain shipments. Besides, they will get the grain a little later.

Among the "Men and Women of the Hour" in the *Saturday Evening Post*, is the picture of Prof. Elwood Mead, the State Engineer of Wyoming, who will represent this country at the Paris Exposition. Of him the *Post* says: "To his exertions is largely due the success of the many irrigation congresses which have been held in his part of the country, and the better knowledge of fluvial conditions and water rights now possessed by the reading public. He was probably the first to make maps that were truly hydrographic rather than cartographic in character. By charting the water supply, water flow and water shed he proved that the problem of irrigation upon a large scale was far simpler than had been believed by preceding experts. The people, as a rule, appreciate his services, although on one occasion Professor Mead found an exception. He was speaking at a meeting upon a local water improvement, and after expatiating upon the benefits which would be derived by the farmer, miner, and even the manufacturer, he said, 'and this extra supply of water is absolutely necessary to our dairymen.' Before he could begin the next sentence a townsman called out: 'Stop right there. They give us too much of it already.'"

**A
Sensible
Infidel.**

A few days ago a Kansas City man who had proclaimed himself an infidel for twenty-five years died and left a curious will. In it his fortune of \$150,000, with the exception of \$4000, was given to religious and charitable organizations. No explanation was made, but the fact itself was eloquent.

One of the most brilliant infidels in this country—a man who did not boast his infidelity or use it for money-making—once wrote a series of anonymous articles asserting his views. "One morning," he said to the writer of this, "I had a caller, a stranger. He came to my house, introduced himself, and with touching fervor thanked me again and again for making him see the light. He had found out that I had written the articles. I was greatly nonplused, but replied as best I could that I was glad to have been of service to him. He had been a worker in his church, and was, as I found afterward, a man of influence and usefulness in the community. His excessive gratitude was really embarrassing, and it reached a climate when he said, with increased intensity, 'Sir, you have converted me.'

Now I have been wondering ever since what I converted him to."

To nothing, of course. When the infidel with his fortune looked around he found that infidelity did not have a single organization by which money could be used for the alleviation of suffering, for the physical salvation of the weak, or for the material improvement of mankind. Leaving out all questions of faith, dogma and spirituality, the plain situation was that religion had provided the means, was doing the work, and was the only agency that could be trusted with the carrying out of his better purposes. The churches had done about all that was of any benefit to the world: had begun, increased and developed the vast machinery of practical aid and philanthropy. Infidelity had done nothing; had nothing to do anything with. The infidel's dollars were practically worthless without religious help.

All this is very simple and familiar, but it does us good sometimes to look at the tremendous and overwhelming material achievements of our churches. Even the

infidel who has not the faith to follow the direction of their spires cannot dispute the testimony of his eyes as to what they are doing closer to the earth.—Lynn Roby Meekins, in the *Saturday Evening Post*.

**Rev.
Sheldon's
Plan.**

On March 13th the Rev. C. M. Sheldon, who has gained a great deal of notoriety through his original sermons, will take charge of the Topeka (Kan.) *Capital* for a week, during which time he will show a wondering world how Christ would have conducted a daily newspaper. No doubt Mr. Sheldon is a good man and a sincere man but he is stepping outside his sphere in what he has undertaken and will bring only ridicule upon the faith he upholds. Let him turn his attention to fields in which he has had experience. Let him aim to preach sermons such as Christ would have preached and he will have enough to occupy himself, without concerning himself, about the daily press. E. W. Howe, Editor of the *Atchison Globe*, says of the Rev. Sheldon's plan:—

"A smart business man got after him and he was induced to edit the *Capital* for a week. The price of the *Capital* a week is now a little more than seven cents. As soon as Mr. Sheldon takes hold the price will be advanced to 25 cents a week. When the *Capital* ceases to be a Christian paper the price will be lowered to the present figures. It is clearly a scheme on the part of the *Capital's* business manager to secure free advertising, and it is a good scheme, for it is receiving much attention; it is the best newspaper scheme announced in this country in years.

It is absurd to suppose that if Mr. Sheldon had any ideas worth exploiting he could accomplish anything in a week. Mr. Sheldon has been worked. He has called upon his religious friends to assist him in making religion ridiculous.

The growth of newspapers is the modern wonder. They don't need any advice or assistance from men who devote their lives to theology. The men who have made the wonderful newspapers of the present day are not asked by the people to step aside for a theologian who has had no newspaper experience. There is no demand for such a paper as Mr. Sheldon would edit. It is

like the stage coach criticising the locomotive."

The Capacity for Work.

There is nothing better recognized by business men than the value of capacity for work.

Genius, they say, is all very well in its way; but when it comes to executing large plans, the men who can do the most and do it to order are in demand. The master of an extensive plant giving employment to a great many laborers, skilled and unskilled, has his eye on details; he is never deceived by the generalizer who makes a great show without bringing much to pass. Efficiency counts for more than knowledge when knowledge has clumsy fingers and a slow intelligence to carry it into operation. It is the bullet that hits, the hammer-stroke on the head of the nail, that must be reckoned with in every calculation, in war or in the workshop. And this accuracy of execution, although displayed by persons not scientifically trained, will command the highest respect and reward of practical employers.

Doubtless the capacity for work is hereditary in many cases; but breeding, even here, means more than ancestry. In a word, training from infancy in the details of industry can work wonders with most unpromising natures. "What can you do?" is a greater question than "What do you know?" Knowledge is theory; work is practice. The professor of agriculture would drive a crooked furrow and gain the contempt of a real plowman guiltless of a single "scientific" thought; he was bred to capacity, this accurate plowman. Knowledge truly is power when it has been digested and assimilated so as to be a part of the man, informing his faculties and vitalizing his capacities to a state of special efficiency. It does not have to beg for respect.

Nothing is more abused than education. On the threshold of school we are too often dazzled and misled by that will-'o-the-wisp, a nebulous and elusive ambition dancing far off over the quagmires of imagination. Many a youth has dreamed through college with his eyes on the Presidency of the United States, and when it was too late he found himself unfitted even for the office of Justice of the Peace

Now and then a rail-splitter or a canal-boat driver has picked up ample resources for doing the work of Lincoln or Garfield. "Know thyself" is a fine admonition; but the capacity for work is the best self-knowledge; it never misleads its possessor.

If we could but discover early in life our limitations, if we could apply the nutrition of school training and home training to such of our faculties as nature has made sound and capable of efficient development; if we could but recognize the absolute and unavoidable law of fitness and be satisfied with the life we are fit for, there would soon be a great lessening of the heaviest and most galling strain of existence. The capacity for work ought to suggest to its possessor what particular work demands his activity. If I am eminently fitted to excel as a hedger and ditcher, my mental training should not be directed so as to destroy that fitness and lead me into the delusive dream of peddling lightning-rods.

This rule of native fitness, this criterion of capacity, is perhaps, applied with less judgment in the field of literary work than in any other area of ambition. Every man and woman who has reached any commanding eminence in letters has had to bear the greatest strain of sympathy and pity caused by constant contact with persons who have persisted in throwing their lives recklessly away trying to do the impossible—trying to find a way by which lack of capacity could be bridged over and success in literature attained despite the most obvious unfitness for literary work. It is a curious dream, ravenously indulged in by many excellent people, that the whole of literary success depends upon getting their writings printed. They assume that capacity exists; they assert that there is favoritism at the publisher's counter; that a friend at court can make matters all right with the editors. No amount of reasoning on business grounds, or from a basis of common sense, can drive them from this destructive delusion. They do not know themselves; they mistake desire for capacity; they go on from year to year aiming at Scott, or Emerson, or Tennyson, and wondering in desperate wrath when their efforts land far short of dime novel and doggerel. Truly the capacity for work must precede ambition.—MAURICE THOMPSON in the *Saturday Evening Post*.

UNTIMELY OPPOSITION.

FEDERAL STORAGE OF WATERS A REALITY. BUT WESTERN DISSENTIONS TEND TO KILL THE PROPOSITION.

BY GUY E. MITCHELL, SEC'Y NATIONAL IRRIGATION ASSOCIATION.

Opposition has been made to the federal storage proposition on the ground that nothing has yet been accomplished along these lines although efforts have been made for years, and therefore, it is argued, the project might as well be abandoned. Attention has been called to Ex-Governor McCord's statement that Congress last winter came very near to appropriating \$215,000, to begin work upon a national system of irrigation for the arid West, and that the leaders agreed with Senators Warren and Carter that at least that sum should be appropriated by the present Congress, if they would then consent to let the matter go over. Therein, it is stated, is the measure of what can be expected for federal irrigation construction by the present Congress. Two hundred odd thousand dollars apportioned among the arid states and territories would make a sum for each so paltry as to amount to naught, and the citizen of today would have to live to be a hundred before he could see any appreciable results from government irrigation development.

This entire position is certainly erroneous and misleading. The small appropriation asked last year was not intended to be apportioned among the States interested in irrigation. It was for the express purpose of building one or two storage reservoirs. This was to be the *beginning* of a policy which should include the complete survey of all the arid region and the building of storage reservoirs by direct and continuing appropriations from Congress to Congress, in every arid State and Territory. Rome was not built in a day, and western legislators did not expect Congress to build at once a hundred storage reservoirs, but this appropriation would have been a beginning. As Senator Carter said "Let it be distinctly understood that this is the entering wedge of a new policy, etc." It is not expected of the present Congress that it will by any favorable possibility make an appropriation of \$100,000,000, or even enough money to build a single reservoir in each arid State, but if it appropriates funds for one reservoir and for complete surveys in other States, the hopes of the people who have been arguing federal storage will be realized. This would be the entering wedge and nothing could prevent its widening and broadening the opening. Wyoming is not going to have a reservoir built

by the government without Nevada and Montana and a dozen others claiming the same privilege, any more than San Francisco can get a government harbor improvement and the rest of the coast ask in vain for like assistance.

So in these times, when Congress seems "very near" to appropriating money for national storage of waters, it behooves every citizen of the territory interested to stand shoulder to shoulder with his neighbor in support of a policy which if carried through to completion, will make a new west over the present west even as the west of today is a different land from the west of the sixties.



WHAT HAS BEEN DONE BY IRRIGATION.

From the census office, Washington, D. C., we have received the following in regard to the work:

The preliminary work of the census office in collecting data relative to the arid and sub-humid regions shows that during the past ten years vast areas have been reclaimed by irrigation, both by ditching from running streams and drilling for subterranean waters.

Where only a few years ago the sage brush struggled for existence in the midst of a waste of alkali and sand, today are fields of waving grain and blossoming orange-groves. Hundreds of miles of canals and ditches have been constructed; hundreds of wells have been sunk, and thousands of acres of land have been cultivated in zones where once the desolation of Sahara reigned.

Moistened by fresh waters and fertilized by the rich silt of the swift mountain streams, once trackless wastes and desolate valleys in the arid Southwest, have become as fertile as the famous Valley of the Nile, and send forth crops of endless variety and exceeding abundance.

Irrigation is intensive farming. Where the water supply is ample, it is sure farming. There are no failures, and crops are enormous. The experienced irrigator is like the trained engineer with his hand on the lever. The movements of his hand regulate the amount of water supplied to his fields as those of the engineer control his engine.

In most of the irrigable sections of the West, fertilizers have never been used, although the land has been constantly cultivated for over two centuries. In many sections fields may be seen which have yielded successive crops of wheat for forty years and show no diminution of productive strength.

Wonderful progress is shown in the methods of constructing canals, dams, and pumping machinery, and in the manner of distributing water. Modern inventions in machinery have greatly lessened the time, labor, and cost of construction and management and made possible many gigantic enterprises of land reclamation and water utilization.

Mountains have been tunneled and whole rivers have been lifted from their beds and spread over the valleys precisely as wanted. High up in the ranges and on the elevated plateaus immense storage reservoirs have been constructed to impound the flood-waters of the streams so that the thirsty land below shall not suffer during the long rainless summer.

As the successful solution of the problem of conservation of flood waters means the reclamation of millions of acres of public land, the people naturally ask the government to promote measures having this end in view. To this demand the government responds. Lands containing excellent reservoir sites have been set aside and a thorough study of the sources and permanence of the water supply of arid regions has been made to enable congress to legislate with intelligence upon this important subject.

In aid of this work the twelfth census will endeavor comprehensively to show the present condition and values of agriculture in the arid and sub-humid regions; the length, irrigable extent and cost of the various canals, wells, and ditches; the character, volume and constancy of water supply; systems employed in distribution; amount paid for water and the crops, acreage, and yield of irrigated farms.

This effort will be successful if those interested in irrigation shall heartily co-operate with the census office and its agents

Within a brief period the main schedules for taking the census of irrigation will be distributed, and Director Merriam requests that all recipients prepare properly to fill them out and to return them promptly.

ECONOMY IN THE USE OF WATER.

A bulletin issued by the Agricultural Experiment Station of the University of California, gives the results of a series of experiments to determine the limits of endurance of drought on the part of the several crop plants. "Alongside of economy in the use of irrigation water, the conservation of the moisture imparted to the soil either by rains or irrigation is most important," says the writer; "critically so when irrigation is available."

Utilization of winter rains, and winter irrigation. However strong is the popular demand for storage of the winter rainfall and flood waters, too many do not appreciate the importance of the storage they can command without the use of reservoirs, within their own soil mass. While there is a well-grounded objection to subjecting plowed land to the leaching action of the abundant rains in the humid region, no such objection holds in the case of lands lying within the limits of 20 to 25 inches of annual rainfall. Here the absorption of the winter rains should be favored to the utmost, for the run-off is mostly a dead loss. Fall plowing wherever the land is not naturally adequately absorbent, and is not thereby rendered liable to washing away, is a very effectual mode of utilizing the winter's moisture to the utmost, so as to bring about the junction of the season's moisture with that of the previous season, which is generally considered as being a condition precedent for crop production in dry years. The same of course holds true of winter irrigation; the frequent omission of which in presence of a plentiful water supply at that season is a prolific cause of avoidable crop failures. Moistening the ground to a considerable depth by winter irrigation is a very effective mode of promoting deep rooting, and will thus stand in lieu of later irrigation, which, being more scant, tends to keep the roots near the surface.

Knowledge of the subsoil. It cannot be too strongly insisted upon that in our arid climate farmers should make themselves most thoroughly acquainted with their subsoil down the depth of at least four, but preferably six or eight feet. This knowledge, important enough in the East, is doubly so here, since all root functions are and must be carried on at much greater depths. It is hardly excusable that a business man calling himself a farmer should omit the most elementary precaution of examining his subsoil before planting orchard or vineyard, and should at the end of five years find his trees a dead loss in consequence of an unsuitable subsoil. Similarly, no irrigator should be ignorant of the time or amount of water it takes to wet his soil to a certain depth. We have lately seen a whole community suffering from the visible decline of the thrift of its fruit trees, which occurred

despite what was considered abundant irrigation, *i. e.*, allowing the water to run for a given length of time, deemed to be sufficient. Yet on being called in to investigate the causes of the trouble, the station staff found that the irrigation water had failed to penetrate during the allotted time to any beneficial extent, so that the trees were, in the main, suffering from lack of moisture—a fact that could have been verified by any one of the owners concerned, by simply boring or digging a hole or two. But no one had thought of doing so, and all kinds of mysterious causes were conjectured to be at work in the suffering orchards. A definite knowledge of the rapidity with which irrigation water penetrates downward and sideways in his soil should form a part of the mental equipment of every irrigator, particularly in arranging his head ditches. For in sandy lands it may easily happen that when these are too far apart, the water near the head ditch is already wasting into the country drainage at the depth of ten or twelve feet, before any has reached the end of the furrows, or has wetted the lower half adequately. Many such cases come under our observation, and such ignorance of the conditions governing one of the most important factors of success is hardly excusable in any one. Nor is the quality of the water used indifferent in this connection; for waters containing alkali will fail to penetrate the soil as quickly as would ordinary stream waters.

Preventing evaporation. But supposing the moisture to have reached the depths of the soil, whether from rains or from irrigation, it is essential that proper means be employed for retaining it in the land, and especially to prevent evaporation. That this is best accomplished by a mulch on the surface, and that the best mulch for the purpose, which need not be hurled on or off and is always ready, is a surface layer of loose, well-tiled soil, is now pretty well understood by all. But the extent to which the presence or absence of such a non-evaporating layer influences plant growth and fruit production in a critical time, is not so fully appreciated. Plate 3 gives an illustrative example of trees grown this season on adjacent fields, with only a lane between, the soil and all natural conditions being absolutely identical; the only difference being the presence or absence of cultivation. In the present case the cultivation was omitted on principle by one owner, who considered cultivation superfluous on the loose, generous soil of Alameda creek; while his neighbor, across the way, held the opposite belief, and had this season cultivated to an extra depth to conserve moisture. The cultural results are sufficiently shown in the plates and need no comment, although it may be of interest to mention that the year's growth on the one hand was over three feet, on the other barely three inches.

The difference of 244 tons per acre of ground shown by the analyses is quite sufficient, according to the data given at the beginning of this

bulletin, to account for the observed difference in the cultural result. The cause of this difference was that in the *uncultivated* field there was a compacted surface layer several inches in thickness, which forcibly abstracted the moisture from the substrata and evaporated it from its surface; while the loose surface soil on the *cultivated* ground was unable to take any moisture from the denser subsoil. This is well illustrated by the familiar fact that while a dry brick will suck a wet sponge dry, a dry sponge (corresponding to the loose surface soil) is unable to take any water from a wet brick. Besides, the tilled surface soil forms a non-conducting layer protecting the subsoil from the sun's heat and the dryness of the air.

In the East, where this principle is well understood, it is considered that a surface layer three inches in thickness is sufficient to afford effective protection. But what is adequate in the region of summer rains is quite insufficient in California and in the arid region generally. It takes fully twice the thickness mentioned, and preferably more, to afford protection against the drought and heat lasting five or six months at a stretch. Here again we find an important point in which our practice must differ from that of the East and of the Old World.

The beneficial effects of summer fallow in California are assuredly due quite as much to the conservation of moisture brought about by the tilled surface layer, as by the weathering of the soil to which the efficacy of the fallow is commonly ascribed. Witness the fact that weeds come up freely on summer-fallow as late as August, when unplowed land is as bare as a barn floor.

Similarly on our mostly new and unexhausted lands, the bad effects of weed growth are doubtless due fully as much to the waste of moisture going on through their leaves as to the competition with the crop plant food. Hence all good orchardists are very careful about keeping their ground clean in summer; but it must not be forgotten that by doing so they quickly deplete their lands of vegetable matter, which requires systematic replacement if production is to continue normally. Yet of the two evils, the loss of moisture is more to be dreaded, and very generally in practice the more difficult to remedy.

THE GREAT NILE DAM.

STUPENDOUS WORK OF THE EGYPTIAN GOVERNMENT.

The English began in 1883 their planning for the storage of the Nile waters that now run to waste during flood periods, but it was not until last year that work was actually started on the great Nile dam, which will reclaim over a million and a half acres. A thousand million gallons of water will be held in storage behind this, the greatest dam in the world, says Mr. Paul Latzke in an interesting letter. Fifteen thousand workmen are now engaged upon the great structure and its completion is guaranteed by July 1, 1903. The contractors are to receive no money until the completion of the work when they will be paid \$800,000 a year for thirty years. Under this method of annual payments, the dam will actually cost the Egyptian government nothing, as the land tax on the new area reclaimed will be, it is thought, about \$8,000,000 yearly. The government is practically building this storage reservoir, and while it is responsible for a certain payment annually, yet by reason of the building of the reservoir, it not only reimburses itself but acquires a handsome revenue additional.

The Minneapolis *Tribune* recently published the following letter from Egypt, in relation to this gigantic engineering problem:

“England is achieving the mightiest engineering feat of its sort ever attempted, in the damming of the Nile.

“There are two ways of regarding this stupendous phenomenon. First there is the British way. The Nile, harnessed and made docile, will insure thousands of British subjects against famine, swell enormously Egypt's produce and put gold in Britain's coffers. The minds of the ‘unprogressive’ natives, made to toil for England's gain, will be fired to a quicker intelligence by contact with the science of modern engineering. And a monument to British skill will be set up where it will rival the pyramids in wonder.

“Indeed the British point to the ancient Egyptian statues—bearing, as the symbol of sovereignty, the figures of two stalwart men binding the great river with strong ropes—and say, ‘Behold the prophecy! The strong men who bind the river are Lord Kitchener, general and Lord Cromer, engineer.’ For to these two men is due the damming of the Nile.

“Tradition lovers, on the other hand, are apt to grow sentimental in protesting against what they consider iconoclasm. For the mam-

moth engineering scheme has doomed, first of all, Philae, the loveliest spot in Egypt.

"Philae is an island and must be sunk beneath the flood. The river will overflow the Temple of Iris, swamp the Temple of Hathor, the Roman arch built in Diocletian's time and the rock of Konosso, bearing its sculptured stories carved 4,000 years ago.

"Palm groves and broad plateaus have had to give way to railroads, mounds of masonry, engineering apparatus and half-demolished rocks. The quiet of the land of the lotus eaters is destroyed by the shrieks of engines and the lotus-eaters' descendants are forced to toil for the British six days in the week and give up the seventh to the British Sabbath.

"But the English engineers insist that their work is one of the greatest of modern marvels. Great dams are being built at two spots on the Nile—Assiout and Assouan. Ancient canals are being restored, ancient sluices rebuilt. Water that now runs waste into the Mediterranean will be guarded in the reservoirs until the surrounding land shall enjoy a fertility it has not known in 2,000 years.

"The water supply of thirsty Egypt will be more than doubled in volume, millions of unused acres will be given over to cultivation, and in a few years the British public will begin to see the return of the bread it so lavishly cast in the waters of the Nile.

"It was only last spring that more than \$50,000,000 was advanced at three hours' notice, and without security, to the contractors having this great work in hand.

"The largest reservoir is near Assouan. There is a tremendous cataract here which the British are busily engaged in subduing. This done they will fill up and divert the torrent and crown their efforts with a granite viaduct 70 feet high on an average, but in some places double that elevation.

"Along the top will be a broad roadway. All this is not being accomplished without a deal of commotion, and the sounds of locomotives, steam cranes, smiths' forges and nitro-glycerine explosions continue uninterrupted. Seven thousand men are employed and the work is carried on night and day. When the moon is hidden its place is taken by electric light. The granite wall will, it is believed, be high enough when completed to be safe above the fiercest Nile flood.

"Two hundred miles down the river is the subsidiary reservoir, at Assiout, where 11,000 men are employed. This work is only one-fourth done, yet considerably more than \$1,000,000 has been spent. The dam will hold up more than ten feet of water, the river here being more than a half mile wide. There will be 111 arches or openings, each 15 feet wide, all provided with sluices open below, to allow the muddy Nile water free vent, for water stored up motionless loses its fertilizing properties. There will be a navigable canal, with gates,

for the passage of the extensive trade that goes upon and down the river.

“Now and then, in spite of the tremendous Abyssinian snow mountains which help to swell the volume of the Nile, the overflow of the great river fails, as happened last spring.

“The earliest record of such a disappointment is 5,000 years old and is engraved on the walls near the cataract at Assouan.

“Again in the time of Joseph, the overflow failed, as the Bible records, and famine followed. This year, because of the engineering already accomplished at Assiout and the strenuous exertions of the irrigation department, the hitherto unavoidable sequel of the failure to overflow—famine—was averted.

“These two mammoth reservoirs each with its system of canals, weirs and dams, represent only two-thirds of the great work whose object is to fertilize Egypt. The remaining one-third is the Cairo barrage, the pioneer of all Nile dams.

“The barrage is more than a mile in length, a handsome paved roadway with embattled walls. Sluices stem the current and hold up at the proper season a wall of water from 20 to 30 feet high. The manipulation of these sluices is so clever that a child, by moving a lever, can regulate a mass of steel supporting the pressure of the Nile.

“The idea of this barrage is due to Napoleon, who, during a visit to Egypt in 1799, saw and pointed out that where the branches of the Nile part to form the delta was the spot to erect a barrier which should irrigate, by raising the level of the river, the low lands between its arms.

“Since then one ruler after another has tried to carry out Napoleon’s idea. The great structure, faultily built, was rapidly suffering ruin until in 1882 Lord Dufferin advised the work now being carried out.

“This dam does more to uphold Britain in Egypt than 10 regiments of red-coated soldiers.

“As it stands, the barrage is the most dignified, useful and picturesque engineering work in the world. Every means is offered to travelers to get an adequate view of this beautiful structure, with its slim towers and embattled gates, spanning the historic Nile.”

ADVANTAGES OF RECLAIMING THE REMAINING IRRIGABLE LAND.

FROM "IRRIGATION IN UTAH," BY CHAS. HILL-
MAN BROUGH.

Any discussion of problems arising from the contemplated reclamation of arid land should be prefaced by a consideration of the reasons justifying the economic expediency of such an undertaking. Advantages which make irrigation desirable in Utah apply with equal force to the other States and Territories of the arid region; hence, a consideration of the utility of irrigation based on Utah's experience possesses more than a local interest. A review of the economic history of the Mormon people warrants the following conclusions as to the benefits when the reclamation of irrigable lands confers:

First, irrigation promotes better methods of agriculture.

a. By introducing the small farm unit. Whatever the difference is as to water control and administration, all the States and Territories in the arid region have the common tendency of reducing their farm areas.¹ Physical configuration contributes largely to this result. There are so many small areas most valuable for facility and access to water to be found within the inter-mountain region, that subdivision is a necessity. But the real philosophy of the small farm is found in the fact that it introduces elements of certainty in agriculture never known before. There is absolute assurance of harvesting the crop. There is the ability to so widely diversify the products of the farm as to provide almost everything the family consumes. There is the scope for science and intelligence to work out the best possible result, and so secure the largest return from each acre and the nearest approach to perfection in quality. Finally, loneliness is banished from country life, because the possibilities of social enjoyment multiply in the ratio of subdivision of area.

b. By fostering intelligent farming. High intelligence and scientific accuracy must be brought into play in the investigation and development of water supply, and in the construction of works for storage and distribution. Irrigation means (1) the power to apply water exactly when needed; (2) the power to apply water in precisely the

¹The average size of the Utah irrigated farm is 27 acres; the mean average for the Arid Region, 67 acres. Cf. 11th Census, Agriculture by Irrigation, 1.

right quantities; (3) the power to give some one crop water and to withhold it from another; (4) the power to obtain in any year diversified crops in one locality. These requirements are evidences that if the water is to be utilized so as to satisfy the demand of irrigators, scientific methods must be pursued. In short, agriculture and horticulture by irrigation exhibit the same tendency to specialization characteristic of the recent development of all trades and industries. This specialization puts a premium on brains.

c. By encouraging the production of special crops. This follows as a natural corollary from the introduction of the small farm unit. Reclamation of arid lands means not so much a competition with the farmers of other sections as it does the creation of special crops of an important commercial character; accompanied by the formation of home markets, by the necessary development of mines, by the exploitation of salt, onyx and other deposits, by the building of towns and factories, by the construction of railroads, and by the increased importance of the West pastoral and timber industries.

d. By abolishing the autocratic control of water. An important result of irrigation, as practiced in the United States, has been a re-adjustment of opinions as to the limit of ownership in what may be termed "natural" wealth. The historical law of aridity is beyond question. It is that in every country subject thereto in such a degree as to require the construction of works, the storage of water therein, and the artificial distribution and application of the same to the soil before cultivation can be made a success, the natural wealth thus created in water must remain public in character, subject to the control of the users and beneficiaries thereof, and be at all times under the administration of law and local authorities.

A denial of the quality of personal property in water is a more or less distinctive feature of the jurisprudence of the arid regions. Water not being capable of identification, nor found in place, has none of the elements which legally distinguish property. In ancient times the central or sovereign authority was the autocratic source controlling water supplies for irrigation purposes; but in the United States the tendency is toward direct State supervision with municipal control and regulation. The immediate result of this socialism, as opposed to autocracy, in the use of water has been to prevent conflicts arising between the supplier and applier of water, for in the former case the applier takes as much water as he wants and pays for what he uses.

Second, irrigation through the introduction of improvements in the method of agriculture promotes commerce and stimulates business.

a. By largely increasing the product of the land, so reducing the actual labor required to raise a given quality of the produce. This would be true even if made on the supposition that conservative

farmers will for years go on in the same ruts, and after securing water will not otherwise change their practices. However, there is every reason to hope for the passage of such water laws in Utah as will increase the duty of water; and, by provision for its more rational use, still further increase the productiveness of the soil.

b. By insuring the crops, and so greatly reducing the risk of capital employed, a risk so great that farmers have become proverbial as weather-grumblers—a natural consequence of seeing their outlay of labor and wages ruined by drought. This insurance by irrigation opens the way for the advancement of agriculture as a business enterprise, lifting it from a precarious investment to a high position as a safe business pursuit. It is safe to say that farmers, as a class, pay higher rates for borrowed money, either on land or on chattel mortgages, than the great majority of other business men. One reason for this is that experience has taught lenders that requests for extension of time in the payment of principal and interest are more numerous on the part of farmer-borrowers than with other classes of borrowers, because their returns are normally subject to more vicissitudes and danger than the average. While this fact may not always be apparent as the reason for the higher rates charged, it is highly probable that the farmer class, as borrowers in an open market, are charged rates which long experience has taught are necessary to cover the risk. It is not possible to believe that discrimination is caused by prejudice, as it is probably true that the great majority of citizens are closely related by blood and friendship to the farmers of the country, and it is certainly true that money seeks safe investment and will seek the farm, if prompt interest payments can be depended upon.

If the foregoing is true, it follows that the uncertainty of crops is the cause of the evil, necessitating requests for extension of time in meeting obligations; and the more frequent such requests are in any one class of securities, the greater the harm to the credit of that class, and the higher the rates charged on future loans. In short, farming in the rain-belt section is an uncertain business as regards returns for any one year. There is no absolute safeguard against improvidence, but irrigation comes very near being such a safeguard to the year-by-year farmers. With a certain supply of water the great losses by drought will cease, and the small capitalists will not be taking undue risk when he invests money in labor on land under irrigation.

c. By making intensive cultivation not only possible but preferable, which it certainly is not where dependence is put upon natural rains. This is because when sure of a crop the investment in more labor and less land will show larger profits. In an irrigated district land rises rapidly in value in consequence of its increased productive power, and the advantages of forcing production are quickly seen by enterprising owners.

d. If intensive cultivation is preferable as a means of obtaining the largest possible returns on the capital invested, it follows that the dwellings of the farmers must be closer together, thereby opening social possibilities now denied to them as a class, and enabling cultivators to act in combination for any public or social purpose. This proposition that intensive cultivation enables farmers to live in a better social environment is a corollary from the third proposition. For with twenty-seven-acre farms 60 to 80 farmers could concentrate their homes in one locality. This concentration of homes would bring social life with both its pleasures and obligations, to each farmer's door.

Third, irrigation through the creation of business opportunity furnishes a remedy for our industrial ills.

a. By furnishing a new outlet for human energy and thus relieving the congestion of our cities. In 1850 only a little over one-eighth of the population of the United States was in cities of 8,000 or more, but so rapid has been the drift of population from the country to the town that nearly one-third of our entire population is now to be found in cities. It is interesting to note how in a single century, from 1790 to 1890, the country has lost in percentage of population while the city has gained. In 1790 the urban population was only 3.35 per cent. of the whole, while the per cent. of the rural population was 96.65. In 1820 the urban population was 4.93 per cent., and the rural, 95.07 per cent. In 1850, 12.49 per cent. of the population was to be found in villages and cities and 87.51 per cent in the country districts. In 1870, 20.93 per cent of the population was to be found in the cities and 79.07 per cent in the country. In 1890, 29.12 per cent of the population was to be found in the cities and only 70.88 per cent in the country.

Not only has the current of population set steadily in the direction of cities, but manufacturing industries have expanded and agriculture has declined. Human genius is already demanding a new field for employment, because the conditions of prosperous activity in all settled countries have been outgrown. Our cities have become the congested slum centers of idle and hungry tenants. They are neither producers in the real sense of the term, nor are they any longer equitable distributors of production. Capital can wait for an adjustment of our economic conditions, but labor cannot. Idleness is danger. Manifestly, the best remedy for the laborless is an opportunity to labor; for the homeless, a chance to earn a home. Forty millions surplus irrigable acres west of the Mississippi await the surplus of the 85 per cent of our population crowded east of the Mississippi.

But, granting that the simple system of putting surplus labor on surplus land will minimize the evil of congestion, it may be asked: (1) How are the unemployed to be transported to the place where labor awaits them? (2) How are they to be supported after they get there? (3) Having completed their labors on the canal and taken up a small

irrigation unit under it, how are they to be sustained until they get returns from their crops? (4) How is the large capital which will be required by construction companies to be raised?

In answer to these questions it may be said: (1) Colonizing experiments have shown that the burden of transportation, in case large bodies are organized to go to common points, is lightened in several ways. Western railroads are interested in the irrigation movements, as settlement of their tributary territory is their only hope of profitable operation. Furthermore, construction companies make advances on wages, because they are obtaining not merely laborers, but settlers who are to make their investments profitable. (2) Laborers will be supported after their arrival and during the period of their work on canals by construction companies which will pay so much a month and board. (3) The problem of supporting a class which starts without original capital during the period intervening between the planting of the crops and the harvest is the most serious question in the list. But it would seem to be feasible to pay the settlers but little cash for their labor while working for their board on the canals, and to pay the balance in orders good for seed and provisions. Under this plan each settler would have the same capital. (4) Capital will be raised for these enterprises in the same manner that it is raised for others. The class of securities which can be offered, based on water rights and ultimately on the land, will be "gilt-edged." The first capital required would probably be advanced in the West and by contractors. Ultimately it would be realized by the sale of securities. The holders of western railroad stocks and bonds should furnish a large market for these securities, since the reclamation and settlement of these lands is the only hope of making the railroad property remunerative.

If these conditions be true, Arid America can perhaps contribute to the solution of the problem as to how tenement wretches may become a community of home builders and bread-winning citizens.

b. By improving the condition of the laborer. The principal ills from which laborers as a class suffer today are unemployment, insufficient remuneration for work done, and a feeling of dependence. Irrigation by promoting intensive farming lowers the margin of cultivation and thus increases the productiveness, of the laborer, the source of his real wages. The small farm unit, requiring little capital for its cultivation, affords a ready market for unemployed labor and makes that labor independent of the entrepreneur class and the pauperization plans of charity.

Fourth, irrigation confers direct benefits on the State as distinguished from the individual.

a. By widening the basis of taxation. Taxes are generally paid out of the annual national production, although they sometimes en-

croach on the capital plant or the accumulated wealth of society. Considering the sources of taxation as furnished by the irrigated farm, we find that the annual farm production by irrigation in Utah in 1804 was \$8,309,000, and that the value of the capital plant, based on the average value per acre and the number of acres, was \$35,587,000. The general property tax, including tax on real estate and improvements, for Utah in 1896 was \$861,607.76. Of this \$610,820, or over 70 per cent, was contributed by the 1,035,226 acres under ditch in the State, while 51,000,000 "arid acres" contributed practically nothing.

b. By making men more independent and thus fostering contentedness and patriotism. Large enclosures mean a capitalistic organization of agriculture and a system of landlords and tenants. This is exemplified by the sheep-runs of England in the fourteenth century, when labor was hired for wages by a pasturage over-lord, and even more forcibly by the plantation system of the South, which required slavery for its existence. - Small farms, on the contrary, mean independent tenancies, because comparatively no capital is necessary to cultivate them. This is seen in the arable fields of the old English "mark", and in the village community system of New England. And just so far as irrigation creates these independent tenancies through the small farm unit, will the instinct of protecting property rights be strengthened and patriotism be fostered. For patriotism and a contented citizenship are based, in their final analysis, on the property-right.

THE COLONY-BUILDERS.

A PRACTICAL COLONY PLAN FOR TODAY.

BY WILLIAM E. SMYTHE.

I should say that the five essential points for a practicable colony plan to meet the conditions of today would be as follows:

First. The colony should be organized, rather than a matter of individual settlement.

Second. There should be a common or community fund, available for certain important purposes which are beyond the sphere of individual action.

Third. The unit of the community should be the individual family, living on its own small farm and succeeding according to its own ability, industry, and thrift.

Fourth. There should be an intelligent plan of production thoughtfully mapped out in advance and adapted to the climate and market of the locality chosen for development.

Fifth. There should be a well-defined scheme of social life, to meet the needs of educated people who require some degree of refinement and reasonable satisfaction for that social instinct which is as much a part of human nature as the appetite for three meals a day.

It is the object of this paper to set out as briefly as possible the main features of a colony plan. A subsequent article will undertake to justify these features by drawing upon the experience of various western communities, which have met with marked success.

IMPORTANCE OF ORGANIZATION.

In the two previous articles we have noted the strong economic tendency toward the organization of all lines of trade, production and transportation. If there were no peculiar reasons why the colony of today should take the form of an organized community, these great facts of current economics would furnish a sufficient excuse. It is the day of organized capital and organized energies. The producer must be likewise organized, or become the helpless victim of the various forces with which he must come in contact. But there are other reasons why those who undertake to reclaim the desert lands of the West, and to put the home and the field where the sage-brush has been, should be formed into companies, with plans and leaders and capital, in order to make the best use of their opportunities.

Settlers in arid regions find a common bond in the irrigation canal. A system of water supply cannot be handled by a single settler. It is

a matter calling for discipline and concerted management. Brought into this close and necessary association, it is an easy matter for settlers to extend the operation of the principle to their various industrial and social affairs. A party of twenty-five to one hundred families, acting collectively, can purchase a given tract of land on much better terms than the same number acting individually. My own experience is that it is actually easier to get a considerable number of settlers than to obtain a few scattered families. Many a man who would not dare to face the wilderness alone enters enthusiastically upon the enterprise in company with a goodly party of his neighbors. I think I do not exaggerate in saying that the chances of success and happiness are multiplied tenfold when settlers act together, under some intelligent and workable plan of association, rather than as individuals.

I would therefore recommend, as the first and most indispensable feature of a practicable colony plan, that settlers be organized into bodies of at least twenty five families, and that this organization precede their departure for the field of action.

THE NEED OF A COMMON FUND.

The success of an agricultural community in a new country by no means depends entirely on the industry and thrift of its individual members. There is a sphere beyond that of the individual. Supplies must be purchased and products sold. Crude products must be condensed into marketable forms. There must be banking facilities to make credit a negotiable quantity. Public improvements and general utilities beyond the reach of any single family, however wealthy, must be provided.

It is not necessary to learn all these facts by painful experience. We are not the first people who have lived in the world. Others have preceded us in just such undertakings and we may learn by their experience. If we are to have a town, with modern facilities of enjoyment, somebody must pay for it and manage it. If our settlers are not to pay extortionate prices for provisions and implements they must themselves control a means of supply. If their surplus tomatoes and strawberries are to be preserved and their surplus dairy product to be converted into butter and cheese, there must be canneries and creameries. These should be provided in advance and should be owned by those who have made their existence possible and profitable. The highest prosperity of the settlers demands that they shall have the capital and facilities to bulk their products and to ship them economically to the best markets.

Therefore I recommend, as the second important feature of a practicable plan, that settlers provide a common fund of five or ten dollars per acre to be administered by the officers of an organized colony company, in which all should be interested in proportion to their

land-holding. If the colony tract be 5,000 acres, then the number of shares in the colony company would be 5,000 also, yielding to the common treasury \$25,000, if the shares be \$5.00 each, or \$50,000, if the shares be \$10.00 each. It will be found that there is no hardship in this provision if the plan is arranged at the beginning and distinctly understood, while the resulting benefits are beyond all calculation.

THE INDIVIDUAL UNIT.

What has been said in favor of organization, and of the creation of a fund to be used for the common benefit, is not inconsistent with my third suggestion as to the importance of making the individual family the unit of the community. What we are aiming at is not Socialism, but Co-operation, limited to the important and well-defined sphere which lies without and beyond the reach of the individual.

Each family should own its farm independently and cultivate it according to its own taste and ability. We shall see in a following paper how this plan has been vindicated by human experience and how the other plan of the collective ownership and cultivation of the soil has generally resulted in bitter disappointment. "Each man's chimney is his golden milestone," says Longfellow, and each man's little irrigated farm becomes the object of such a degree of his loving labors as he cannot possibly manifest if he be an indistinguishable factor in a multitude. What the man may do for himself without encroaching upon his neighbors' rights he should be permitted to do for himself. It is only because each man cannot maintain his own store, cannery, and creamery, and lay out and improve his own town-site, that the colony company and the community fund are required. It is just here that the line is drawn between individual and community effort. And world wide experience has demonstrated that this is the place to draw the line.

FORETHOUGHT IN PLANNING PRODUCTION.

The products upon which a community is to depend both for its existence and for its profits should not be left to haphazard development, but carefully planned in advance. While the details of such a plan must be made to conform to local conditions of soil, climate, and surrounding markets, the three leading principles on which the plan should be based will be similar in all localities, as follows:

First. The variety of things which families consume and which are therefore essential to a generous living.

Second. The things which the home market will absorb, including the products of various simple industries which may be created with the colony capital.

Third. The things which bear the burden of transportation and may therefore be exported to distant markets.

The community which plans its productions along these lines is sure of a good living, year in and year out. It is founded not upon

speculation, but upon the soundest and sanest industrialism. Neither wars nor strikes nor panics may put forth a hand to stay its abundance. In good times it will prosper more than in bad times, but in all times it will enjoy a comfortable existence and, over a long period of years, will obtain a gradual accretion of substantial wealth.

THE SOCIAL INSTINCT AND COLONY LIFE.

It is a grave mistake for the planners of colonies to forget the existence of the social instinct in human nature, or even to seek to subordinate it to the demands of the physical and commercial instinct. Men, and especially women and children, are social animals. They want neighbors, friends, and the open door to intellectual association. They crave refinements and enjoyments—religion and libraries, musical and dramatic entertainments, and even the dance.

In irrigated lands, farms are necessarily small. Whereas our Plains Region of Kansas and Nebraska were settled in quarter sections (160 acres) 10 acres is a common unit where irrigation prevails. That means just 16 times as many neighbors, and there are few to object to the ratio of 16 to 1 in this connection. But even this does not tell the whole story of social possibilities in the colony life of the West. It is a common thing for farmers to assemble their homes in village centres, building on acre lots on the exterior of town sites and so enclosing their parks and business centres, with their churches, stores, and post-offices. The farms are made on adjacent outlying lands. Under this plan the colony of today results in a happy combination of the advantages of town and of country life—the benefit of neighborhood association with the independence which inheres in the ownership of productive soil. Such a community may have ready access to school, church, and store, to libraries and entertainments. It may even enjoy the delights of the club house.

The twentieth century is to see thousands of such beautiful colonies grow up in the now silent valleys of the West and wax great and powerful within the shadow of their everlasting mountains. Here the common man will build his home and rear his institutions. Instead of great cities we shall have a succession of charming villages, in which it will be difficult to observe where the town leaves off and the country begins. Here Co-operation, rather than Competition, will be the fundamental economic force. In these countless villages of the future we shall make new centres of pure living and high thinking and shall realize our dreams of equality and fraternity as never before. It is a merciful Providence that has reserved for the future an empire of incalculable wealth, capable of supporting more than one hundred million souls under conditions which will enable us to create the crowning glories of Anglo-Saxon civilization. These terms are not too warm and hopeful to forecast the future of that

great Western land, now lying almost vacant and voiceless between the Missouri River and the Pacific Ocean.

In a future article we shall see how far these colony plans have been learned of the world's successful experience, and in what small degree they are based upon the writer's enthusiasm for Arid America.

(The next paper in this series will be entitled, "The Light Of Experience On Colony Plans." It will refer to the history of various colonial undertakings in our own and other countries during the last 50 years and will aim to prove that all the features of the foregoing plan have been justified by the lessons of success and failure in this field of effort.—EDITOR).



THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

THE AGE wants to brighten the pages of its Diversified Farm department, and with this object in view it requests its readers everywhere to send in photographs and pictures of fields, orchards and farm homes; prize-taking horses, cattle, sheep or hogs. Also sketches or plans of convenient and commodious barns, hen houses, corn cribs, etc. Sketches of labor-saving devices, such as ditch cleaners and watering troughs. A good illustration of a windmill irrigation plant is always interesting. Will you help us to improve the appearance of THE AGE?

THE RICE INDUSTRY.

The people of the United States consume over 300,000,000 pounds of rice every year, less than one half of which is grown in our country. This cereal forms the principal food of one half the population of the world. It is used as a substitute for potatoes, made into flour, forms a dainty dessert and is a valuable nourishing food product. Good rice soil produces from 30 to 50 bushels per acre. A bushel weighs 45 pounds and the general market price—\$1.00 to \$2.00 per bushel—gives a fair income from an acre. Add to this the by products, straw, hulls and broken grain, and the profits are large. The Louisiana Experiment station reports rice polish worth \$21.50 per ton, rice bran, \$20.80; rice straw, \$9.13; and rice hulls, \$8.34 per ton. From these figures it would appear that the industry is a profitable one that should no longer be neglected, when such a large area may be cultivated.

Rice can be grown successfully in moist climates, where water may be had for irrigation. The department of agriculture reports that the plant can be grown anywhere south of the Ohio river, if suitable soil and climatic conditions prevail. The es-

timated area now subject to irrigation for rice culture is given at 3,000,000 acres, extending over several southern States. The crop is at present almost entirely grown in North and South Carolina, Georgia and Louisiana. All of the Atlantic and Gulf States have large areas that may be used profitable in rice fields. As the demand for rice increases every year, it is but reasonable to suppose that the acreage devoted to this crop will soon be doubled. The Chinese authorities give 1,400 varieties of rice, of which the irrigated kinds are the best. They have tried upland rice with very unsatisfactory results, still it is recommended for subirrigated land.

A low muck soil is best adapted to rice culture. The land should be thoroughly prepared for drainage and irrigation before planting. After being plowed and harrowed it is sown broadcast, at the rate of one and one half to two bushels per acre. March and April are favorite times for planting. The gold seed and white varieties are considered most profitable. In some sections the silt coming in from irrigating waters supplies a portion of the fertilizing elements. Experienced rice growers find it profitable to use additional plant

food, and put on about 450 pounds of a fertilizer, containing 6 per cent each of potash and phosphoric acid and 3 per cent nitrogen, to each acre. In some instances the sowing of three bushels of lupin seeds per acre will supply the necessary nitrogen, through the decaying of these seed. In any case the rice requires a perfect plant food having proper component of potash, phosphoric acid and nitrogen.

When the plants are six inches high the first irrigation is given, by allowing the water to partly cover the plants. Some growers wait until the plants are about one foot high before putting on the water, and then keep the ground covered, taking care however to draw off the old water occasionally, to prevent spoiling the crop. Canals are the best methods of supplying water for rice fields. These may be filled by gravity flow from the creeks or rivers, or the water lifted from wells by windmills or other power. When the grain is in the dough the water should be drawn off and the fields left to dry while the seed ripens. Cutting should be done while the straw is green, as it gives better seed and more valuable straw for feeding purposes.

Harvesting may be done by any of the grain machines. The straw should be bound in small bundles and shocked very carefully to insure the shocks to stand and keep out rain and storm. Thrashing should be done by good machines that do not break too much grain. There are improved machines for milling, which may be hauled about from place to place, and used for hulling and cleaning several fields in one neighborhood. The rice must be graded into at least six or eight classes. The prices obtained range from one cent to six cents per pound, depending on the grading. American grown rice, when properly sacked, always takes the lead in the markets. It is important that growers prepare it for the market so that there be no red rice, chalky or sun cracked grains. If farmers residing in the rice growing belt will investigate this crop they will find it

offers an excellent field for profits, on land that has heretofore been considered worthless.

JOEL SHOMAKER.

FARM LOANS AND FARM LANDS.

The demand for loans on Western farm property shows signs of becoming active again after a period of remarkable dullness. The inquiry for gilt-edged farm mortgages is brisk, especially as they still net the investor at least 1 per cent. more than the municipal and railway bonds.

Few securities are to-day better understood or more appreciated by the individual investor than the Western farm loan in a good agricultural section. This is particularly true of people of moderate means, accustomed to manage their own affairs, but who of necessity are forced to obtain a maximum return for their money consistent with absolute safety.

They have profited by the experience of others and eagerly covet the farm loan securities of the central Western States. They do not indulge in any old-time imprudence nor are their investments made in any superficial way. They realize the fact that the true and best way to place their funds is to get as close as possible to the borrower and to deal with a representative in the West whose integrity, experience and knowledge of farm mortgages offer ample protection and the highest guarantee.

While the decline in the values of farm lands in the last 30 years in the State of New York alone has reached the enormous sum of \$1,000,000,000, with a manifest decline in the productivity of the farm and the pride and ambition of the farmer, values in the reliable agricultural sections of the West are steadily enhancing and safe for a generation to come.

As fast as the amateur farmer of the boom days abandoned the farm there has come in a farmer from Germany or other European countries, severely trained by

practice in the art of soil preservation, which has filled up the West with careful, painstaking husbandmen. The sons, in turn, have an ambition to become farmers. With several good crops and a strong bank account to his credit, the Western farmer finds himself in a position to gratify the desire of the younger and growing generation, and has been looking for the "adjoining quarter" for that purpose. This may be interpreted to be the forerunner of the active demand in the farm lands which will manifest itself this winter.

In the meantime new farm mortgages will grow scarcer and they will be restricted almost to refunding loans, partly paid off, and the balance to be refunded on a more favorable basis of interest, and such mortgages as will represent a balance of purchase money for new land bought by farmer who has faith in the same and knows its value. Such securities admit of no doubt and it is but natural that the demand for them should become brisk.

Even in Western Kansas and Western Nebraska, which sections were never intended for agricultural pursuits, the changed conditions appeal to the most discriminating investors.

As water finds its own level these Western counties have adjusted themselves to their possibilities, with the stock and their dairy interests flourishing beyond expectation. Here, also, values have been enhancing, business is progressing very satisfactorily, and a condition of financial stability and contentment exists which must be a revelation to the holders of some of the defaulted Western securities, which may yet redeem themselves wherever properly nursed and cared for.

Western farm loans and farm lands are the peer of any securities offered, and to-day the investment world attests to the truth of this allegation by the unlimited confidence which is once more being accorded in them.

MONEY IN POP CORN.

The demand for pop corn increases every year, yet, the crop is never equal to the market. Good corn sells on the retail market today for five to six cents a pound. Farmers do not consider the profits of this special crop or there would be more grown for supplying home demands. An acre will produce from fifty to one hundred bushels of salable corn and a ton or more fodder. The corn weighs 56 pounds to the bushel and never sells for less than \$1.50 to \$2.50 a bushel. The farmer will pay for the cost of growing and the corn be left as a fair profit after paying rental and interest on the land. From those who make a business of raising pop corn I learn that a poor crop will bring \$100 an acre, and many get double that sum from an acre every year.

Pop corn requires about the same soil as that demanded by the sweet and field varieties. A sod or vegetable mould, containing more sand than clay and having previous clean culture is best adapted to corn growing. If plowed in the fall or winter and left to freeze until the spring weeds begin to grow before planting the land will be in fine condition. As the plant ripens during the hot summer months the use of nitrogenous fertilizing elements is not very beneficial, but there is no field crop that yields better returns from liberal application of potash and phosphoric acid. Numerous experimental stations report that potash alone has increased the yield of field corn over 20 bushels per acre, and added one half ton of fodder. The increase in pop corn is more marked by using 500 pounds of a fertilizer containing 10 per cent potash and 8 per cent phosphoric acid than by any other means.

There are different varieties of pop corn, all possessing merit as marketable crops. The white rice is probably the most in demand, but yellow or golden, gives perfect satisfaction to those who purchase by the carload for commercial purposes. The Mapledale Prolific is a very choice variety

having from eight to twelve good ears on each stalk. There are several mixed colored kinds much esteemed for ornamental frames of dainty handwork. When popped, one quart of good corn will make a bushel of balls or bricks in which form it is usually sold at confectionary stands, pleasure resorts and thousands of other places. The pop corn business has become so important that large sums are paid for privileges of selling at fairs, picnics and public conventions.

The corn gets better with age, but it can be sundried and made marketable the first year. As a general rule the poppers want it three years old. After getting thoroughly dry in the shock it can be husked put in gunny sacks and left in the sun for several days, when it will be thoroughly dried. If completely dried it will sell better after being shelled, which can be done with a commercial shellers. Many farmer boys might find a very profitable winter trade in popping corn, buttering the rolls and selling it in neighboring cities and towns. Two or three quarts, costing less than a dollar, will plant an acre. The cultivation is about the same as for field corn, and consists in keeping the plow going and cutting out the weeds. It must not be put in near field corn, as the pollen will cause the varieties to mix.

Pop corn may be planted closer than any other varieties. One man reports having grown 176 bushels the past year upon an acre. His plan of planting is to make the furrows three feet apart and have the corn stand one stalk in a hill, fourteen inches apart in the rows. If the corn is planted very early or late it will not suffer so much from the worms as the medium planted crops. Where irrigated care must be taken in keeping the water from the stalks and not give the plants more than two periods of irrigating during the growing season. The poor ears can be fed to poultry with profit and the fodder is relished by the cows, sheep and horses. A ready market always awaits the grower of good pop corn and the business is certainly profitable.

JOEL SHOMAKER.

SUGAR OF WATERMELONS.

D. Hanz, a farmer and gardener, of Bowling Green, Ky., has recently made some successful experiments in making an excellent quality of syrup from watermelons. He will shortly attempt to convert some of the syrup into sugar, and expects to be successful.

Mr. Hanz figures a big profit in melons if used for making syrups. In an interview he said:

"From 18 melons, weighing from 20 to 25 pounds, we made two gallons and one pint of syrup. We cut the melons in halves, cut out the pulp, ground it in a cider mill and pressed out the juice. We boiled the juice in porcelain kettles on the kitchen stove for 12 hours. With a cider mill and hot air or steam evaporator two men can make 25 or 30 gallons of syrup per day. At the above figures it would take about 270 melons to make 30 gallons of syrup, worth \$15. Melons would be worth at wholesale about \$5 or \$6, and it would take two or three days to haul and sell them at market. With a mill and an evaporator in the melon patch, a farmer and one or two hands could realize 100 per cent. more by making them into syrup and feeding the refuse to hogs, cattle, horses and chickens, which eat it greedily."

CUTTING OFF BEET TOPS.

Secretary Wilson tells a story to the Chicago Record which illustrates the uses of adversity. A farmer out West planted a lot of ground with sugar beets. They grew beautifully and sent out a glorious foliage of dark red leaves, with deep red veins in them, which he admired very much. A tornado came and cut them off close to the ground. The poor farmer was discouraged. He decided that he would give up farming and go back East. Before they had finished packing, however, he noticed new, healthy shoots coming from all the beets, and told his wife he guessed they had better wait a while and see what happened. In a few weeks the foliage was

as fresh and strong as before, so he hoed out the weeds with confidence of getting a good crop. When he dug up those beets and took them to the sugar factory that Fall they were found to contain more saccharine than any others that were offered, and on investigation at the experiment station it was decided that their superiority was due to the storm.—*Pacific Tree and Vine.*

A GRADUATE.

"There is one college in this country, and only one," said William Robinson, buyer for a North Carolina house, "where butter is made and sent out duly certified the same as a graduate. The State Normal and Industrial College located at Greensboro in our State is fortunate in having a large and fertile farm attached to it. This farm is now used for dairy purposes, it being stocked with a fine herd of Jersey cows. The girl students are required to milk these cows and convert the milk into butter. The girls as a rule take a great deal of interest in this novel branch of their studies, and it is not an unpleasing sight to see forty or fifty pretty milkmaids going out in a body to milk the cows. The girls have reached a high state of perfection in the science of butter making, and the butter is much sought after by the fastidious in Greensboro and vicinity. Every pound bears the college stamp and so excellent is the quality that the demand has got beyond the capacity of the dairy farm to meet it."—*N. Y. Commercial.*

THE NEGRO AS AN AGRICULTURIST.

Every aspiring colored man who may have the opportunity and inclination to read Booker T. Washington's article on "The Opportunities of the Negro," in the *Atlantic Monthly* for November, will finish his persual of that admirable dissertation on the race question with a more exalted hope for the future of his people. It may perhaps be claimed that Mr. Washington's optimism is too pronounced, and that his passionate devotion to the upbuilding of his race impels him to take a too roseate view of its progress toward intellectual and industrial advancement. Nevertheless, the fact remains that this gifted educator is profoundly in earnest and thoroughly practical in his arguments and conclusions. In the article in question he makes the notable observation that the negro acquired a knowledge of agriculture "during slavery, and hence in a large measure he is in possession of this industry in the South today." Being in this advantageous position the colored man, Mr. Washington declares, "can buy land in the South, as a rule, wherever the white man can buy it, and at very low prices," and he urges that philanthropy be directed toward aiding the negro to acquire an education in farming, dairying, stock raising and horticulture. He sees in this mode of practical instruction a most effective means by which a solution of the perplexing race problem may be reached; and certainly no one can gainsay the soundness of his belief in this respect.

ODDS AND ENDS.

IRRIGATING THE VALLEY.

Land owners in the Spokane valley are taking keen interest in the project of D. C. Corbin and W. L. Benham to put a large part of this beautiful valley under irrigation. At Rathdrum, the citizens held an enthusiastic meeting, and it was the sense of the gathering that the construction of the irrigation ditches meant much for Rathdrum and the Spokane valley. A citizen's committee was appointed to confer with the promoters.

After careful surveys, Mr. Corbin and Mr. Benham are convinced that the plan is entirely feasible. The Spokane valley, running in an easterly direction from this city for 30 miles, presents a beautiful expanse of undulating grass lands. Here and there farms and gardens have been planted, and on the upper part of the valley fair grain crops are grown without irrigation. Where extensive cultivation has been practiced excellent gardens have resulted. But on the whole, and taking one season with another, the rainfall is insufficient for the warm gravel soil of the prairies, though the occasional seasons of unusual rainfall have demonstrated what could be done with abundance of water.

This water is near at hand. Near the state line, both in Washington and Idaho, Nature has carved out a number of extensive reservoirs. Some of these are almost on the borders of the valley, and others lie only a few miles back in the hills. It is now proposed to gather the waters of Hayden, Fish, Newman, Coeur d'Alene, Saltese and Libérty lakes, and convey them in pipe-lines and ditches over the rich soil of the prairie. The enterprise contemplates he irrigation of about 100,000 acres.

This undertaking is the most important improvement now on foot in this city and section. If carried out it will provide valuable and productive homes for several thousand farmers, market gardeners and dairymen, and convert the bare valley into a vale of unusual beauty. Spokane will be made still more attractive as a home place, and a source of enduring wealth will be brought into existence. — *Spokeman Review*, Spokane, Wash., Dec. 31, 1899.

MCCLURE'S.

The February *McClure's* opens with a second instalment of "The Life of the Master," by the Rev. John Watson (Ian Maclaren), illustrated with four of Mr. Liuson's brilliant paintings reproduced in the colors of the originals, and a number of beautiful drawings in black and white. In both text and illustrations, the work increases in interest and distinction as it progresses, and more and more decisively sets a new standard in magazine publication.

THE FORUM.

The Forum for February contains many articles of great merit, nearly all written by well-known authorities. Lieut. Gen. Den Beer Poortugaal, of the Holland Privy Council, contributes the leading article on "The Relation of England to the Transvaal;" an able paper is furnished on "The People's Party" by Senator Marion Butler, Chairman of the People's Party National Executive Committee. President Charles Dabney, of the University of Tennessee, writes a timely article on "Washington's University." Two papers of the Old-Age Pension Prob-

lem in England are contributed by two eminent men, the first by Michael Davitt, M. P., on "A Plea for Old-Age Pensions," and the second by Rt. Hon. W. H. Lecky, the brilliant, English historian, on "Why I Oppose Old-Age Pensions." David Wilcox throws new light on "The Futility of the Anti-Trust Issue," and William R. Thayer writes an unusually convincing paper on "Longevity and Degeneration."

REVIEW OF REVIEWS.

The February number contains an interesting article which will probably be of interest to every-one who knew the great evangelist, (and their names are legion) a character sketch of Dwight L. Moody, written by George Perry Morris. Another timely and intensely interesting subject, is the position of England at the present time and this is ably discussed by W. T. Stead, under the heading "The Perilous Position of England." Among the other articles are "A French View of the German Empire" and "George Henry W. Lawton."

SCRIBNERS.

Scribner's Magazine for February has for its frontispiece a portrait of Donald G. Mitchell, recently drawn from life by A. I. Keller. It is accompanied with an article on "The Master of Edgewood," by Arthur Reed Kimball. "The Opening Period of the Boer War" is brilliantly described by H. J. Whigham. There are two articles, of special significance at this time, in relation to our colonies. Major T. Bentley Mott, late adjutant-general of the department of Havana, describes "The Social life of Havana."

One of the most essential things to a complete Gasoline Engine irrigating plant, in our estimation, is the utmost reliability of the engine driving the pump.

We have recently come across a Witte Gasoline Engine, located in Southern California, which the writer was informe

had been running for 34 consecutive days of 24 hours each, without even shutting down the engine. This was accomplished by wipe oil cups on all movable joints, by absolute, perfect, electric ignition of the gasses in the cylinder, and by the high perfection of the workmanship obtainable on such an engine.

We believe it to be the longest and best test ever obtained from any make of gasoline engine, and the Witte Iron Works Co., Witte Gas and Gasoline Engines makers of are certainly to be congratulated upon this result.

Anyone desiring any further information on this subject will be accommodated by addressing the Witte Iron Works Co., of Kansas City, Mo., or their Western agents, Chas. B. Boothe & Co. of Los Angeles, California.

PHYSICAL CULTURE.

The following extract from an article on longevity by Prof. James W. Grahame, in *Physical Culture*, January, 1900, must appeal to every sensible physician:

"As life's statistics prove, it takes the average human being longer to wear out than, to use an expression, 'rust out,' and while thousands die daily from want of exercise, few indeed succumb like the professional athlete to over-exertion. If you are a parent do this: Send the young children to the turning school, the older ones to the gymnasium—then go yourself. While attending these colleges of health, and watching the little ones go through their simple-looking studies, bear in mind the young scholars are doing what you should have done years ago, viz.: sewing the seeds of longevity and assuring strong and comfortable old age. Stiffness of limb and joint is ever the forerunner of human senility; therefore to all—I include both sexes—who are desirous of lengthening their days, try and 'postpone the inevitable' as follows: Every morning—I say

every—devote ten minutes at least to exercises which tend to strengthen the muscles of the abdomen and chest. The effects of this will be felt in a week or two and show themselves in health, strength, vigor and appetite. Recollect you are now exercising certain portions of the vital organs which for years you have carried about and hardly used. But whatever you do persevere with your home treatment, none the less sure because not pre-



scribed by the family physician. Your own sense or ingenuity will suggest what movements tend best to develop the parts required, or if your ingenuity fails, consult some turning or gymnastic instructor; either will tell you. To digress—strange but true, the stomach, the most important and weakest part of the body, invariably gets the least care. Whoever thinks of exercising the stomach? And yet when dissolution sets in, as a rule here is where it commences. Therefore, when practicing your daily calisthenics give it extra attention, which the grateful member will soon acknowledge by allowing you more liberties at the table. Physical culture alone is the true basis of longevity, especially when directed to strengthen those parts which by nature are essentially weak. Of course all this, unless accompanied by early soberness and chastity, becomes null and void."

Bernarr A. Macfadden, in *Physical Culture* for January, in an article on the above subject, gives the following simple and practical rules for developing the muscles of the body without apparatus:

First, the room must be well ventilated. Pure air never hurt anybody, but bad air has murdered millions of human beings. The less clothes to hamper the movements the better. Take the exercises immediately on rising or just before retiring. After finishing the movements here illustrated an exercise similar to jumping a rope might be indulged, or, if strong, jump back and forth over chairs or other objects.

Continue each exercise until thoroughly tired. Immediately after the exercise rub the surface of the body all over with a soft bristle brush or rough towel. Then take a cold shower or sponge bath.



Every one desires to possess strong arms. They add to one's dignity, energy and confidence.

Assume the above position, hands tightly closed, bring hands up and down quickly, about two movements to a second, from twenty to fifty times. Now, hold the elbows tightly against the body, then flex strongly the upper arm just as though you were lifting a very heavy weight, and bring hands up and down several times very, very slowly. Grip a handkerchief or some-

thing tightly in each hand during this exercise and the grip will also be increased greatly in strength.

The importance of strong lungs and chest can hardly be over-estimated. This movement is specially good for strengthening the lungs and for filling out unsightly hollows near the collar-bone from which many young ladies suffer.

Assume position as above. Inhale until the lungs are completely filled. Now retain this breath and bring the arms far forward and backward with elbows straight on a level with shoulders as long as the breath can be conveniently held. Continue several



times the same exercise very, very slowly, flexing the muscles with great tensivity, as though some one were resisting your efforts.

If one desires grace and ease in the handling of the body, the muscles of the legs, waist and hips must be strong and shapely.

This exercise is excellent for this purpose. Stand erect with feet far apart. Now bend to one side and touch the floor out as far to the right side as possible. (See figure.) Same exercise to the left. This one exercise uses the muscles of the thighs, calves, back, sides, hips and shoulders.

The strengthening of the abdomen muscles is of great aid in remedying digestive troubles. It seems to vastly increase the powers in this way. This movement can be especially recommended for building digestive strength and for reducing large abdomens.

Lay flat on the floor, hands on thighs. Now rise to a sitting position, keeping the feet on the floor. If you have difficulty at first in holding the feet on the floor, place them under a sofa or chair. If the movement is too difficult even then, place one hand on a chair to assist your rising.

Weakness and pains in the small of the back are common complaints. Every one seems to occasionally suffer from this trouble. This movement is warranted to cure it, and furthermore, will enable you to walk more erect.

Keep the knees rigid, bend down as illustrated above. Now keep the arms straight at elbows and quickly raise the hands as high as you can reach overhead. Hands back to first position, and continue back and forth until tired. After considerable practice you may be able to touch the floor with the knees rigid. You can also practice this movement as described in the first exercise. Make movements very, very slowly, and flex the muscles strongly as though you were lifting a great weight as your hands go up.



In the *American Journal of Medical Sciences* for November A. Stengel calls attention to the results of his observations over a period of six years made upon the student athletics of Pennsylvania University.

A series of charts illustrating the conditions of the heart before and after athletic exercises, demonstrate the fact that the "untrained" cardiac dilatation and murmurs are usually developed after severe muscular ef-

forts, while this condition does not occur in the "trained" and "seasoned" men.

Several instances are cited showing marked ventricular hypertrophy, with oppression and dyspnea occurring early after the cessation of active exercise. The author has met with numerous cases of disorders of the cardiac muscle in middle and later life which, in his opinion, can be attributed



to the "remote consequences of over-exertion in early manhood," and he believes that the blood pressure is increased "from the cardiac hypertrophy if for no other reason." He has found over-distension of the heart frequently in athletic contests, and hypertrophy and over-action as a result of continued athletics.

His conclusions are that any over-exertion are markedly detrimental to those not in regular training, and advises that all athletic sports should be under the supervision of a physician during the "athletic period of life" and a gradual, rather than sudden discontinuance of the severer muscular exercises.

With several other physical directors, Dr. W. G. Anderson, of Yale, has been carrying on a series of observations in order to determine the kind of exercise best to develop the physical strength of athletes. It was found that baseball players were the only ones who lost weight during their season of training. The track athletes and the gymnasts gained most rapidly.

A Fall-Crick View of the Earthquake.

I kin hump my back and take the rain,
And I don't keer how she pours;
I kin keep kind o' ca'm in a thunderstorm,
No matter how loud she roars;
I hain't much skeered o' the lightnin',
Nor I hain't sich awful shakes
Afeared o' cyclones—but I don't want none
O' yer dad-burned old earthquakes!

As long as my legs keep stiddy,
An' as long as my head keeps plumb,
And the buildin' stays in the front lot,
I still kin whistle some!
But about the time the old clock
Flops off'n the mantel shelf,
And the burro skoots for the kitchen,
I'm a-goin' to skoot, myself!

Plague take! ef you keep me stabled
While any earthquakes is 'round—
I'm jist like the stock—I'll beller,
And break for the open ground!
And I 'low you'd be as nervous,
And in jist about my fix,
When yer whole farm slides from inunder
you,
And on'y the mor'gage sticks!

Now cars hain't a-goin' to kill you
If you don't drive 'crost the track;
Crediters never'll jerk you up
Ef you go and pay 'em back;
You kin stand all moral and mundane
storms
Ef you'll only just behave—
But a' earthquake—well, ef it wanted you,
It 'ud husk you out o' yer grave!
—Indianapolis Journal (about 1884.—Ed.)

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A PUBLIC WRITER.

JOEL SHOMAKER, late editor of *The National Farmer and Dairyman*, has severed his connection with that publication and resumed the work of a public writer. He writes advertisements, circulars, price lists and booklets for business men; prepares essays and speeches and criticises manuscript for students and teachers; compiles histories, genealogies, biographies and reminiscences for families; and writes stories, sketches and general articles for newspapers and magazines. He answers questions about Washington and the West if stamps are enclosed, and gives instruction on Journalism at reasonable rates. His field of labor reaches every State and Canada and Mexico. Editors of agricultural, sporting and travel publications will cheerfully testify to his abilities as a writer and capable instructor. Address him at North Yakima, Washington, if in need of his services in any line.



THE IRRIGATION AGE.

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THE PROGRESS OF WESTERN AMERICA.

Of Benefit To All. In discussing the subject of storage reservoirs and the part the National government should bear in their construction, it is often urged that this would be unjust to those who are not benefited by the reservoirs and who are not interested or profited by irrigation. But are not all citizens of this country benefited thereby, at least indirectly? The National Irrigation Association in regard to this matter says that the manufacturers of this country are beginning to realize that national irrigation is a subject in which they are directly interested. The problem is not an intricate one. Every merchant is looking for new accessible markets in which to exploit his goods. If irrigation shall reclaim ten or twenty or a hundred million acres of fertile land in the West and people it with as dense a population as exists in the East, it does not take any remarkable business acumen to see how the manufacturer profits thereby.

The building of storage reservoirs for the West is as much within the province of the national government as is the building of levees and other protections against the Mississippi floods. The question is sometimes asked whether those in favor of the storage reservoir policy propose to do away with the levees and expend the money for storage reservoirs. The answer to this is that if there were

nothing to increase the volume of these rivers they would not overflow in disastrous floods and levees would therefore not be needed. The reports of official engineers are that if storage reservoirs were constructed at the head waters of these rivers, floods would be done away with, since the surplus water which now runs to waste, causing ruin and disaster, would then be stored up for use in dry season. Millions of acres of desert land could in this way be made available for agricultural purposes. With such good results to be anticipated from the construction of reservoirs it is easy to see why there are so many advocates of this policy.

Truth and Fiction Very often a writer gives to the public a true story which is regarded as fiction pure and simple by his readers. Seldom does the author receive the high compliment of having a fictitious tale accepted as a statement of scientific truth. This was what recently happened to a writer in *McClure's* magazine. The story in question was published in the October, (1899) number and was entitled "The Killing of the Mammoth" by H. Tuckeman. According to the story the mammoth was found and killed and the remains sent to the Smithsonian Institute. So well told was the tale that it was accepted by many as the truth and inquiries began to pour in to

Smithsonian Institute and to the editor of *McClure's*, asking for further information regarding this mammoth.

To clear up the misunderstanding the editor of the magazine presented in the February number an article called "The Truth About the Mammoth," prepared by F. A. Lucas, of the National Museum, together with an explanatory note by the editor.

Should go With the Land. The West would long since have had working examples of national irrigation and government construction of reservoirs, had it not been for western opposition. This statement has been made by Hydrographer Newell of the Irrigation branch of the Geological Survey and by others who have been connected with irrigation development, surveys, etc., for a long period of years. It was thought at first that vast fortunes were to be made out of dam sites, the construction of reservoirs by private capital and the selling of water-right to settlers. But the experiences of the last ten or twelve years have shown that private capital in storage reservoirs is not generally a good investment. Right here comes in the question of title of water, and whether the rights to the water should go with the land. Irrigation investments have proven safe, and money can now be found for investment, only in projects organized as co-operative canal companies, or where the title of the land and the necessary water is united, while under the water-right system it is impossible to longer secure the investment of intelligent capital.

The difference between the two plans is very clear. Under one, the farmer owns the land and the company sells the water-right. This is the system which has almost invariably turned out disastrously. Under the other system, the owner of the land also owns a share in the water property, so that the ownership of land and water is united. This is the successful system. So with proper manage-

ment, the co-operative system can be successful as far as it goes; but it is necessarily limited in extent.

At this point national irrigation comes in. Some have conceived the impression that national irrigation contemplates the building or ownership by the government of all reservoirs and irrigation works. This is erroneous. No one proposes such a policy. The national irrigation movement contemplates the construction of reservoirs, etc., by the government, only when such work is beyond the scope of private enterprise or private capital, while at the same time national irrigation would operate along the same lines as co-operative irrigation, that is, it would mean land and water ownership in one, only the water ownership would be a public instead of an individual ownership.

Siberia and Irrigation. To the average person Siberia is associated with the idea of Nihilism, political prisoners and intense cold, and little, if any thought is given to its agricultural pursuits and possibilities. Siberia is a vast country and while portions of it—especially those to which political prisoners are banished—have a severe and rigorous climate, there are millions of acres of fertile land well adapted to the growth of grains. Irrigation is practiced here to some extent, but in many places the winters are so long and cold and the short summers so hot that the streams from which the irrigators depend for water, are dried up. "Necessity is the Mother of invention" and the following method, described by the National Irrigation Association, has been devised to secure water for irrigation purposes.

"The farmers of certain districts construct each year storage reservoirs, and in the summers use the contents, reservoirs and all, for the support of their crops. They do it in this manner: During the winter they collect great drifts of snow in the bottoms of deep, shaded valleys, rolling it down the sides in immense snow balls and there pressing and compacting

it so that it will be the more resistant to thawing. At the end of the winter they cover the enormous piles thus formed, with branches, straw or trash, in order to protect the snow from the sun's heat. All during the Spring this mass of snow melts a little during the days but freezes at night until it becomes a great solid cake of ice. Then, when the temperature rises to summer heat and the streams begin to dry up from lack of rain, this snow ice commences to melt away, and by means of a ditch leading from it, the water which runs down supplies the river until the recurrence of rainfall."

The Christian Newspaper. In a few days the Rev. Sheldon's newspaper will be launched upon the world, and the public will have an opportunity to see how he fulfills the promise made to run a daily newspaper as Christ would run it. We have spoken more in detail of this venture in a previous issue. The Topeka, (Kan.) *Daily Capital* is the medium Rev. Sheldon will use for conducting his experiment. As is pointed out by one of the Chicago newspapers this publication of Mr. Sheldon's will not be a true experiment and will prove nothing "for a single week," as the editor of the *Chronicle* points out, "it will be easy enough to draw such artificial support as its novelty may create. It is the pace that tells in the life of a newspaper, not for one week, but for a series of weeks and years." Mr. E. W. Howe, editor of the *Atchison Globe*, announces that during the week in which this experiment is being carried on in Topeka; he will publish daily sermons in his paper on "How Ministers Should Preach the Gospel." Mr. Sheldon says his plans are not entirely matured but that he will personally inspect all matter that goes into the paper, during the week he is in control

and will subject it to the test "What Would Jesus do?"

Our Near Neighbor. *Modern Mexico* says the United States is the only country with which Mexico does business in which the foreign country does not hold the balance of trade in its favor. The United States sells Mexico more than all the rest of the world, but she also buys more than three-fourths of all Mexico sells abroad. The two republics are good neighbors. They are getting better acquainted and doing more business with each other every day. The agricultural development that has been going on in Mexico during the last few years, is beginning to tell. The modern machinery introduced, the new reservoirs that have been built, and the new plantations that have been started, are increasing the country's output very materially, and the value of the agricultural exports of Mexico is showing an increase month by month.

Free Delivery To Farmers. The Postmaster General came near causing a civil war by introducing the free delivery of mail in a rural district in Maryland, but in Wisconsin the farmers took the opposite view of the system. Mr. Hyatt, of Sheboygan Falls, says: "One thing I know, I shall write a great many more letters. You see I know if I write a letter and just step and put it in my mail box that ends it. In the last year I traveled a great many miles to get my mail. Farmers if they but know it can learn enough about the weather to pay them several times what a good daily would cost. Scores of times a farmer can plan his work to his advantage if he can know what to expect of the weather for the next twenty-four hours. The weather man can beat corns and rheumatism three or four to one predicting

weather. I always want to sow my turnip seed on freshly cultivated ground, and depend on a dashing shower to cover it; also grass seeds. It is so nice to have my Uncle Samuel send me word to my farm when I may expect a shower. Three cheers for rural delivery and may the time come speedily when every farmer in this big blessed land may have his mail brought to him as I have now."

And Henry Walsh strikes a keynote when he says: "I think the system is for farmers one of the most important improvements that the post office department ever made, more than cheaper postage would be."

It means not less cost but better service. Let us rejoice that the farmer has at last been recognized by the government through the post office department.

BETTER A SMILE.

BY J. MERLE STEVENS.

Better a smile than a sigh, my dear ;
 I wouldn't be frowning so ;
 This world has some hardships and
 sorrows, I own ;
 We can't have all joy, you know.

Better look up and not down, my dear ;
 Better be happy and glad ;
 You may have some troubles and bur-
 dens to bear,
 But then I wouldn't be sad.

Better be kind and not fret, my dear ;
 Make somebody's life more bright.
 In helping another his burdens to bear
 Your troubles will all come right.

Better to sing than to cry, my dear ;
 Don't look on the dark side so ;
 There's somewhere a cure for all pain,
 I hold,
 A comfort for every woe.

So better a smile than a sigh, my dear ;
 I wouldn't be frowning so ;
 This world has some hardships and
 sorrows, I own,
 We can't have all joy, you know.

INDIA'S GREAT FAMINE—MILLIONS STARVING.

THE BOER WAR OCCUPYING ENGLAND'S ATTENTION AND TREASURE IS A DISADVANTAGE TO INDIA.

[From the National Irrigation Association.]

India is again confronted with the misery of a great famine and England, even with a disastrous war in South Africa upon her hands, will have to stretch forth a strong arm to help the suffering millions of her far eastern peninsula. Over 50,000,000 souls are now reported to be affected by the famine, and with the famine area rapidly expanding. A London dispatch states that the sum of \$8,700,000 will be expended on "relief works," and that already over 8,000,000 persons are receiving relief. Water, or rather its lack, is the cause of the affliction. This year both the monsoons and the winter rains failed and left the earth parched and dry for months.

Yet the English, by their public works in India and their great irrigation projects, have vastly added to the producing capacity of the country and have greatly ameliorated the natural condition of the natives. The products from irrigation for last year, according to the Indian official figures, amounted to 450,000,000 rupees.

NATURE'S MIGHTIEST WORKS.

India includes within her borders the highest mountains in the world and some of the mightiest rivers and greatest plains. The great Himalaya range, 1,500 miles long, lying across the northern border, shuts out the rest of Asia. Mount Everest, the highest peak in the world, pierces the sky 29,002 feet above the tides, while peaks over 20,000 feet elevation abound in all parts of the range. There are numerous well worn trails leading from India across the Himalayas through Kashmeer and Nepal into Thibet and China, and the passes on these are from 16,000 to 19,000 feet high. In making such a journey the traveler for several days remains above 16,000 feet altitude. Only one pass is as low as 16,400 feet.

The historic Ganges, the Indus and the Brahmaputra are the three great rivers of India. These with their affluents drain an area of

nearly 900,000 square miles. Their waters are largely used for irrigation, constituting in reality the life blood of much of the country. The flood discharges of these great streams are enormous. The Ganges alone, in flood, may discharge 1,350,000 cubic feet per second.

HEAVIEST RAINFALL IN THE WORLD.

India's rainfall, which is accountable for this immense volume of water, comes exclusively from evaporation from the Indian Ocean and the bays on either side of the peninsula. The distribution of this rainfall is extremely varied, ranging from a couple of inches a year, or in some sections practically nothing, to over 600 inches, which falls in a limited area in Assam. At Chara Pungi, Assam, the maximum rainfall of the world is reached in an average annual precipitation of 363 inches, while at this place in 1851, thirty inches fell in twenty-four hours and 305 inches fell during that year. These figures can be appreciated when it is remembered that the annual rainfall in the Atlantic States on the American seaboard is from 30 to 45 inches, and that in the West farming is conducted without irrigation on as low an annual rainfall as 15 or 16 inches.

STUPENDOUS IRRIGATION WORKS.

The irrigation works of India are the vastest in the world, watering over 20,000,000 acres of very fertile soil. The government has entire control over all sources of water supply and so exercises it as to make it the greatest benefit to the community at large. Each province has a separate department known as the irrigation branch, at the head of which is a chief engineer, while over all the chief engineers is an inspector-general of irrigation. The Indian government is greatly in favor of the extension of irrigation works. It fosters the use of irrigation waters by placing the water rates very low or by even giving the water away in years of scarcity. The Indian irrigation works have generally been of the most substantial and indestructible character, of solid masonry and great strength. In some instances canals of immense volumes of water are carried clear over other rivers.

There are in India two classes of irrigation works, which may be termed productive and protective works. In general, protective works have been constructed as a protection against famine, such as now stares India in the face, and they act in the amelioration of such disasters in two ways. First, they are constructed during famine times to give employment to the people and furnish them money and food for their sustenance; and second, after their construction, they are expected to furnish protection against future famines in those districts. Most of these protective works consist of storage reservoirs, but they have been constructed in regions semi-arid, and they have generally proven financial failures, while the so-called "productive"

works have earned good interest on the investment. From all of which we can learn a lesson applicable to America's arid West. The productive works have been constructed in arid regions so barren and devoid of water that nobody could live there to produce crops of any sort without irrigation, therefore those who immigrated to the country were compelled to use the water and make the works do full duty. On the other hand, the protective works have been built in semi-arid regions where crops can often be raised under the natural rainfall, so that the works have been in entire disuse through some seasons.

STORAGE RESERVOIRS A SUCCESS IN ARID REGIONS.

Anywhere in our arid West, where irrigation works can be constructed, it is reasonable to suppose, therefore, judging from analogy, that when a sufficient population settle below them, the works will be called upon to supply their full capacity, and if they have been carefully planned and estimated for, economically constructed and administered under a proper system, they should return fair interest on the original outlay.

It has been in our semi-humid region of the United States, where there are naturally good crops once in several years, that hard times have fallen the hardest, but it is also here, judging from Indian experience, that irrigation works would pay least, because they would not be continuously used.

WHEN Y'ER FEELIN' RECKLESS.

BY VINCENT JONES.

I.

When y'er feelin' reckless—
 Don't care how things go—
 Light your darlin' corncob
 'N watch the smoke rings grow.

2.

'Pears like pleasant mem'ries
 Haunt the corncob bowl;
 When the 'backer's burnin'
 Out they allus roll.

3.

Somehow thoughts of trouble
 Disappear in smoke,
 'N sweeter rev'ries lighten
 Up the heart that's broke.

ORIGINAL IRRIGATORS OF THE WEST.

BUT THEIR INDUSTRY HAS NOW DEPARTED.
CROWDED OUT BY THE WHITE MAN.

From National Irrigation Association.

Four hundred years ago according to the narrative of that intrepid Spanish adventurer, Cabeza de Vaca, the portion of Southern Arizona now occupied by the Gila Indian Reservation, grew luxuriant crops of fruit and maize for the friendly Pima Indians. This explorer describes them very much as they are to-day. They occupied the same lands as at present and were industrious farmers and irrigators, as they continued to be for many years after the acquisition of Arizona by the United States. They have raised corn, wheat, pumpkins, beans, sorghum and vegetables in profusion; they have lived in small villages and held their lands in severalty and they are expert weavers of fine blankets and cotton fabrics. All this has been accomplished through irrigation, practiced by them since before the discovery of the New World.

What is the situation in this reservation to-day? Those philanthropists who bewail the passing of the American Indian, may well turn their attention to the destitute condition of the Pima Indians, brought about by the push of the white settler and the criminal neglect of the Government, whose wards the Indians are.

The Pimas have always been friends of the whites and enemies of the Apaches. They gave aid and succor to the early white pioneers and their tepees were always open to peaceable whites or Indians when hard pressed by the savage foe. It is to-day their boast that their hands have never been stained by the white man's blood. It was under these conditions that they were joined about a century ago by the Maricopas who came as fugitives from the more powerful Yuma tribe. When the belligerent Apaches broke out upon the warpath, the troops of the United States often obtained substantial aid and subsistence from the gentle Pimas. Their agriculture has been carried on entirely by irrigation with water diverted from the Gila River. The tribes have always supported themselves, but have shared their world's

goods with the poorer Indians to the south of them not favored by irrigation. They have learned readily at the government Indian School and their progress towards modern civilization has been regarded as one of the encouraging features of the Indian problem. During the last ten years their irrigating water—their life blood—has been taken away from them and they are perforce, lapsing into indolence, misery, and vice.

The waters of the Gila, above them, have been diverted by white settlers and instead of waving fields of green, they now, during the summer, look out upon the dry parched earth. Year after year they plowed, and sowed and irrigated their crops, only to see them wither and die before maturity owing to lack of sufficient irrigation water in the dryer months. A few who are favorably located at points where water appears in the dry bed of the Gila, can still mature their crops, others can eke out a bare existence by hauling wood or other precarious employments while the larger number have become more or less dependent upon charity or have degenerated into thieves and vagabonds.

About 6,000 of these Indians are dependent upon the lands of the Reservation which contains 350,000 acres, while the water supply in the Gila last year, owing to use for lands above, has not been sufficient to irrigate 1,000 acres belonging to the Indians. Fully half the crops planted have not produced enough for seed, notwithstanding the great fertility of the soil. Two acres per Indian of irrigated land, has been shown by competent authority, as ample land for their use and comfort.

Government engineers have pointed out the solution of the problem through the building of a storage reservoir on the Gila which will supply water not only for the Pimas, but for thousands of other Indians whom the government could then move to this reservation and commence the process of education and agricultural civilization. Statesmen have urged upon the government the necessity for such action, from standpoints of justice, humanity and even economy, but thus far Congress has turned a careless ear to such entreaties. Had the Indians been private American citizens, they could have claimed their rights and enforced them, but being wards of the nation, others have come in and taken their water to which they have had undisputed title for four hundred years, and the government turns indifferently away even directing its attention to new wards thousands of miles distant; while its original friends and allies are left to steal and beg an existence or starve.

The United States has expended large sums of money for the introduction of irrigation on the Indian reservations where it is desired

to educate the Indian into agricultural habits as a means to his civilization. Here is a tribe of Indians who have for centuries been engaged in agriculture by irrigation, and who were, until recently the only successful irrigators in Arizona. They are now deprived of their water through the agency of the white man, directly encouraged by the United States government. Is it not an imperative obligation of honor upon the American people that their supply should be restored to them? The only means lies through the construction by the government of a storage reservoir on the Gila. And instead of the uncertain possibility, of elevating a savage or hostile tribe the necessity presents itself of preventing the destruction of a civilization already attained among a friendly and in times past, hospitable people.

A WEB.

BY ETHEL E. BEERS.

Though strive I with the utmost care
 To keep the pattern firm and fair,
 The threads will break, the figures
 blend,
 Before I reach the purposed end.

But when, at length, at close of day,
 The finished fabric I survey,
 Shall I discern a larger plan
 Than saw the weaker mind of man?

Or will there be but broken lines,
 Confusion, half wrought out designs,
 Dim hints of what a stronger hand
 Had done, with more of stern com-
 mand?

I cannot know, I only weave,
 And hope, nor wholly disbelieve,
 That plan there may be, plan there
 must,
 Though hid by this gray smoke and
 dust.

IRRIGATION IN THE ROCKY MOUNTAIN STATES.

THEIR AGRICULTURAL CONDITION.

BY J. C. ULRICH, C. E.

The Rocky Mountain region and its development under irrigation is the subject of a publication just issued for free distribution by the Irrigation branch of the Department of Agriculture. It was prepared by J. C. Ulrich, an irrigation engineer of Denver, and describes particularly the States of Colorado, Idaho, Montana, Utah and Wyoming. The bulletin explains how ditches are built and operated, its main purpose evidently being to inform those to whom the subject is new and strange, and thus enable them to avoid the costly mistakes to which beginners in irrigation farming are liable.

The difference is shown between ditches built and operated by individuals, corporations or districts, and the difference of methods of operation. The detailed organization and management of the canals are described, especial attention being given to the duties of the "ditch rider," the official with whom the farmer comes into most frequent and intimate contact. His duties consist in patrolling the ditch throughout the season of actual operation for the purpose of seeing that the works are in good repair and to superintend the proper distribution of water to the various stockholders or irrigators from the system. Where a ditch does not exceed 12 or 15 miles in length one ditch rider is expected to patrol its entire length, but upon more extensive systems several may be required to perform these duties.

The different methods of applying the water to the land (flooding, furrow, and compartment systems) are described, and the conditions under which each is especially applicable are explained. The advantage of reservoirs in equalizing the flow of streams and in increasing the irrigable area is pointed out. The quantity of water necessary or used for irrigation fluctuates during the irrigating season, but unfortunately the period of maximum use does not usually coincide with the period of maximum flow of the streams. An adequate system of storage will not only protect irrigators from the variation in supply from month to month, but assist in reducing the fluctuations from year to year. It will enable the floods of years of large discharge to be held back for the years of drought. Reservoirs are simply a secondary means of utilizing waters which otherwise run to waste, and

they are the only safeguard of irrigators on streams in which the natural flow has been overappropriated.

In his introduction Mr. Ulrich says:

“The differences between agriculture under irrigation and that in regions of abundant rainfall are as marked as those between the appearance of a landscape in Arizona and one in Illinois. The home seeker from a humid region finds that his past experience as a farmer is of little service in choosing a location upon the arid lands of the West. The soil and climate are different and the conditions which farmers discuss are strange. As a result he usually follows the advice of those who settled before him, and the final result of his efforts depends in large measure on the kind of company he falls in with at the outset.

If he is a practical farmer he has been accustomed to consider the fertility of the soil, its drainage, the proximity to market, and the social advantages of a community the leading factors in making a location desirable; but when he casts his lot in an irrigated district he finds that all the unirrigated land looks alike and all apparently worthless. He frequently finds that lands conveniently located, close to market, and with a contour and slope suited to irrigation, are yet unoccupied and for sale at small price. If he seeks for the cause from a disinterested source he will probably learn that it is lack of a water right—that other lands absorbed the streams before ditches to water the land in question were built, and that when streams run low no water is left for its use. If he is not so informed at the outset, he may learn of this through unhappy experience.

The significance of a water right, and the importance of having both an adequate supply and adequate provision for its just distribution, are matters which the home seeker is most apt to overlook, as they were the last things to be properly appreciated by the early settlers.

Nor are the beginners the only ones who make mistakes in locations or feel themselves perplexed by the problems growing out of the distribution of the water of rivers among those dependent thereon. Old and capable irrigators find it hard to discriminate between the merits of widely differing ditch contracts for the supplying of water or to understand what rights farmers have in streams under the conflicting court decisions growing out of the litigation over water rights. They are earning that farming under irrigation requires a study of other things besides the application of water, and are today studying the broader questions with an earnestness and alertness which must in time result in important changes in present laws.

Two causes explain the rapid extension of irrigation in the arid West. One is the inability to raise crops without it; the other is the ease and cheapness with which the first ditches were built. To the New England hill farmers the distribution of a layer of water over

every inch of a wheat field seems a labor of great magnitude and difficulty; but when one has seen the gently sloping table-lands of Colorado, Kansas, and Nebraska he realizes that spreading water over the surface is as simple as plowing corn in Iowa. The dweller along the sluggish, deeply sunken rivers of the middle West marvels at the methods by which the irrigator gets his water supply above the surface; but when he looks at the mountain torrents, which have scarcely any banks and have a fall so great that the ditches which leave them seem to be running up hill, this mystery is also explained.

The first steps in practical irrigation are surprisingly simple, easily understood, and as easily carried out. Many ditches have been built by men who knew nothing of either irrigation or engineering. A few days' instruction and experience will make any man of ordinary intelligence able to irrigate most farm crops without any further direction or oversight. This does not mean that he knows all there is to be learned, or that further time will not enable him to do his work with greater ease or with increased economy in the use of water. The requirements of different crops and the time when water should be applied vary greatly, and the experienced irrigator has a great advantage over the novice; but this does not prevent beginners, without either experience or direction, raising good crops the first year. On land reclaimed, and with an ample water supply, success with beginners is the rule rather than the exception."

Mr. Ulich gives the following methods as those used in applying water for irrigation purposes.

METHODS OF APPLYING WATER TO THE LAND.

Where an irrigator's land is contiguous to the main canal or distributary, he may have independent diverting works or lateral ditches. When, however, as usually happens, their position and the topography of the ground is such that a number of farms can be served by the construction of a single lateral, such is usually the method adopted. These laterals are usually constructed as partnership or community ditches, and are frequently extended and enlarged to meet the necessities of increased acreage and additional farms. Each irrigator is usually required to contribute in money or labor to the cost and maintenance of such ditches such a proportion of their whole cost as his water bears to the whole quantity of water carried, although sometimes the assessments are made also somewhat proportionate to distance from the head of the lateral. On most systems the company's responsibility ceases after turning into the head of such individual or community laterals a quantity of water equal to the aggregate amount to which all the users from it are entitled, the operation of the lateral and the distribution of water among the various consumers being left to be arranged by the interested parties. Where there are many users from a common lateral they usually select one of their number to take

charge of the distribution of the water, whose duty it is to see that sufficient water is turned into the lateral by the company's ditch rider, and that it is equitably distributed among those entitled to its use. The proper location of these laterals is a matter of very great importance to economical and successful irrigation, and too great care can not be exercised in planning them, both to obviate the necessity for a multiplicity of ditches and to secure the best possible advantages for diverting the water over the lands to be irrigated.

FARMERS' DITCHES.

Individual farmer's ditches are required to convey the water from these community laterals to the places on the area to be irrigated from which it can be most advantageously spread over the ground for the irrigation of the various crops. These ditches should generally follow the ridges and higher contour of the area to be watered, and great care should be exercised in their location, so that all the land can be covered. Large areas of crops are frequently burned up through the careless and faulty location of these small ditches. Experience gained in such a manner is expensive, and too much care can not be exercised to secure their proper location in the first instance. The diverting works on these lateral and individual ditches are usually reduced copies of those used on the main canal, being in this country most often wooden boxes with sliding regulating gates. In the case of uneven and rolling ground it is frequently found necessary to divert water from several places on the main lateral to secure the proper irrigation of a single farm. The proper location for all distributing ditches is possible only after a very careful study of the topography of the ground in each particular case.

The irrigator, having his stream of water in his own lateral, which is constructed across the highest part of the field to be covered, is now ready for its actual application to the growing crops. If his land is very favorably located, with comparatively uniform slopes, his lateral is probably in a straight line across the upper end or side of his field, with the greatest slope of the land at right angles to it. If his land has not so uniform a surface, his lateral may follow its irregular contour or be kept straight by diking it across the low places. In general the lateral ditches, from which actual application of the water to the crop is accomplished, should follow the line of least descent from the highest point of the field, the greatest slopes being perpendicular to them. There are several methods of applying the water to the land to be irrigated. Of these the two most common and generally used are the "flooding" and "furrow" systems.

FLOODING SYSTEM.

Under the flooding system small parallel ditches are constructed

every hundred feet or so, according to the slope of the ground. Where the surface is broken they will be irregular and will follow along the ridges. These ditches should also have a slight fall, the steepest slope being at right angles to them. Such ditches are usually simply furrows made with a heavy mold board plow, and, where the crop is grain, they are filled back by the plow before harvesting. These ditches, being cut at convenient points, allow the water to run out and spread over the adjacent land. The water thus released at once begins to follow the lines of quickest descent, and in so doing spreads out over the ground as it proceeds, dividing into numerous branches or rills as it increases its distance from the opening in the ditch. For the purpose of facilitating its spreading and to insure its thorough application to every portion of the surface, the irrigator follows its course, and by means of a long-handled shovel guides it to every portion of the field. This guiding is done by moving a few shovelfuls of earth here and there, and thus separating the various small rills and starting the branches in different directions. In this way the irrigator follows the water through the field and prevents its collecting in the depressions, leading it out upon such points as would without his assistance be missed by the water. Where only one operator is at work it is usually advisable not to make very many openings in the ditch at one time, since to do so may result not only in a waste of water through his concentration into larger streams which rapidly escape to lower ground where it may not be needed, but its concentration for long periods in the depressions of the surface is likely, through oversaturation, to damage the crop at those places. When the area which can be most conveniently irrigated from the openings thus made has been sufficiently moistened, the latter are closed by throwing in a few shovelfuls of earth, and similar openings are made at other points, the same process being there repeated, and so on until the irrigation of the whole area has been completed.

The entire operation is characterized by much greater simplicity than would be supposed by one unfamiliar with the practice of irrigation, only presenting feature of serious inconvenience when the surface to which the water is applied is very irregular and broken, the slopes steep, and the soil loose and friable to such an extent as to be easily eroded. Even under those circumstances no real difficulty is presented, though the work is thereby rendered slower and more tedious through the greater care required in handling the water, and because a large volume can not be handled at one time on account of the greater liability of washing away the top soil and thereby injuring the land. Fortunately, however, most of the farming land in the arid region has a comparatively uniform surface, and this difficulty is therefore not frequently encountered. The land so preponderates

over the available water supply in most localities that neither the necessity nor the inducement exists for developing and improving lands of great irregularity of surface, and it is not generally nor frequently done.

Under this system an experienced irrigator can cover from 10 to 20 acres a day, the area depending upon the character of the land surface and the volume of water at his disposal. For such crops as grain, alfalfa, clover, and the various grasses—for everything, in fact, which is sown broadcast and is distributed uniformly over the surface—the flooding system is employed, and furnishes the best, in some cases the only, practicable method of applying the water; but for many other crops this plan is neither the most convenient nor the best method.

FURROW METHOD.

Under this method parallel furrows are plowed, leading from the ditch through the field between the rows of the crop to be irrigated. A small opening is made in the ditch to let the water into each furrow. A dam of canvas or earth is placed in the ditch just below the lowest furrow into which water is being run at the time, thus holding the water nearly level in that part of the ditch from which it is being drawn. Where the slope of the ground is excessive, these furrows must run diagonally, or irregularly, in order to reduce their grade and prevent erosion of the soil.

In the case of fruit trees it is generally found desirable during very hot weather to prevent the water from coming into actual contact with the trees, because of the danger of scalding. Flooding the surface also results, in some soils, in baking and compacting the earth about the trunks and roots of trees. To avoid these consequences the furrow system is employed, one or two furrows being plowed along each side of a row of trees, at a distance of two or three feet therefrom, and the water is turned from the ditch into these furrows and permitted to traverse slowly from end to end, thoroughly soaking the ground as it progresses, and reaching in to the roots without coming in contact with the stems above the surface. The necessary moisture is thus imparted without the wetting and subsequent baking of the surface which might result from flooding. When the trees are sufficiently irrigated, the water is turned out of these furrows and into others, the process being thus continued until the whole area has been served. The furrows are then filled in with a plow, the whole surface worked over with a cultivator, and no trace left of either the furrows or the application of water.

This method also requires the attention of an irrigator, to see that the proper amount of water is kept in each furrow, and that it does not break out and flood the surface in places, leaving the furrow

beyond the break without water. One man can take care of a considerable number of these furrows at once, and under favorable conditions of surface and water supply can accomplish the irrigation of as great an area in a given time as by the flooding system.

This method is also applicable to the irrigation of corn, and in fact of any crop whatever which is planted regularly in rows, a single furrow between each two rows being generally used for such crops. When applicable it is the favorite method, both for its convenience and the economy of water thereby effected. But where the ground is very irregular this plan is often inconvenient, for the reason that the furrows paralleling the rows of crop would, upon such surfaces, be up and down hill, and would therefore not carry water. To make this method applicable in such cases it would be necessary that the rows follow approximately the contour of the ground, in order that the parallel furrows might carry water throughout their length. The irrigation of irregular surfaces, however, is generally conducted under the flooding system, except in localities where, as in parts of southern California, the value of the crop frequently warrants the expense of leveling off or terracing irregular surfaces, or the application of water through buried pipes, as it is arranged in the water supply of cities.

COMPARTMENT SYSTEM.

A modification of the flooding method is the compartment or check system of irrigation practiced in some localities, particularly in portions of Arizona. This consists in dividing the field to be irrigated into squares or compartments by levees or dikes of such height as to cause the water to stand over the entire area of compartments at one time, the water being admitted to each compartment by means of a gate in the levee. The water is allowed to stand until the ground has become properly moistened, the time depending largely upon the character of the soil. The compartments or squares vary in size according to the ground, but are not usually more than an acre or so in area.

PUMPING WATER FOR IRRIGATING PURPOSES.

[Read before the Farmers' Clubs' Institute, Los Angeles, Cal.]

Pumping water for irrigation is not new. India has long irrigated almost as many acres from pumped wells as from the great canals built by the English government.

It is but a step from flowing wells, with which we have long been familiar, to wells which must be assisted by the pump.

Southern California did little with pumps prior to 1898. Some large work was projected earlier. In August, 1897, a movement looking toward pumping for 25,000 acres or more in the vicinity of San Jacinto, Lake View, Perris and Elsinore was begun. While less than fifty horse-power was then being used on wells in all that region, there is now not less than 350, and the proposed company transmitting its power from Mill Creek, a distance of thirty miles, will find immediate sale for over 600 horse-power and will confine its work to a radius of about ten miles around Perris, leaving out San Jacinto and Elsinore. Much more power than they will be able to develop will be called for in the San Jacinto valley. The Chase Nursery Company, purchasing over 1,000 acres near Perris, has already contracted for a steam electric plant of some 300 horse-power, to be used for various purposes, but primarily to distribute power to a dozen or more wells scattered over the tract supplying water for alfalfa.

Such large plants will be very common. The Kern County Land Company of Bakersfield was the pioneer in actual use of electric pumps upon a large scale, though not the first electric company to make some use of such power for pumping water. I believe the pioneer electric pumping plant for irrigation was at Pomona, in connection with the San Antonio Light and Power Company—the company which led the world by two years in the commercial use of high voltage and long distance transmission. Ten thousand volts and a thirty mile pole line was a great leap from earlier practice. The pumping industry now opens up so largely that it appears plain that all available water power in Southern California, including the Kern River, brought in from 125 miles distance, can be permanently utilized in this single industry. The water powers are not numerous or large in dry seasons. It is equally plain that all our oil will be used in our industries. Every acre of land capable of intense culture will be needed to supply the open and opening markets; and, for vast areas, pumped water will be the only water available.

Reservoirs above ground with large drainage areas are not numerous in the region of the San Gabriel, the San Bernadino or the San Jacinto mountains. But reservoirs of remarkable areas and of great depths and deeply covered to prevent evaporation, and with hundreds of miles of watershed behind them, underlie the most fertile valleys of Southern California. The water stored in the mountains should be reserved for the lands lying too high to be economically reached by pumping. There is enough such land to call for all such water we have. Bear Valley Reservoir in the mountains has but forty-five miles of watershed and three miles of area, while the great reservoir under San Bernadino Valley has not less than ten times that watershed and is at least 140 miles in area, and so far as sounded is more than 1,000 feet deep. The vast resources of Riverside irrigation waters—the best we have—flow out of this reservoir. What vast supplies for lower lands flow out below the surface we do not know. Bear Valley Reservoir was dry in July, 1899, and is still empty, while the San Bernadino basin is overflowing through artesian wells which are the wonder of the world.

With such underground reservoirs, the average drainage of the vast mountain areas can be depended upon, and they are adequate for all uses. As another example, the San Jacinto basin, with an area equal to that of San Bernadino, has dropped during the last six years of unprecedented drouth but about one foot a year in its water level, though being pumped to over 1,000 inches this year. And the San Fernando Valley has likewise shown most remarkable resources, justifying the greatest confidence in its permanence. These are the three great basins in connection with these mountains. In many other places we have seepage from these basins, and these may be as permanent as the basins themselves.

The areas along the San Gabriel foothills have developed many good wells, but nearly all of these, like foothill tunnels, show signs of failure. Such wells near Pomona, which a few years ago flowed 200 miners' inches, are now being pumped down 55 feet and yield only half as much water. These wells show also the fatal signs of shallow supply in that they rise promptly after rains. These have been and will be of great use in an occasional dry year to supplement free flowing streams, but if depended upon for a series of years for steady irrigation they must fail. There is no indication that any of the sources of water spoken of are fed from more distant drainage areas.

Wells in and along the underground outlets of the great basin of San Bernadino and San Jacinto have a most hopeful outlook as permanent sources of water supply for all lands to which they can be economically raised. These waters should be guarded for the areas immediately adjoining, and not run off to distant regions for use upon new lands. Owners with growing orchards needing to be saved should

not be too harshly blamed for seeking distant supplies which may affect those nearer. Speculators, however, who propose to pump water to run off long distances to cover raw lands, should be resisted by all lawful means. Underground reservoirs are as valuable as mines and a spirit of loyalty to one's neighborhood should guard against their depletion.

Having the water, we now come to the question of getting it to the top of the ground and lifting it to higher levels economically.

I have examined many pumping plants and have reports from many more, and from these reports and examinations I come to some conclusions.

Water can be raised from a sump hole or reservoir at surface of ground to higher lands and delivered at a single level most economically, on account of style of pump and connections with motor. One cent will in good practice raise a miner's inch of water—12,960 gallons—twenty-four hours six to seven feet, using pumps of moderate cost and combining distillate at about 13 cents per gallon and oil \$1.50 per bbl. If delivered at various different levels with the same power unit, one cent for five feet is good practice, and will be less or more according to conditions. This is fuel cost only.

In raising water out of wells we have two distinct classes: 1. Deep wells, where it is impracticable to sink a shaft to the water. Within the reach of the ordinary farmer, these well pumps will afford twenty to thirty inches at about one cent for six feet of lift. The great sources of loss in these wells are found in cheap pumps and gas engines which break down and entail great loss of crop from failure to deliver the water when most needed. The best is none too good, and great care should be used in selecting the pumps and gas engines. With oil at \$1.50 per bbl., almost as good results can be obtained, except for cost of attendance. It is true that gas engines require the time of a man, but a cheap man can attend an engine twenty-four hours, while a steam engine requires not less than two men, and one at least an unusually good man, and the cost of attendance will be more than double. Small plants cannot pay these wages, and it pays to use gasoline engines, but they must be good ones.

Where the wells are not too deep and will yield a large amount of water, the best plan is to put down a curb to the water, and put in a vertical centrifugal pump. Such an outfit will furnish any quantity of water up to the capacity of the well at one cent per miner's inch for five feet of lift, at above prices for fuel.

Under some circumstances it will pay to set a rotary pump, a steam pump or large reciprocating pump, in the bottom of the pit where it is desired to deliver the water to different points much higher than the surface of the ground. Such pumps have a higher efficiency, and being positive displacement pumps admit of greater variation of

head than the centrifugal. Great wisdom should be used in selection of rotary pumps to receive good wearing properties.

In the large majority of wells the water gradually falls below suction. In such cases the pit must be deepened and the pump lowered. One of the best devices for this consists of a "stirrup" to hold the vertical centrifugal pump. This is thus freely suspended from the top of the well and can be lowered while at work. In thus lowering the shaft the best device I have noticed for preventing loss of suction through too rapid pumping, consists of a pipe connected with the delivery pipe just above the pump and turn-down into the well. With such valve you can regulate the amount of water flowing back into the well to keep the water up to suction. Such a device is often useful to secure automatic action. Those who have suffered loss of time from loss of suction will appreciate so simple a device.

One of the common conditions is a group of wells each yielding a small amount of water. These can be connected together if not too far apart, but if there is a general fall in water level, making it necessary to lower the pump to keep it within suction limit, it is an expensive matter to lower these connections. It is not a very serious matter if the wells are within a radius of thirty feet. Often the only reason for a nest of wells is that the sand is so fine that it gives up its water slowly. If you take sand and gravel, coarse enough to go through a twenty mesh screen, water will pass through it so freely that you can pump 100 miner's inches or more out of a seven inch casing. In the same water area where the strata are unquestionably all connected, you may yet strike sand so fine that much of it will go through an eighty mesh screen. You take a quart can of this material dry and you can pour into it almost as much water as into the coarse gravel, but you can turn the glass over and not a drop will run out.

Where you have fine sand and yet are sure that the water is present in large quantities, large wells should be put down and close together and the group connected to one well, using a deep pit and tunnels to the side walls.

In many cases the wells are necessarily scattered a half mile apart; no one will yield much water; and the general water level lowers rapidly from month to month. Such an area is not a valuable permanent supply, but may be worth very much in a dry year. A central compressed air plant may work here with greater economy than any other plant. Never use compressed air on a single well. There is no question that it is highly efficient, but in such a case as the above it would be most economical all thing considered. Where the wells are scattered over a large area for the purpose of saving conduits and to deliver good irrigating heads at convenient distances, and where the area calls for constant pumping, I think the plan

adopted by the Chase Nursery Company near Perris is the most economical. A central steam plant with high class machinery, economical of fuel and requiring high class labor to operate it, electric generators, vertical centrifugal pumps in "stirrups" at each well, with an electric motor directly connected to shaft without belt or gearing. One man and his assistant with a boy helper can operate such a plant and furnish a dozen heads of 100 inches each, as may be demanded.

A large amount lifted to a high level will justify compressed steam pumps. These will attain high efficiencies—300 feet for 33 cents for fuel at \$1.50 per bbl. for oil.

A brief paper of this kind can only be suggestive not exhaustive. Let me close with some suggestions more or less elaborated.

Never put in a cheap plant.

Never be in a hurry to put in a plant.

Look up your dealer's records. Do not suppose that the man who publicly refers by name to men who have his plants needs no investigation. Oftentimes the man who talks most confidently of the perfect satisfaction his plants have given to your neighbors has made a record black with failure, and all the men to whom he refers with such apparent confidence are wholly dissatisfied and would not deal with him again and are even now at law with him to force him to take his plant out. This is experience in Southern California, not a fancy sketch.

Don't do any experimenting at your own expense. A good firm will make a hard and fast contract, assuming the risks. Have it examined by your lawyer. The \$25.00 paid for that advice in execution of the contract will be the best money you ever spent.

Deal with good firms. Pay good prices for what you know to be good rather than try to do better with firms of less experience and no reputation.

A man with an excellent well, water within thirty feet of surface and abundant enough to afford 100 inches with a fall of only seven feet took advice of an unknown firm. Put in an air plant at a cost of \$800, besides his boilers, etc., and it was so poorly made as to be absolutely worthless to take out. I know expensive plants to have been thrown out after a single season's use, bought by honest men from honest men, but inexperienced. Some gasoline engines, new and untried but very attractive in appearance drop to pieces in a season, while others are known to do as good work as ever after five year's use. The difference of cost is slight. The difference in efficiency and wear astonishingly great. You must remember that in the inexperienced business house you fall into the hands of a salesman who often knows no more than yourself. He is there to sell. He is honest, but does not know.

It is wonderfully easy to make a mistake. The chances are twenty to one that you will not do the best you could. Make careful inquiry for successful plants. Learn all about them. How far they raise the water. Look up size of suction and discharge pipes. Don't waste \$5 per day against a needless friction head. That would pay interest on \$10,000 of added investment. Measure water over a wier. Don't guess at it. Find just what fuel is used to raise one miner's inch one foot, and if you find cost of fuel more than one cent for five feet of lift per miner's inch for twenty-four hours, look farther. Assume that you need not have any service but the best within reasonable limits and those reasonable limits have very probably been already well established by the best practice within 100 miles of your own well. Look them up.

Perhaps the simplest plan would be to go to these good dealers. Lay before each in writing the exact facts, viz: depth of well; level of water; drop when pumped for the amount of water you have found you need and the well will yield. To this end you should in every case have your well tested. It will be the best \$100 you spend in the whole undertaking. No good dealer will take the risk of such an untested well, and you are obliged to do so, a very unsafe risk, often costing a man more than \$1,000 to save \$50 or \$100, which would have made him secure.

Ask each dealer to prescribe the best plant he can furnish you for such conditions, and to refer you to one or more such installations. Then go to see them. Take all the time you need. You will gain enough valuable information to richly repay you. Take the statement of facts, your three presumptions and your observations of all of them to one of the best four consulting hydraulic engineer in Southern California, and get his advice, and aid, in redrawing the plans or in acceptance of one of the offers. Then have your lawyer draw the contract throwing all construction responsibility upon the dealer.

Such a course is not a cheap method, but it is a good one; almost sure to be successful and the extra cost will not exceed \$100 for all the care and insurance against disappointment.

Beware of a junk heap. I can point you to piles of junk bought by honest men from honest men. They did not take precautions. You cannot be too careful.

One more caution. I know a community which has made up a purse and is now sinking a well. There is excellent promise of plenty of water at 200 deep. Very little expectation that it will be nearer the surface. They will need to lift it 200 and 50 feet higher to cover the main orchards. They can get the well down for \$400 less. But there is no portable well testing machine to tell them whether they have much or little water. They want much. There-

fore they must put down a large pump, suited to lift water to a high level. Such a plant will cost perhaps \$3,000, and must be put into a pit 200 feet deep, costing not less than \$800. If the water is not there, the net loss will not be less than \$2,000 and all their time. If the water is there the lift of 400 and 50 feet will be found to be too high for profit. And so under the best conditions the end is disappointment and loss. The way to think is to think through to the end. Had this been done the first step would not have been taken.

Think! Think thoroughly! The whole series of steps must be considered. Almost all failure comes from failure to foresee a single fact which proves to be the fatally important one.

THE GHOST.

BY FRANCES M. MILLIGAN.

A haunting sin sent I over the sea,
 A treacherous wave brought it back
 to me.
 I tossed it up towards the arching sky;
 Lo, it fell down whizzing, from high,
 so high.
 And then I buried it deep, so deep,
 But still it haunted me in my sleep.
 I gave it away, weighted down with
 gold,
 But my heart knew its clammy touch
 of cold.
 Then at last I chained it to my side,
 And took the pale grim ghost for my
 bride.
 It is strangling my soul, as it strangled
 my will;
 Oh, Sin! My Sin! It is with me still!

THE COLONY BUILDERS.

THE LIGHT OF EXPERIENCE ON COLONY PLANS.

BY WM. E. SMYTHE.

In the February number of the AGE we dealt with the five essential points for a practicable colony plan to meet the economic and physical conditions of the West. The aim of the present article is to show that these plans are justified by experience—not necessarily that all the principles presented have been utilized in any single community, but that each principle has been thoroughly demonstrated by the experience of some community and that all five features may be expected to produce a satisfactory result when brought together.

ORGANIZATION OF COMMUNITIES.

“A colony should be organized, rather than a matter of individual settlement.”

Out of many instances which might be quoted in justification of this principle, we will select two from the west and two from Europe. These four instances illustrate three different methods of controlling the organization,—by a priesthood, by a town meeting, by the power of a national government. The first method is represented by the Mormon experience; the second by the Greeley Colony of Colorado; the third by the labor colonies of Holland and Germany. All of these undertakings are so thoroughly seasoned and established as to admit of no question as to the value of the experience they represent.

The Mormons built up settlements in the midst of deserts and mountains, with an aggregate population of 250,000. They were organized from the beginning, root and branch, working always under the guidance of a strong central authority. There is no reason to believe that they could have got their first foothold, gone on to prosper, and waxed ever stronger with the years save for the quality of their organization. Emigrating in considerable numbers, working together in building canals and improving lands, co-operating in all their manufacturing, and commercial affairs, they were ever like a trained army, with officers and discipline, and never like a mob. It is true that Brigham Young was in many respects an autocrat, but he could not have transmitted his power if he had not succeeded in forming a perfect machine which extended to the remotest hamlet. Great men may formulate plans and initiate movements, but those plans and movements cannot enjoy perennial vigor unless they are sound nor unless they are thoroughly organized.

Greeley's colony in Colorado—the noblest monument to his work for his fellowmen and perhaps the only one that endures—was also an organized community. It was indeed “a Church without a Bishop and a State without a king,” but in place of bishop and king it had a town meeting. It was born in a town meeting of *Tribune* subscribers held in Cooper Institute. It was set agoing in a town meeting under the open sky of Colorado, and perpetuated in a long series of town meetings in Colony Hall at Greeley. The same number of settlers acting individually, even if favored with the same degree of material prosperity, would merely have made farms. The Greeley colonists made history and made institutions. But without organization, as a matter of fact, they could not have succeeded at all at that time and place. It was organization alone which saved them from succumbing to a hundred difficulties, just as it had enabled them in the first instance to purchase their lands on the most advantageous terms and to obtain and apply to their own benefit the large profits arising from their improvements. It was organization which enabled them to develop and perfect the highest agricultural methods and to become the historic leaders in founding the civilization of a great State. Without organization they would have been like a million other settlers who have moved from East to West, drifting from obscurity to obscurity, and exerting no influence upon their time. As it is, you cannot write the history of our Western Empire and leave them out.

In making the labor colonies of Holland and Germany the governments of those countries have worked with the poorest possible materials, both as to people and soil. Outcasts from the streets, and lands which no one else would take as a gift, were the component parts of the Dutch colonies. So in Germany estates which had reduced their owners to hopeless bankruptcy, and the dead and wounded from the industrial strife of great cities, were chosen for these momentous social experiments. Yet nothing but success resulted and simply because these new communities were thoroughly organized. Their plans had been made by thoughtful men; their labor forces were directed by superior intelligence, enriched by experience. The result was that the humble settlers passed from beggary to tenantry, from tenantry to proprietorship, and that the vast capital used in the enterprise was preserved, compensated, and finally repaid. Without the saving grace of organization nothing but financial loss and human misery could have resulted.

In this brief paper I cannot deal with methods, but only with a few luminous results which point the moral.

A COMMON FUND.

“There should be a common or community fund.”

The Mormons had it from their tithing system, under which the banker and the merchant paid ten per cent. of their profits, the

school teacher ten per cent. of his salary, and the laborer devoted a tenth part of his time to be used in accomplishing many things wholly beyond the reach of the individual, yet of the highest importance to every individual as members of the community.

The Greeley settlers had it from the large profits of their town-site which, under their humane and sensible plan, belonged to all and was applied for the benefit of all.

The members of the Dutch and German labor colonists had it through the wise provision of those who planned the work, a certain percentage of the available fund being set apart for the purpose.

This common fund, belonging to the community as a whole and handled under its direction by able executive officers, is one of the essentials of success. It effects a saving of tens of thousands of dollars to the community and it makes them *absolutely independent*. In purchasing their implements, provisions, and all other supplies they make a saving of twenty-five to fifty per cent. They are not at the mercy of local merchants. Not only do they save in buying things at wholesale rates and with cash discounts, but they save again by combining their products and transporting and selling them in quantities. They realize added profits by owning and operating various little industries, such as creameries and canneries. These arrangements make the difference between success and failure. There is no communism in the plan. It is only co-operation under the familiar forms of the stock company. It is simple horse sense to adopt such plans and methods. It is conducting colony business in accordance with the sound business plans which have brought success to the wise men in every other line of industry and commerce.

THE INDIVIDUAL UNIT.

“The unit of the community should be the individual family.”

In all the successful instances which have been quoted homes and farms have been individually owned and there has been no attempt at common ownership. Theoretically there are some advantages in communism, but practically the method has never commended itself to men of our race, nor has it been successful when attempted, except in a few instances like that of the Zoar community, Oneida, and the Shaker settlements. Even in these cases it has not endured long enough to be of value as a guide. On the other hand, there have been numerous instances of the saddest failures.

The reasons for choosing the individual unit are deeply planted in human nature. One man wants his house painted white and another yellow. One man wants Jersey cows and another Durham. One man has a natural taste for gardening and sees a fortune in celery. Twenty other men prefer to depend on twenty other crops for their cash income. If it be true that no house is large enough for two women, it is not less true that one small irrigated farm cannot

accommodate several proprietors. There is a sphere for the individual and there is a sphere beyond the individual. When the latter is reached individuals must combine, organize, and co-operate. Communism makes the community the only individual, but the most abundant experience teaches us that the single family and home furnish the better foundation on which to build a new American settlement at this time.

A PLAN OF PRODUCTION.

“There should be an intelligent plan of production thoughtfully mapped out in advance.”

In the European colonies this matter has received careful attention on the part of the founders, with gratifying results to the settlers. In the Mormon colonies the people have been taught to raise diversified crops and so make sure of their living by collecting it from the soil. But as a whole too little attention has been given to this subject everywhere. Speculation has been the rule and the single crop the result. One locality has grown raisins exclusively, another wine grapes, another oranges or prunes. The lines of production mentioned in the previous article should be followed as the surest road to prosperity. This lesson is enforced alike by the results obtained by those who have followed and by those who have ignored the plan. Far greater prosperity has come to the former than to the latter.

THE SOCIAL PLAN.

“It is a mistake to ignore the social instinct in human nature.”

Not only in the European colonies to which reference has been made, but in European agricultural life generally, the plan of assembling homes in a village center has been followed to the marked satisfaction of the people. This is the universal method among the Mormons and has largely contributed to make them a contented people. We chose this plan for our Plymouth colony of Idaho and the settlers testify that if they had realized no other advantage than the social one from the general scheme this alone would have made it well worth while. To be close to the school, church, store, and post-office, to have a pleasant company of neighbors immediately at hand, and to be able to assemble in the little hall for social contact without inconvenience—these things took the rough edge off pioneer days and kept the people contented while their farms were improving. Much of the charm of life in Southern California has been due to the same consideration. Anaheim, the mother colony of that famous district, was made in this way. Riverside and its neighboring beautiful settlements have all the advantages of the finest New England town. It is a thoroughly practicable plan and one that should not be ignored unless it is found that settlers are distinctly prejudiced against it.

The foregoing, of course, is only a very superficial discussion of the important principles which have been advanced as the foundation of colony-making. In an article of this length it would be impossible to enter upon the subject in detail. The point is that these principles are real and not imaginary and have been abundantly vindicated by experience.

(The next article in this series will be entitled, "Ways and Means for Settlers," and will discuss the important question of how homes are to be made not only for those possessing sufficient ready capital themselves, but for those who must accumulate it in the future and for still others who can only hope to obtain it by means of a loan.

AN OLD FASHIONED HOME.

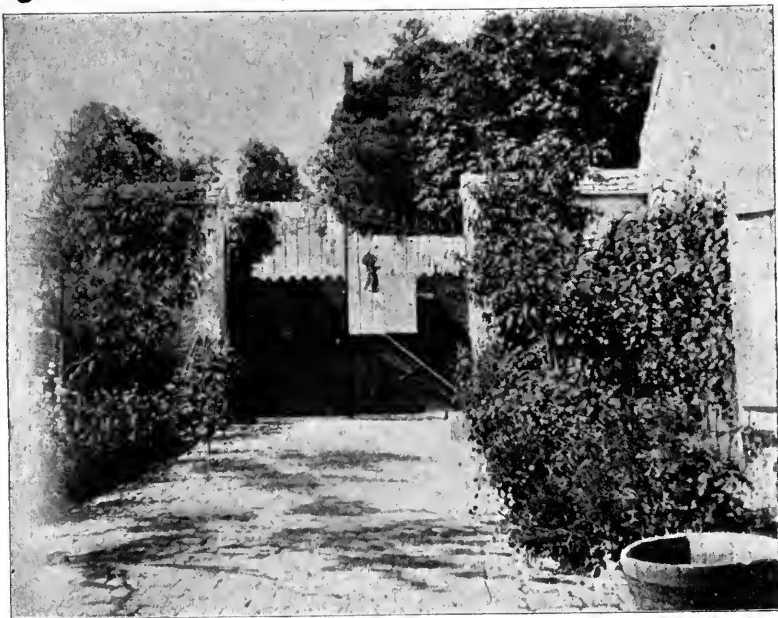
BY MARIE MADISON.



In a quaint, old country village,
Far from the city's mart,
From its greed and grind and vanity,
And shallowness apart:
In a quaint, old-fashioned cottage
Lives this woman of to-day,
To a by-gone life still clinging,
Treading still its vistas gray.

THE IRRIGATION AGE.

In the sweet old-fashioned garden
Each paving-stone—moss grown—
Each tiny shrub or flow'ring tree,
Has a story all its own ;
Some mem'ry of the child-life
Spent in that garden fair,
With the faint, sweet, haunting echo
Of its laughter ling'ring there.



Where the ivy and the roses
Clamber up beside the well,
Within its cool, sweet shadow
Love did first his story tell.
'Twas there, with youthful blushes,
His whispered hope she heard,
And ere the vines were withered
There gave her plighted word.

And there in happy motherhood
She watched her boys at play,
A-sailing tiny warships
O'er wind-tossed waves, away!
What if the sea were but a tub—
The ships but withered leaves—
'Tis thus that Fame in childhood's
play,
Her first bright picture weaves.



In homely rooms she labored,
Her task a work of love,
For the ties of human kindred
Were ne'er so closely wove;
Nor with such shining luster
As in that happy place.
When sorrow knocked upon that door
He wore God's shining face.



Then, one by one, they left her,
Those loved ones. Passed away
Down through the sweet rose garden,
Down through "life's vistas gray."
And at evening in the shadows
Beside the open door,
She dreams of those dear loved ones
That threshold knows no more.



Her hair in scanty tresses
Lies, silvered, on her brow ;
Her lips, where love once loitered,
Are seldom smiling now.
But peace and faith and flow'ring hope
Within her soul doth dwell,
And deep within her heart a voice
Is whispering, "Lord, 'tis well!"

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

THE MONTHLY wants to brighten the pages of its Farm department, and with this object in view it requests its readers everywhere to send in photographs and pictures of fields, orchards and farm homes; prize-taking horses, cattle, sheep or hogs. Also sketches or plans of convenient and commodious barns, hen houses, corn cribs, etc. Sketches of labor-saving devices, such as ditch cleaners and watering troughs. A good illustration of a windmill irrigation plant is always interesting. Will you help us to improve the appearance of THE MONTHLY?

USING WATER.

There are few things where people differ more widely than on this subject. The reason, no doubt, explains itself when we consider the many kinds of soil we have to contend with. We could not expect to irrigate lands of Riverside in the same way we do in this valley, as the first named are of a heavy, gluey nature, while ours is composed of a sandy loam.

My experience has taught me that heavy land of any nature that hardens by the sun's rays when wet, should be irrigated by the furrow system for the best results, as the water running at the bottom of furrows leaves the top much more pliable and more easy to cultivate and pulverize in a manner calculated to retain moisture.

Most horticulturists in this valley have decided the check system the best for many reasons, the greatest of which is economy. The land must be laid off in double checks, the ditches running as most suitable to carry the water without carrying away the soil. When water is plenty, cover the whole land six inches deep or more if possible, which can be done if the land has been ridged in a thorough and workmanlike manner.

This dry season we have paid attention to filling the check nearest the tree, and I will not state to you how many inches deep, as we have to cut our garment according to the cloth. Let me say here that where land is level, or nearly level, it is not necessary to double check.

The greatest mistake many of us make in this country that is liable to droughts, is not irrigating abundantly in the months of March and April, when water is plenty and cheap. As an experiment, last March I ridged up three acres of land and filled up checks carefully; as soon as water had settled, went over the ground again in the same manner. The result is, the trees have gone through in splendid condition, showing a beautiful crop of fruit, while the trees treated in the usual way have needed much more irrigating and care to pull them through the season.

I think all fruit growers will agree with me when I say there is no work in our business that should be done more thorough and painstaking than the using of water. Whatever is worth doing is worth doing well. In traveling about our valley, on almost any street you will observe where some party has just finished putting in his pro-rata of water, the land looking as if i

had been prepared by a small boy with the aid of a balky mule, and the water run by a fellow that let nature run its course. This class of people wonder why their trees look dry and curled and the fruit so small and pinched.

This country is becoming thickly settled, and a very large amount of water will be needed to govern it. My opinion is, if we want to prosper, development must continue, and we must use the water in a manner that the tree will feel every drop, and cultivate and pulverize the soil in such a way that the moisture will be the longest retained.

C. T. HARRIS.

Read before the Pomological Society at Covina, Cal.

TREATING OF GREEN-MANURING PLANTS FOR ORCHARDS.

During the past year the Arizona Experiment station has been testing plants that gave promise of being useful for plowing under to improve the soil. Special attention has been given to plants suitable for growth in orchards. The two best plants tested were *Melliotus Indica* and alfalfa. The former is the plant commonly called "sour clover" in Arizona. It belongs to the same class as white sweet clover (*Melliotus Alba*), the flowers being yellow instead of white. It is an annual, while the clover is a biennial.

Yellow sweet clover (sour clover) grows naturally throughout the south-west, being commonly considered a weed. In southern Arizona it is quite common in grain fields, this being the source of the seed used for sowing in orchards. Seed can be obtained where grain has been threshed, or at grist and flouring mills, the cost being slight.

The seed will germinate only during the cool weather, from September to April. The earlier it is sown in the fall the more growth will be secured for turning under in the spring. If sowed the latter part of September or early in October it will ordinarily attain a height of three to six inches before being checked by the cold weather of December and January. It may be

sown as late as December, but will not give as heavy a yield as if sown earlier. About fifty pounds of seed should be sown per acre.

The method of seeding found to be the best is to level the ground well, sow broadcast, furrow with a three-shovel furrower, roll and irrigate by running the water in furrows, which should be two or three feet apart. Irrigating it frequently during the winter will not only increase the yield of manuring matter, but benefit the orchard as well.

It should be plowed under when beginning to blossom, which ordinarily will be early in April. At this stage the yield proved to be fifteen to eighteen tons of green matter, or three to four tons of dry matter per acre last April. If permitted to grow longer it becomes more woody, does not turn under so well and decays less rapidly. By attaching a chain to the plow all the growth can be turned under.

The alfalfa may be sown earlier than the clover, as the seed will germinate during warmer weather. It does best if sown in the same manner as described for the clover. As it does not grow as rapidly during the winter, it will usually not be ready to plow under as early. Thirty pounds of seed per acre will be sufficient.

Peas sown very thickly, (125 to 200 lbs. per acre) during fall or winter will give a small yield of vines and in addition furnish a supply of green peas. The best varieties for this purpose were found to be Yorkshire Hero and Champion of England.

White clover makes a luxuriant summer growth, but grows but little in winter. Moreover, it is no better than alfalfa as a summer grower.

The benefits from winter-grown green-manuring crops are four-fold, at least. In the first place, the soil is thus covered during a portion of the year and the exhaustion of decayed vegetation by the heat of the sun retarded. In the second place, plant food that would otherwise be washed away by rains and irrigation is appropriated by growing plants and thus saved for the tree. One of the most important bene-

fits is the improved physical condition of the soil, due to the decaying of the green manure turned under. It causes the soil to bake less and hold irrigation moisture longer.

The chief benefit to the trees comes from the addition of nitrogen to the soil. This important plant food is derived from the air mixed with the soil. Most plants are powerless to use nitrogen from the surrounding air, notwithstanding the fact that the latter contains about 80 per cent. of the element. Members of the pea family (peas, beans, clovers, alfalfa, etc.) are an exception. They harbor upon their roots colonies of microscopic plant bacteria which have the ability to absorb nitrogen and pass it along to the plants to which they are attached. The irritation produced by these colonies of bacteria causes the formation of the small nodules or knots by which nitrogen using plants can always be distinguished.

The plowing under of plants that have secured their nitrogen elsewhere than from the soil, adds to the latter the nitrogen secured, and is a great benefit.

M. W. Ward, a large orange orchardist of Phenix, has used yellow clover in his grove for several years, and with material benefit. His experience was that after one or two sowings enough seed matured under the trees and in other places not reached by the plow to seed the orchard from year to year, the only work necessary being to furrow and irrigate early in October. — *Bulletin Arizona Exp. Station.*

TO PREVENT FLOODS.

"The famous Johnstown flood of May 31, 1889, will probably soon be recalled to the public by an attempt to reforest a large portion of the Conemaugh watershed to prevent further damage from freshets," says the United States Department of Agriculture. "The Johnstown Water Company, which controls 5,000 acres of mountain land, has asked the Division of

Forestry to devise a plan by which the area can be re-covered with timber and the too rapid run-off of the rainfall prevented.

The region is peculiarly liable to freshets, owing to its geological character and the removal of its timber. The now historic catastrophe, which swept away \$10,000,000 in property and half as many lives as the battle of Gettysburg, was but an exaggerated instance of many similar floods. This tendency has been increased by logging off the timber and clearing numerous farms, so that the rainfall flows quickly from the surface, causing high water at one time and the drying up of springs later.

The Johnstown Water Company has bought up many of these farms and torn down their buildings, and now wishes to expedite their return to the forest. The tract is in a sandstone region, much broken, with valleys averaging 350 feet in depth. The timber consists of hemlock, oak, locust and ash, with some beech and poplar. The openings are from twenty to fifty acres.

As soon as the weather permits, J. W. Toumey, Superintendent of Tree Planting, and another working plan expert of the Division of Forestry, will examine the region and decide on a plan of reforestation. In the clearings, tree planting will be required. An attempt will probably be made to increase the stand over the whole area by skillfully assisting natural reproduction. Protection from fire and cattle will also be required. The expense will be shared by the Government and the Water Company, the former furnishing the expert work and, possibly, some of the material for planting."

PLANT TREES.

It is on the treeless plains that the settler appreciates at its true value the presence of tree growth and realizes the necessity for some general policy to preserve not only a priceless investment, but a vast source of water supply.

PULSE OF THE IRRIGATION INDUSTRY.

CENSUS OF IRRIGATION.

The prompt and careful responses to the recent request by the Director of the Census, for information relating to canals and ditches, indicate that the importance and value of a complete and accurate Census of Irrigation are appreciated by those engaged in this branch of agriculture.

Director Merriam is very well pleased with the great interest evinced in the work of collecting data, and is confident that with the continued assistance of the irrigators and the press, the present investigation will be a success.

The returns from the preliminary inquiries furnish evidence of the material progress made in arid America and give promise of an advance in the twentieth century exceeding the wonderful development of the Mississippi Valley during the past decade. The boundary line, which so long has divided the arid and humid regions, will no longer stay the onward march of agriculture. Today it is realized that just beyond that line lies an empire greater and far more resourceful than any yet conquered. With the narrowing of the unoccupied limits of Government lands in the humid zones the question of reclaiming the arid and subhumid regions grows in importance, and is today claiming the attention of the wisest minds of the nation.

Many of the preliminary schedules sent out in December and January have been received and are already tabulated. The mailing of the principal schedules is being pushed as rapidly as possible.

The questions in this schedule are numerous and important. Director Merriam requests that they be carefully answered, as upon these answers an accurate and

perfect Census of Irrigation largely depends.

The scope of the present inquiry is broad. Its purpose is to determine the present conditions and results of irrigation, and to tabulate the same in such a manner that they may be fully comprehended by every one. Such a work, successfully conducted, will result in bringing about a more complete realization of the fact that the development of irrigation is affecting the prosperity of our nation as well as the progress and stability of many Western States.

EXCHANGES.

SCRIBNER'S MAGAZINE.

H. J. Whigham, the correspondent of *Scribner's Magazine*, who is now with Methuen's division at the Modder River, has had very good fortune in getting his articles and photographs to this country promptly. *Scribner's* has been the first of the magazines to publish articles written on the field of battle. Mr. Whigham's article in the March number will describe three fights. All the illustrations are from his own films, which were developed after they reached this country.

THE LADIES' HOME JOURNAL.

"The return of the Business Woman," by Edward Bok, "The Anecdotal Side of Mr. Beecher," "College Girls' Larks and Pranks," "The Modern Son and Daughter," "Where the Founder of the Kindergarten was Born" are among the notable features of the March *Ladies' Home Journal*. "The Autobiography of a Girl," "The Theatre and its People" and "The Parson's Butterfly" are continued, and "Edith and

I in Paris" and "Her Boston Experiences" are concluded. Howard Chandler Christy contributes the first of his American Girl series of drawings, showing her at church and A. B. Frost humorously pictures "The Country Store as a Social Centre." An Easter solo and an anthem are timely; and the numerous articles on fashions in woman's wear will be a useful guide just at this time. This is but a hasty glance between the covers of the March journal.

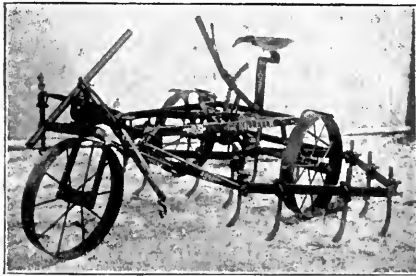
THE FORUM.

The Forum for March contains its usual array of timely and interesting articles. No dull contribution graces its pages. Among the twelve papers to be found in this number are "Government Deposits in Banks," by George E. Roberts, director of the United States Mint. Mr. Henry O. Dwight discusses "Our Mohammedan Wards;" George F. Becker, United States Geologist, protrays "Rights and Wrongs in South Africa;" F. Cunliffe-Owen writes

entertainingly of "Englishmen in the United States;" William Ordway Partridge, the celebrated sculptor-author, contributes an article on "The True Relation of Sculpture to Architecture;" Ho Yow, Chinese Consul-General to the United States, gives his views concerning "Western Benefits Through China's Development;" and Prof. W. P. Trent furnishes a review of "Mr. Stephen Phillip's Play."

THE DELINEATOR.

The April number of the *Delineator* will contain an article by Grace Teckham Murray dealing with the Sick Child. "The Patriotic work of Southern Women" by Maldon Fawcett, is an illustrated article in the same magazine, and the last article by Cornelia Atwood Pratt regarding The Young Girl is a wise and careful discussion of that interesting period in a young girl's life when she becomes conscious that the company of a young man is at times more interesting to her than the company of her sister.



CULTIVATION

is now an indispensable part of all good irrigation. But cultivation is *stirring*, not turning over, of the soil. Turning the soil turns weeds under to form air spaces to dry out and throws damp ground to the surface to dry out.

Cultivation must also be deep, no weed cutter can run deep enough. Deep stirring is also necessary in many soils to

keep a hard pan from forming at the bottom of the plow's path.

The Killefer Cultivator has been specially made to meet the case and has given the greatest satisfaction in California where people have had the most experience and are very particular.

Extra teeth go with it so that it can be quickly changed into a weed cutter when needed, also into a furrower. But if used enough it will never be needed except as a stirrer. It is also all the plow needed for most loose soils, such as those of the desert.

It cuts from five to nine feet with from thirteen to thirty-seven teeth as desired.

The tongue guides the castor wheel without draft so that the machine can run much nearer to the tree without danger or strain on the horses than any other.

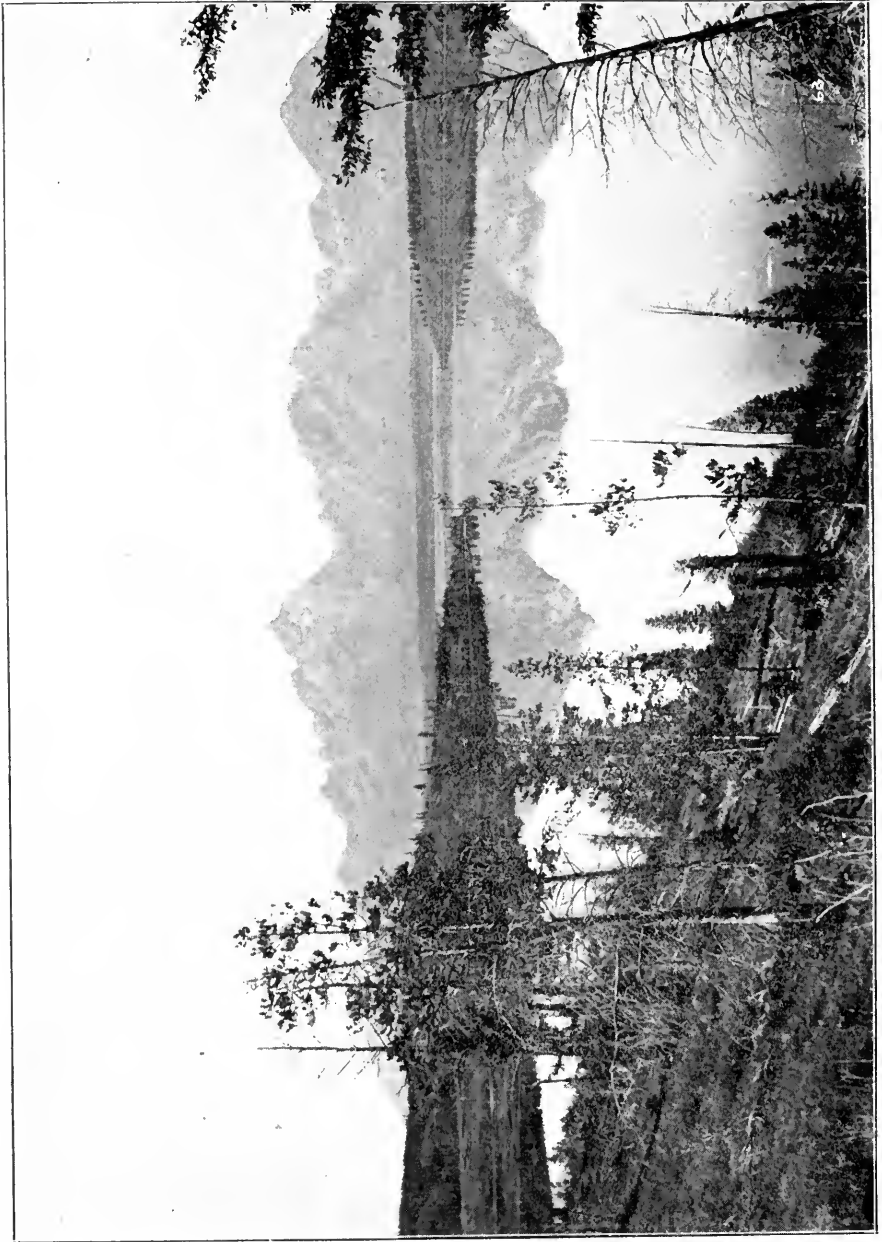
Fine teeth, plenty of them, running deeply and evenly, readily raised or lowered, and quickly changed to any form, are absolutely essential for orchard work. These you get in the Killifer Cultivator, with the easiest draft on the team, and the easiest guiding principle.

KILLIFER CULTIVATOR CO.,

1535 PALMETTO STREET,

LOS ANGELES, CAL





THE IRRIGATION AGE.

VOL. XV.

CHICAGO, APRIL, 1900.

NO. 7.

THE PROGRESS OF WESTERN AMERICA.

The Sheldon Experiment.

The experiment of the Rev. Sheldon has been carried out and the much-talked-of newspaper issued. Whether it has been a success financially we are not yet able to say, but doubtless it was, since the curiosity of the public was aroused and would create a demand for the paper for the brief time it was issued under Mr. Sheldon's supervision. That its success or failure for the brief period of a week was any criterion of the ultimate success of a publication of this nature, all newspaper men will deny. Had Mr. Sheldon continued his experiment for a year or more it would have been of value as proving either the wisdom or the folly of his attempt, but a week or a month or several months is too short a time. From the three or four copies at hand we are at a loss to know why the publication was called a daily "newspaper." It was a daily, it is true, but it was more in the nature of a temperance organ or church publication, and while either of these may contain many valuable things and be a power for good, they can not be newspapers since they contain no news. It is a question whether experiments such as the one entered into by Mr. Sheldon do not do far more harm than good to the cause of religion; whether they do not bring ridicule upon Christianity. That there is a necessity for a better newspaper

—for a cleaner, purer, more honest press—is conceded but that the Rev. Sheldon has done anything toward helping the good work along is open to doubt. Ex-Senator Ingalls deals with this subject in a new Kansas publication known as the *Knocker*. He points out that when Christ was on earth he did not concern himself with earthly affairs but with spiritual ones. His was a spiritual kingdom. "Render unto Caesar the things which are Caesar's" is the keynote to his treatment of political and public matters, and to attempt to say how Christ would conduct a newspaper is, in Mr. Ingalls' opinion, to lower our conception of this perfect nature and is incompatible with the scene in Gethsemane and the suffering on the cross.

School Savings Banks.

If there is one thing in which Americans are lax it is in economy. Poor Richard's maxim in regard to saving the pence is but little heeded. We would save the pounds or dollars if we had them but "small change" is very apt to be frittered away. This is more especially true of the laboring classes of the city than of country dwellers, probably because there are so many more opportunities to spend money foolishly, so many attractive things to wheedle the money out of ones pocket. The children of the poor begin at an early age to run with their pennies to the "can-

dy store" and often spend more than the children of the well-to-do. They grow up without habits of saving and as they begin to earn money their out-lay increases in proportion to their increase of wages so that nothing is laid up for the inevitable "rainy day," and sickness or death finds them as a rule entirely unprepared for the expenses incident to either event. There is a vast difference between economy and miserliness, but too many confuse the two and go to the other extreme; spending all their income with an optimistic faith in something "turning up" in the future. The various small savings banks have a tendency to correct this evil and when once a child has been persuaded to save a little money he is very apt to see the wisdom of it and continue the habit as he grows older. School savings banks are comparatively new institutions in this country, but their success in Great Britain proves what a boon they are to whole communities. J. B. Breed, in writing in the *California Citirograph*, gives some statistics in reference to the school savings banks in New York state where they have been in successful operation for several years. In 1894 the board of education in New York gave permission to primary and grammar schools to establish, in their classes, stations of the Penny Provident Fund. A number of schools have started stations with gratifying results, the scholars in the schools of the poorer districts making a good showing. In a school in which 31 children deposit the amount was \$122, in another school where there were 140 depositors the amount was \$1,291. Mr. Breed says: "Thousands of children are now doing business at this bank, and their aggregate deposits are more than \$16,000. These school banks are in a large number of our different states, not only in schools, but they are blessing whole communities, who have opportunities for depositing the smallest amounts of money. In Great Britain these penny savings schemes are considered of such great use as helping the poor to save

their small coin and to create habits of thrift, that they have a postal savings bank with 1,200 branches, and every post-office in the united kingdom is also a branch, and in these, together, they have seven million depositors and hold in trust six hundred million dollars. I am afraid to put these amounts in figures, or it might be thought the transcriber or the printer had made a big mistake. The elementary school work with the banks, and the children form a large percentage of depositors. It is said that so greatly have these savings been appreciated by the masses that one in every five of the people in England and Wales are depositors, and one in every fourteen in Ireland and Scotland has an account also. This subject is considered of so much importance by those who see its beneficent workings, where it is in good working order, that our consul to Lyons has recently made a report to our state department in reference to the matter. He says children in France are depositors, and long before a girl is over her fondness for dolls, she is depositing in the savings bank. He speaks of a washer woman who has six children, each one of whom deposits from one to ten sous per week. I have said all that needs to be said in regard to this important subject.

It does not seem possible that our brave, active, up-to-date people will not enter into this matter with the heartiness and zeal that characterizes them in other matters, some of which, surely, are not of more importance than this. The additional work that will have to be performed by teachers need not prevent any one from entering heartily into this work, I would rather say, from the enjoyment of conferring so great a benefit on those who need such help. A half hour a week will be all the time needed for one or two to do all needful work."

The Right Way. In these days of newspapers, experiment stations, farmers' clubs, etc., farmers are not content to go on in the same old way but are ever striving to gain more knowledge in their calling, which is, in reality, a science. All farms are more or less experimental but there is a right and a wrong way to try experiments. Some farmers will dash into an experiment with hogs, chickens or cattle with no preparatory study, and if the venture proves to be a failure, as it often does, it is given up for another "experiment," entered upon in the same haphazard way. Others go slowly, trying a new venture after careful study and giving it a fair trial. On this subject A. K. Boyler writes:—"Try something new on the farm each year; not the puffed-up novelties, but watch your experiment station and see what it recommends, and see if it will work on your farm."

The Sugar Beet. Two-thirds of the world's sugar is now produced from beets. Prior to 1871-2 the world's production of beet sugar had never reached 1,000,000 tons; in the present crop year it is, according to latest estimates, 5,510,000 tons, while the cane sugar crop which in 1871-2 was 1,599,000 tons, is in the present year 2,904,000 tons. Thus cane sugar production has scarcely doubled during the period under consideration, while that from beets has more than quintupled. Meantime the price has fallen more than one-half, the average cost in foreign country of all sugar imported into the United States in the fiscal year 1872 being 5.37 cents per pound, and in 1899 2.39 cents per pound.

These facts are shown by a tabulation prepared by the Treasury Bureau of Statistics in response to the demands for information regarding sugar production which have followed the meeting of Congress and the prospective consideration of matters relating to the sugar producing islands which have recently

come into closer relations with the United State.

No development of the world's production of food stuffs has been more rapid or striking than that with reference to beet sugar. In 1854-5 the total beet sugar crop of the world was but 182,000 tons; by 1864-5 it had reached 536,000 tons; in 1874-5 it was 1,219,000 tons; in 1884-5, 2,545, tons; in 1894-5, 4,792,793 tons and in 1899-1900, 5,510,000 tons. In 1854-5 beet sugar formed 13 per cent; of the world's total sugar crop and in 1899-1900 it formed 66 per cent.

Thus the sugar producing area of the world has in less than a half century been shifted from the tropics northward and the farmer of the temperate zone has shown his ability not only to compete with the low priced labor of the tropics, but in doing so to reduce by one-half the cost of the article produced.

Our Grain Trade. "The grain trade of the United States" is the title of a monograph just published by the Treasury Bureau of Statistics as the first of a series of studies upon the production and transportation of the great staples and upon the internal commerce of the country. The present article points out the immense increase in the agricultural production of the country, the rapid and continuous westward shifting of the area of cultivation, and the changes in the routes by which Western grain reached the Eastern consumers and the European markets. The development of the grain production and trade is traced from colonial times to the opening up of the Mississippi route by the purchase of Louisiana, when the shallow barges and later the steamboats descended the Mississippi, and New Orleans shipped grain to New York and Boston. After the completion of the Erie canal in 1825 and the settling of the Lake Michigan territory, the great bulk of the Western grain traffic moved eastward over the Lakes and the canal, and New York

became the great grain shipping port of the country.

The report, which is quite comprehensive, contains a series of tables dealing with the rise and development of the grain trade at various collecting and distributing points, the efforts of the several railroads to control and effect the ever increasing transportation of grain and the distribution of the traffic among the various routes. A great amount of information is furnished about rail, canal, and ocean freight rates; about the production, distribution, and consumption of cereals, and a special paragraph is devoted to the subject of the foreign market for American grain. The monograph includes a number of tables regarding acreage, production, imports, exports, consumption, prices and rates of duty for wheat in all the principal countries of the earth, as well as a map showing in general outline the present wheat area of the world.

The statistics contained in this report throw light upon the present grain and more especially wheat situation of the United States. They show that the exportation of grain is increasing with great rapidity, that both the production and exportation of corn are assuming a greater volume and that a constantly growing portion of our wheat is exported in the form of flour. During the last thirty-two years the amount of corn produced has increased from 868 to 1,924 millions of bushels, an increase of 122 per cent., while the exports of this cereal increased from 16 to 177 millions of bushels, or over 1,000 per cent. During the same period our production of wheat increased from 152 to 675 millions of bushels, a gain of 344 per cent., while our exports increased from 12.6 to 222.6 millions of bushels, or almost 18 fold and our net exports of this grain increased at a still more rapid rate.



THE ARID WEST.

COST AND CONDITIONS OF RECLAMATION

Many men who decide to go West and invest their small capital in arid lands which, by the aid of irrigation, will be made fruitful farms, do not investigate as thoroughly as they should before risking their little all, and disappointment and failure is the inevitable result. It is with the view of informing prospective settlers of the actual conditions which prevail in the arid regions that we give the following extract from the bulletin, prepared by J. C. Ulrich, on "Irrigation in the Rocky Mountain States." The introductory portion of this bulletin and also that relating to the various methods of applying water to land, was given in the AGE last month and we will now take up the cost and conditions of reclamation, of which Mr. Ulrich speaks as follows:

"A serious mistake is involved in the assumption that the immigrant to the arid West has only to homestead or purchase a quarter section of land and at once become a prosperous and successful farmer. This would be possible if the land secured were at the time of its acquisition developed and highly improved. Lands of this description are available throughout this region, but in most cases they command prices equal to those prevailing in the humid states for lands of similar quality and equal productiveness and proximity to markets. They are, therefore, out of the reach of settlers of limited means. Those offered for sale by the various irrigation companies are almost without exception raw and unimproved prairie lands, upon which much development work must be done in the way of breaking and subduing the native sod, leveling, erecting fences and buildings, constructing ditches, etc. These lands can usually be bought at very moderate figures, and upon very favorable terms. They are, as a rule, capable of being developed into farms of superior fertility and productiveness; but they can be brought into this condition only at the expense of great labor and a considerable investment of time.

"Similar conditions prevail in those cases where the settler homesteads land from the government and creates his own water-supply facilities under the individual plan. His land in this case, nominally, costs him nothing, and if he does the work of development and improvement himself he may get along without the expenditure of much actual money; but if he should figure up the cost, at its market price, of the labor and time which he has devoted to the work, he would discover that the farm thus acquired, practically without cash, had in reality involved an expenditure largely in excess of anything which he had anticipated at the outset, and we will then understand why well-improved farms in the arid regions, which originally cost nothing for the raw land, sell for as much as similar farms in the well settled states of the humid region. Nor is there any good reason why they should not do so, since a fertile, well-improved, and well-located ranch in this region, which has a satisfactory supply of water for irrigation, will, under skillful and intelligent management, as a rule, yield a profitable return upon the investment represented by its cost; and this is especially true in those cases where the actual settler acquires raw lands and improves them himself through his own labor and without the expenditure of cash. The labor and the hardships involved may appear trying and burden-

some for a while during the pioneer period, and before the development is completed, but past experience indicates that where the conditions are favorable, the results will, in the end, generally be satisfactory. Where failures and disappointments occur, they are usually the result of an insufficient or unreliable water supply.

“The value of farming lands and water rights varies so greatly in different localities of the arid region that it is extremely difficult to give any average price that will not be misleading. The price of raw land with a perpetual water right under the larger enterprises is usually between the limits of \$15 and \$35 per acre, with the annual maintenance charge on the water right varying from 50 cents to \$1.00 per acre. From 40 to 80 acres is generally regarded as the proper acreage for a person of limited means, and in ordinary farm crops can be farmed principally by his own labor. The payment of land and water right is usually extended over a period of five years or more, the time of the second payment being often two years after the first, thus enabling the farmer, under favorable conditions, to make his second as well as succeeding payments from the results of the cultivation of his land.

“Taking \$20 per acre as cost of land and water right, and \$1 per acre as the annual maintenance charge, the first year's experience on an 80-acre tract of this kind of land will be likely to run something like this:

First year's expenses on an 80-acre irrigated farm.

First payment on land and water right (one-fifth of \$1,600).....	\$320
Fencing material.....	150
Buildings.....	390
Team, wagon, implements, etc.....	300
Annual assessment for ditch maintenance.....	80
	<hr/>
Total.....	1,150

“To this must be added a year's living expenses. The above items will of course vary with the tastes and means of the settler, but they can not well be greatly reduced below these figures. Of course he may bring his team and implements with him from the East, thus cutting out those items. If he commences in the early fall he may be able, under ordinary circumstances, to do the necessary fencing, clearing, plowing, leveling, and ditching, so as to get 40 acres into crop the following spring. He can hardly hope to do better than that, and may have to have a little help with some of the work. Where this work is done with hired labor, its cost will usually be between \$5 and \$10 per acre so prepared for crop, depending very largely upon the amount of clearing and leveling required. It is always poor economy to slight this part of the work. Ground should not be put in crop without painstaking preparation for its easy and complete irrigation.

“If the farmer under consideration has a sufficient water supply and has fairly good luck with his 40-acre crop, its proceeds will pay his maintenance, assessment, taxes, and, as he has no further payment to make on his land the first year, keep him going for the succeeding year, when he will have his entire 80 acres in crop, and, with the aid of his year's experience, should have a full yield. With careful economy and hard work he will be able to meet his second and succeeding payments on his land from the proceeds of its cultivation, and at the end of five or six years, from an investment of from \$1,000 to \$1,500, he will become the owner of an 80-acre farm worth probably \$50 an acre, and capable of making him a good living, besides, if in a favorable location, constantly increasing in value. This is the

result under favorable conditions. If, however, he has been so unfortunate as to locate on poor soil (which is not likely to happen), or under a canal having an uncertain water supply, his case may be decidedly different. His best efforts will avail him nothing if he is not able to get the necessary water at the times needed. This is the most important, as it is sometimes the most perplexing, question to be settled before purchasing. The soil is almost certain to be of excellent quality, and there are few irrigated regions where there is not now a market for all products raised. Prices vary considerably in different localities, owing to local conditions which are largely temporary in their nature. The safest basis for estimating prices, however, is not upon such conditions, but especially for such products as hay, etc., upon their feeding value upon the farm. Farming throughout the arid region, except as regards such specialized products as fruit, hops, sugar beets, etc., is each year getting nearer that character which long experience has demonstrated as most generally successful and profitable, viz, that in which the bulk of the product is fed on the farm. Success in this kind of farming in the arid states does not necessarily depend upon the nearness to railroads or large towns, but is quite largely influenced by other considerations, such as proximity to free grazing lands. Of course favored localities will demonstrate the great success of particular kinds of products, but still the great proportion of farming throughout this region will be of the diversified and general nature practiced elsewhere, and its success will be most largely dependent upon a good water supply. Much farming is done in the arid region under conditions of water supply which are not entirely satisfactory, but its success in all cases is directly proportional to the sufficiency and certainty of the supply. Entire success is only achieved when the water is sufficient in quantity and certain in its duration throughout the period when it is required. Where these conditions prevail the factor of uncertainty is as nearly eliminated from farming operations as can be predicted of any business, and its results are more certain and satisfactory than can be realized from farming in any part of the humid region.

"The farmer in the humid States is always practically between two fires. He may be either burned out by drought or seriously damaged by too much rainfall, and he is powerless to avert either of these evils. The ranchman in the arid region, who is operating under favorable conditions, is protected from the latter by the aridity of his climate, and from the former by his artificial water supply, whose assistance he can invoke at pleasure. He has the exact amount of moisture which he needs, just when he wants it, and at no other time. His operations are rarely delayed by weather conditions. He may plow when the crop needs it, nor is he hampered by either dry or wet weather. If his land is too dry to plow when the crop requires cultivation, he irrigates it to the proper degree of moisture. In most localities he will be able, so far as climatic conditions are concerned, to work on his farm nearly every day in the year. Under favorable conditions he is certain of a large crop, and will be able to harvest it in good condition. Taken altogether, the practice of irrigation furnishes the very ideal conditions for the conduct of agricultural operations."

After pointing out the necessity for careful investigation by intending settlers of the conditions of water supply, priority rights, methods of their enforcement, etc. the writer gives the following details of the systems of water administration prevailing in the different states:

"For the purposes of this discussion the states under consideration may be divided into two general classes, each class having somewhat similar laws and customs in regard to water administration and distribution. In one grouping may be

placed Nebraska, Colorado, and Wyoming; in the other, Idaho, Montana, and Utah. In the former three States the distribution of water from the natural streams to the various parties entitled to its use is vested by law in water commissioners appointed by the governor and acting under direction of the state engineer, who is the head of the irrigation department in each of those States. The methods of adjudicating the various rights to water (as a basis for its proper distribution by the water commissioners) are, however, essentially different in Nebraska and Wyoming from those prevailing in Colorado.

“In the first-mentioned states, rights to the use of water are determined by a board of control, constituted by law for that purpose. Under the provisions of the law, the adjudication of the rights to the waters of any stream may be inaugurated by this board at its discretion. It is usually done upon petition of some of the water users. All claimants to the water of the stream are properly notified of the intended adjudication of their rights, and must present their respective claims and evidence to the board at the time and place fixed by it for the taking of such evidence, which place is selected with reference to the convenience of the claimants. After considering all the facts, the board makes a decree fixing the priority and value of each right of the waters of the stream under consideration. These decrees are based upon the records and testimony introduced by the claimants, and upon a very careful examination and survey, under the directions of the state engineer, of the stream, of all ditches diverting water therefrom, and of the areas of land upon which the water is used. The results of this survey are tabulated and mapped for the use of the board in its consideration of the case and determine the volume of water decreed to each claimant. The maps and evidence in each case are made public before the decree is finally entered, and a reasonable time is allowed for contesting any of the facts therein contained. These decrees always specify the land upon which the decreed water is to be used. It is forever inseparable from it, and the water right must always go with the title to the land. The actual beneficial use is made the basis for the decree in all cases. These decrees may be appealed from to the proper court within a certain time after being rendered, but so careful is the board in its examination and determination, and so complete the data submitted by the state engineer, that such right of appeal is rarely taken advantage of and the determination of the board is very seldom reserved.

“In Colorado, on the other hand, these decrees of water rights are rendered only by the district courts after trials under the ordinary rules of evidence as to the facts in each particular case. No special regulations exist governing the character, accuracy, and completeness of the evidence which must be submitted, and no provision is made for any examination or survey under authority of the State to obtain the exact facts as a basis for the determination of the volume of each acquired right. The whole matter is settled in a suit between the various claimants and upon whatever evidence may be introduced by them, while the interests of the state, the real owner of the water, are not represented in the case at all. Frequently there is no real contest in the suit, each claimant getting a decree for the full amount claimed by him. The lack of accurate, as well as the presence of inaccurate and untrue testimony, renders the issuance of a fair and just decree in such cases impossible. The necessity for a painstaking survey of the streams, ditches, and land is very apparent, both for the protection of the interests of the state in the water and those of the appropriators.

“An investigation of the results of these two systems of water-right adjudication leaves no room for argument as to which is best suited to the accomplishment of the

end in view, which is, or should be, the distribution of the water of the streams in such a manner as to secure its greatest possible beneficial use and the best possible protection of the interests of the actual users of it. The advantages of the system adopted in Wyoming and Nebraska are getting to be generally recognized by all parties interested in a just determination of water rights, and the prevention of costly and interminable litigation in regard to them, which is doing so much to retard settlement and irrigation development in some of the states.

"The systems of administration and distribution of the water after the decrees fixing the priority and volume of rights are rendered are practically the same in Nebraska, Colorado, and Wyoming. Each state is divided into several water divisions, each as nearly as practicable embracing a single drainage system. A commissioner or superintendent for each division, who has general supervision, under direction of the State engineer, of the distribution of water in his division, is appointed by the governor. Each division is subdivided into districts, each district having its water commissioner for the actual distribution of the water, among those entitled to its use, under the orders and general direction of his division superintendent. The decrees of the board of control, or of the courts, furnish the basis for such distribution. These water commissioners are vested with the power to arrest any person interfering with the execution of or failing to obey their orders in regard to the distribution of water, heavy penalties being provided for such offenses. They also have power to require the owners of the various ditches to construct and maintain the necessary and proper head gates and measuring devices for the proper distribution of the water.

"In Utah, Idaho, and Montana (in fact, in all the arid states except Wyoming and Nebraska) water rights can be established only through lawsuits the same as in Colorado, and a similar condition of litigation and dissatisfaction exists. The distribution of the water under the decrees, however, is accomplished in a different manner.

"In Idaho the judge of the district court from which the decree was issued is required by law to appoint before May 1 of each year, a water master to take charge of the distribution of water under each decree for the ensuing season. He is charged by the court with the execution of the decree. He receives his instructions from the judge, and is responsible for the proper performance of his duties only to the court appointing him.

"In Montana the law is similar to that of Idaho, with the exception that the judge can not appoint a water master except upon the petition of at least 25 per cent of the parties entitled to water under the decree. It would seem that under this provision injustice might be done to a small minority of the users from a stream, without their being able to get adequate relief. The compensation of the water masters in both these states is fixed by the judges who appoint them, and is collected by assessments against the parties entitled to the water, in proportion to the quantity distributed to each. Anyone dissatisfied with any action or order of the water master may of course appeal to the court for redress.

"In Utah the water masters are chosen by the water users at an election held for that purpose, at which time their compensation is also fixed. This is collected by assessments levied as in other states.

"The water masters in Idaho, Montana, and Utah have similar powers and duties to those of the district water commissioners of Nebraska, Colorado, and Wyoming, already described. In both Utah and Idaho, on streams where no adjudica-

tion has been had and no decree fixing the priorities for the distribution of the water has been issued, but where a supervision of such distribution is deemed desirable by a majority of the claimants, water masters are sometimes elected for that purpose, the basis for their distribution of the water in such cases being mutual agreements of local customs and recognized rights, In some cases also, especially in Utah, the earlier appropriators have in some instances secured injunctions from the courts against later ones, enjoining the latter from using the water claimed by the former. These injunctions have usually been obtained without a consideration of all the rights in the stream, and the results under their operation have not generally been satisfactory.

“The United States has never attempted to exercise any supervision or control over the appropriation and use of the public water supply in the arid States, this having been left to the various States which have assumed the responsibility to a greater or less extent. The result has been the growing up of important State departments having this work in charge. In addition to the duties which have been specified, these officers are directed by law to measure the flow of the various streams used for irrigation, to collect all possible information in regard to water supply, and irrigated and irrigable lands of the State, to examine dams, existing reservoirs and possible reservoir sites, to give information in regard to measurement of water, to examine all existing irrigation systems, and in general to become thoroughly familiar with the agricultural and irrigation conditions and possibilities in their respective States and districts. The results, in a general way, may be found in the reports of the various state engineers, and of the Montana Arid Land Grant Commission. These reports may often be obtained, and they embody the best and most reliable information in regard to the region under consideration. Special inquiries addressed to the irrigation officials in the different states will secure additional information.”



SUGGESTIONS IN IRRIGATION DEVELOPMENT.

By CHAS. E. RICHARDS, Cal. Sec. National Irrigation Association.
(Read before the Farmers' Clubs' Institute, Los Angeles, Cal.)

The investigations into and discussions over the problems of irrigation, which have been carried on for the last few years, particularly the last year, more particularly the last few months, most particularly on the 14th and 15th days of November last at San Francisco, all this agitation has above everything else demonstrated the fact that irrigation, though a complex and highly scientific problem, is nevertheless perfectly capable of solution. The factors, however, in this solution should be neither good guesses of incompetent men, nor foolish guesses of good men, but should be sound deductions from facts by scientific men, by keen business men.

That irrigation is absolutely necessary throughout all the arid and semi-arid West, is now a self-evident proposition; that in the near future a large portion of the garden truck and fruit produced in the Eastern part of our country will be raised under irrigation is the prediction of our eminent agriculturist, based upon close observation over a long period of years. The study of irrigation, therefore, should enlist attention, and demand scientific investigation in all parts of our country.

In Southern California, the center of intelligent and successful irrigation, it is unnecessary at this date to study the problem in its general application, for we all appreciate the benefits of irrigation and understand to a degree its principles; I will therefore confine myself to stating what should be the course in planning an irrigation system in any particular locality.

There are six cardinal points,—and not only should none of them be overlooked, but each should receive most careful preliminary examinations.

1. What is the exact legal status of the land to be irrigated and of the water supply to be used?
2. Is this location, this soil, suited to development under irrigation.
3. What crops can be grown and what would be the average per acre?
4. How much water will be required to produce an average crop?
5. What water tax can the increased productiveness of the land easily afford to pay?

It will be noticed that in order to answer these questions the service of lawyer, a civil engineer, a chemist, an agriculturist and a financier are all needed and the conclusions of such a body of men, if guided by a large measure of common sense would be correct. An approximate answer can be given to every one of these questions and after making ample allowances for contingencies, there is no reason why an irrigation system cannot be as successfully carried on an engineer's plans as a house can be built upon an architect's specifications. Each of these six questions is a complex problem, and each should demand more time than I can devote to all, but without attempting to make the paper exhaustive, I will give a few deductions from the experience of the last few years.

1. What is the exact legal status of land and water?

The legal status of land is generally not difficult to obtain, and it is self-evident

that land encumbered with law suits or of uncertain ownership or of unstable ownership, had best be freed from any cloud upon its title before an attempt is made to include it in an irrigation system. There has been altogether too much of "buying into lawsuits."

But the status of the water—this is another matter. In a general way we know that all unappropriated water is said to be the property of the State, and the right of appropriation is, or should be, simply the right to the measure of beneficial use; but many of us know to our sorrow, that the right to water is as uncertain as the stuff that dreams are made of. It is, however, certain that water rights can be established and protected and litigation in a great measure prevented.

Professor Elwood Mead says: On right division of water hangs the welfare of thousands of homes. The laws which define the ownership and control of water are the most important the State is called upon to enact. The law should provide:

First, an accessible and accurate record of preliminary filings on streams and water courses.

Second, a clear definition of water rights and a simple, orderly and inexpensive method of procedure for their determination.

Third, some means of apportioning water in times of scarcity in order that the holder of prior rights may be protected.

In this connection it is most satisfactory to know that Prof. Mead, irrigation expert to the Department of Agriculture, than whom no one is better fitted to cope with the problem,—is now engaged with a large and able corps of engineers in a careful, systematic study of the water laws of California and the water rights within some of the most important irrigation basins, including the San Diego, Santa Ana and San Gabriel watersheds in Southern California. Until there is a sure, speedy and inexpensive way to determine rights to water, irrigation problems will be severely handicapped and development retarded; but in the assurance that the present investigation is in good hands, backed by the new State Water and Forest Society and the Federal Government, we may reasonably expect a speedy and satisfactory solution to the legal difficulties and a cessation to the water litigation to a large degree.

2. Is this particular location suitable for development under irrigation? This may be determined by:

a. A general survey of the topography of the country, a special survey for areas and levels.

b. Analysis of the soil, not only of the surface but of the substrata to some depth to ascertain the amount of alkali.

c. Test wells to determine both the character of substrata and distance to surface water.

d. A year or more's careful weather record.

Land with a large amount of alkali should never be irrigated, land even with a moderate amount of alkali should not be irrigated, unless amply provided with drainage, and, in fact, all irrigated land should have ample underground not surface drainage merely. No land should have a canal system of irrigation, when surface water is within twenty-five feet of the top of the ground. Such land should be irrigated from wells, the water pumped if necessary, and in this way the water level can be kept down. Fruit trees with but one or two exceptions (notably the pecan) will become unhealthy and will be short lived because the land always becomes sour if the water level comes too near the surface. It is also a well-known fact, that well-

drained land is from eight to ten degrees warmer than the same land without drainage, and the additional warmth makes a very material difference in the growth of the trees and plants.

Lands irrigated from wells which yield cold water, should have individual storage reservoirs, so that the water can be pumped into them and allowed to stand and become warm before going on the land. All growing plants are checked in their growth by the application of cold water. In case a reservoir is impossible, then it would be best to irrigate every other space between the trees, so that only one-half of the roots of a tree would be chilled at one time. In fact, this latter method of irrigation seems to work most successfully, whatever the source of the water supply, and many orchardists believe it to be the only real way to keep up a continuous growth.

Good land is in such abundance, that land underlaid with hard pan close to the surface should at present be passed by. Young trees may do well on such soil and come to fruiting early, but the trees are short lived and the land requires too frequent watering while the fruit is maturing. Test wells determine the depth to the water.

The necessity for a year or more's weather record is also self-evident. We could then tell by comparison approximately the amount of average temperature, also the amount of wind: and all these points should be most carefully studied. Had such local tests been made before the attempted development of many of our localities, thousands, yes, millions of dollars spent in experimental planting would have been saved.

3. What crops can be grown and what will be the average revenue per acre? The first part of this question can be determined by:

a. The character of the soil, the temperature, the wind, in brief its general local conditions.

b. A comparison of this data with that of well-established communities.

The question can then be answered very readily, if the products proposed to be grown are such as have been marketed for a considerable period of time, staple products as we call them, and upon such production only would it be safe to base an estimate.

Speculative agriculture can form no basis of calculation. How many hogs for sausage, not how many lilies for perfume, must be the ratio; how many people will a given area sustain, not how many roses can be raised.

4. How much water will be required to produce an average crop? No other question furnished such a variety of answers at the convention at San Francisco as this. The answers were based upon personal observation and whereas one man stated positively that three acre-feet of water was needed in his location, another said that a crop of citrus fruit would follow the application of one-half an acre-foot. In the first case the depth to the surface water was under fifty feet, and in the second, presumably more than one hundred. In general, three things will fairly determine the amount of water necessary in the locality.

a. The character both of top soil and substrata.

b. The average ratio of evaporation.

c. The variety of crops to be raised.

As a rule, the soil that drinks in the moisture most readily parts with it most slowly. Sandy loams retain water longer than adobe soils, especially if not perfect-

ly cultivated. The soil underlaid with hard-pan more easily parts with its moisture than that which has no under crust.

The three factors in evaporation are temperature, humidity and wind, and these three can be determined with a fair degree of accuracy, and a knowledge of them is most necessary in determining the fitness of a location for the growing of any crop. That some crops require vastly more water than others is well known to all of us, and after noting the local conditions of soil and climate and deciding the kind of crops to be grown, we could tell about how much water would be needed.

It was interesting to note at the San Francisco convention the different results recorded from a similar treatment of soils to conserve moisture. One man thought it possible to so saturate the soil in winter and cultivate it in the warm months as to require little or no summer irrigation. The theory of thorough winter wetting, deep spring plowing and perfect summer cultivation is right and should always be adopted where there is drainage, but while some lands will retain and furnish sufficient moisture to fully mature deciduous crops, other soils, such as the foothill adobe, dry out very quickly, though at the same time if saturated with water in the winter and kept thoroughly cultivated in summer; they require comparatively little subsequent additions of water to perfectly mature the crop. It should be noted in this connection, that whereas crops have been raised in Southern California on one-half an acre foot of water and even less—that is about one inch to ten acres—yet the experience of intelligent men is a safer guide than the theory of the scientist, and though in theory an inch may do service on twenty acres of land, yet no careful orchardist would run this risk of raising a citrus crop on a less amount of water than one inch to eight acres, and it is generally conceded, that for citrus fruits and alfalfa one inch to six acres is the minimum and for deciduous one inch to ten acres.

5. What water tax can the increased productiveness of the soil easily afford to pay?—and notice, please the emphasis upon the word “easily.”

This problem can be readily solved when the preceding questions have been answered, but, in addition, the personnel of the prospective settlers should always be taken into account. Given every physical advantage, some men will make a flat failure of farming, while others will make a fair success under adverse conditions, as another writer has said:

“Farming under favorable conditions is a reasonably safe business, but it must be conducted with intelligence and economy to ensure that its results will be satisfactory and certain. The margin of profits is not generally sufficient to overcome the effects of numerous blunders following each other in rapid succession. Therefore any investment, which depends for its revenue upon the results of farming, to be successful, must be conceived and conducted upon the lines of economy, which are necessary to the success of the latter.”

The margin of profit, therefore, being as a rule moderate, the water tax must be also moderate. A wide margin should always be reserved for land under the system remaining unproductive. It requires a long time to fully develop an irrigation system, many authorities saying from fifteen to twenty years is the shortest time a complete development can be expected. The tax for water, therefore, must not only be moderate, but the revenue must be expected to be furnished by not over two-thirds or three-fourths of the total area of the system. Promoters of irrigation enterprises in the past have usually deluded themselves by computing a speedy revenue from all the system and many failures have resulted from this cause.

In general it might be a conservative estimate to say that the land can stand a

water tax of about five per cent. of the average annual crop revenue. Thus taking the average citrus yield as one hundred and fifty dollars per acre and that of deciduous or miscellaneous as one-half or seventy-five dollars per year, we deduce, that for an ample water supply citrus land can stand a tax of eight to ten dollars per acre and deciduous land from four to five dollars.

6. Can the necessary water be furnished and supply amply maintained at the price the land can easily afford to pay?

With the data furnished by the preceding questions, this is largely an engineer's problem and capable of accurate solution. Whether the supply is to be from the surface sources, as streams and storage basins, or whether from artesian or pumped wells, in any case ample provision must be made for dry years. Especially must there be strict regulations against a needless waste of water. It is safe to say that during the last two seasons many wells have failed and orchards gone dry, because of the prodigality in the use of water by those having flowing wells on the lower ground.

There should be a state of government control in the use of all waters. Mr. Jas. D. Schuyler, our prominent Los Angeles hydraulic engineer, has suggested the wisdom of government supervision in the building of dams and irrigation works with full authority to compel the builders to work upon safe lines or not at all. This idea will certainly be adopted in the near future.

I am fully convinced that it would be economy for every new irrigation district to pay for the services of a skilled horticulturalist and irrigator, who has made a success under conditions similar to the new locality; should such a man superintend the initial planting, not only would the agricultural and horticultural success of the community be assured, but the people would be protected from many impositions usually practiced upon new settlers.

In conclusion; no one can long remain indifferent to the great problem which affects our material prosperity, and that the problem of irrigation is of paramount importance, we must all acknowledge. On the success of the irrigated home, will some day rest the prosperity of our State and the stability of our government.

The impetus which has been given the study of irrigation by the annual meetings of the National Irrigation Congress, by the wide dissemination of the literature and information through the National Irrigation Association and by the personal work of its executive chairman, Mr. George H. Maxwell, that champion of irrigation—add to this the new momentum given by the convention at San Francisco—all this proves that irrigation will be, if it is not already, one of the greatest questions before the American people. Our universities will soon establish departments of irrigation, and young men will make its problems a life study. The field for research and for invention seems almost limitless. Mechanical devices for lifting water, or the application of some now unused or unknown force, which will greatly cheapen the present method of pumping; such discoveries are sure to be made if the inventive American mind is but turned in that direction.

He who helps to solve the problems of irrigation either legal, engineering or agricultural, is a public benefactor. He who helps to establish the security of the irrigated home will also help to establish the prosperity of that larger, that composite home, the United States of America.

Evolution.

By Langdon Smith.

When you were a Tadpole and I was a Fish,
 In the Paleozoic time,
 And side by side on the ebbing tide
 We sprawled through the ooze and slime,
 Or skittered with many a caudal flip,
 Through the depths of the Cambrian fen.
 My heart was rife with the joy of life,
 For I loved you, even then.

Mindless we lived and mindless we loved
 And mindless at last we died;
 And deep in a rift of the Caradoc drift
 We slumbered side by side.
 The world turned on in the lathe of time,
 The hot lands heaved amain,
 Till we caught our breath from the womb
 of death,
 And crept into light again.

We were Amphibians, scaled and tailed,
 And drab as a dead man's hand;
 We coiled at ease 'neath the dripping trees,
 Or trailed through the mud and sand,
 Croaking and blind, with our three-clawed
 feet,
 Writing a language dumb,
 With never a spark in the empty dark
 To hint at a life to come.

Yet happy we lived and happy we loved,
 And happy we died once more;
 Our forms were rolled in the clinging mold
 Of a Neocomian shore.

The Eons came and the Eons fled,
 And the sleep that wrapped us fast
 Was riven away in a newer day,
 And the night of death was past.

Then light and swift through the jungle
 trees
 We swung in our airy flights,
 Or breathed in the balm of the fronded
 palm,
 In the hush of the moonless nights,
 And oh, what beautiful years were these,
 When our hearts clung each to each;
 When life was filled and our senses thrilled
 In the first faint dawn of speech.

Thus Life by Life, and Love by Love,
 We passed through the circle strange,
 And Breath by Breath, and Death by Death
 We followed the chain of Change.
 Till there came a time in the law of Life
 When over the nursing sod
 The shadows broke and the soul awoke
 In a strange, dim dream of God.

I was thewed like an Auroch bull
 And tusked like the great Cave Bear;

And you, my sweet, from head to feet
 Were gowned in your glorious hair.
 Deep in the gloom of a fireless cave,
 When the night fell o'er the plain,
 And the moon hung red o'er the river bed,
 We mumbled the bones of the slain.

I flaked a flint to a cutting edge,
 And shaped it with brutish craft;
 I broke a shank from a woodland dank,
 And fitted it, head and haft,
 Then I hid me close by the reedy Tarn,
 Where the Mammoth came to drink—
 Through brawn and bone I drave the stone,
 And slew him upon the brink.

Loud I howled through the moonlit wastes,
 Loud answered our kith and kin;
 From West and East, to the crimson feast,
 The clan came trooping in.
 O'er joint and gristle, and padded hoof,
 We fought and clawed and tore,
 And cheek by jowl, with many a growl,
 We talked the marvel o'er.

I carved that fight on a reindeer bone
 With rude and hairy hand,
 I pictured his fall on the cavern wall,
 That men might understand.
 For we lived by Blood and the Right of
 Might
 Ere human laws were drawn,
 And the Age of Sin did not begin
 Till our brutal tusks were gone.

And that was a million years ago,
 In a time that no man knows;
 Yet here to-night, in the mellow light,
 We sit at Delmonico's.
 Your eyes are deep as the Devon springs,
 Your hair is as dark as jet;
 Your years are few—your life is new,
 Your soul untried—and yet,

Our trail is on the Kimmeridge clay,
 And the scarp of the Purbeck flags,
 We have left our bones in the Bagshot
 stones,
 And deep in the Coraline crags;
 Our love is old, our life is old,
 And death shall come amain;
 Should it come to-day, what man may say
 We shall not meet again?

God wrought our souls from the Tremadoc
 beds,
 And furnished them wings to fly;
 He sowed our spawn, in the world's dim
 dawn,
 And I know that it shall not die.
 Though cities have sprung above the
 graves
 Where the crook-boned men made war;
 And the ox-wain creaks o'er the buried
 caves
 Where the mummied mammoths are.

Then, as we linger at luncheon here,
 O'er many a dainty dish,
 Let us drink anew to the time when you
 Were a Tadpole and I was a Fish.

ORLANDO FLORIDA WINTER RESORT.

By JAMES N. BUTT, M. D.

One is supposed to write with some prejudice in regard to his own home. It is reasonable to expect that, after living amongst a people, sharing their patronage and hospitality, one would be influenced in their favor. I beg to state, however, that this is not a patent medicine advertisement. Florida is not a panacea for human

been engaged in the practice of his profession.

Orlando is a desirable health resort for hay fever, asthma, bronchitis, rheumatism, and consumption. These diseases can be relieved, in Orlando, and sometimes cured when reparation is reasonably possible. There are, of course, many lung troubles beyond the hope of relief. Florida climate will not grow new lungs, nor supply wasted limbs; it is criminal to send desperate cases to Florida. Many people come here in the last



"THE DARROW", ORLANDO, FLA.

ills; we share with others the inevitable calamities incident to life. Yet I venture to offer some observations of the immediate section, stating what I know in regard to Orlando, Florida, as a climatic resort, for the relief and cure of troubles aggravated by a frigid climate, together with some of its advantages as a permanent home. I may state that the writer is a graduate in medicine, University of Pennsylvania, class of 1855, and has for the past sixteen years resided in Orlando, where he has

stage of consumption, only to die among strangers, deprived of the comforts of home. Before coming to Orlando, consult your family physician. If he thinks that relief is possible, then come at once, and prepared to stay—not for a day, week, or month, but forever, if necessary. Stay just as long as you are convalescent—to return north, even after you think you are well is in many cases fatal. To get the benefits of the climate one must stay winter and summer; to make

progress he must have home comforts.

Many invalids suffering from acute diseases come to Orlando trying to practice stricter economy than they employ at home; hire uncomfortable rooms, do their own cooking, and live on canned goods. I have known many of these to die of starvation, living on a diet of toasted crackers, stewed prunes etc. Proper nourishment is absolutely necessary in our excellent climate, and unless a person can digest wholesome food, and has the means to provide home comforts, he will

out a stirring air, to make one comfortable. Sultry weather is unknown day or night. The thermometer does not register so high in Orlando during the summer months as in northern cities, as the report of Government Observer, E. A. Richards clearly shows.

"I have had charge of the weather observers office at Orlando, Florida since Nov. 10th 1893. From data in my office I have completed the following table. The maximum point of heat for the past six years has been:

1894 97° Aug. 11 and 18.



"THE DARROW", ORLANDO, FLA.

be a thousand times better off at home.

Relaxation of mind is essential, and one should come prepared to hunt, fish, and eat and sleep out of doors. I have known many sad cases of invalids who could not be induced to remain in Florida even when they were on the road to recovery, complaining unreasonably that the summers were too warm. After an almost continuous stay of fifteen summers, I say with deliberation, there is never an hour with-

1895 97° June 23, 24, 25, July 31 Aug. 1, 19, 20, 23.

1896 97° Aug. 4th.

1897 95° June 24th.

1898 98° July 18th.

1899 97° June 2, 3, 15, 16, Aug. 5, 6, 9.

E. A. RICHARDS,
Weather Observer."

Orlando is situated on a dividing ridge midway between the Atlantic and the Gulf of Mexico. It is built on high rolling pine land; the air is pure, wholesome and invigorating,

being ozonized by the close proximity of the sea, and deriving salubrity from the neighboring pines.

Within the township are thirteen fresh water lakes of great depth, from five to forty acres in extent, and fed by flowing springs. One of these, Highland Lake, is the source of our water supply. I give below the official analysis of this water, supplied by the State Chemist of Florida, Prof. Norman Robinson.

Amount of solid matter 1.79 grs. per gallon, the constituents being as follows:

most other cities, the water of London containing eleven times, that of Paris six and a half times, and that of Chicago five times the solid matter per gallon found in that of Orlando.

Dysentery and cholera infantum, the scourges of so many sections, are almost unknown in Orlando. I have not seen, nor do I know of, a single case of cholera infantum during my long residence here. I saw one case, brought here from western North Carolina in a state of collapse, which quickly recovered. The dread disease, diphtheria, is



WINTER PARK, ORLANDO, FLA.

Organic matter.....	42.09	per cent.
Sodium chloride.....	24.15	" "
Potassium chloride.....	5.80	" "
Magnesium chloride.....	5.01	" "
Calcium sulphate.....	6.40	" "
Calcium carbonate.....	3.20	" "
Iron oxide.....	4.60	" "
Carbon dioxide.....	3.61	" "
Phosphoric acid.....	0.42	" "
Silica.....	3.62	" "
Loss undetermined, etc.....	1.10	" "

seldom met with. I have never seen a case.

Scarlet fever is of so mild a type that it takes an expert to diagnose it, and the physicians are rarely in harmony in regard to it. It is not a fatal disease here, and has never been an epidemic.

Typhoid fever is infrequent and mild as compared with other sections, and is seldom fatal. There has never been an epidemic or an endemic of it in the city. Pneumo-

From the foregoing table it appears that the mineral matter contained in a gallon of this water is 1.04, and the organic matter 0.75 grains. The water of Orlando, therefore, is superior to that of

nia is of rare occurrence and is rarely seen uncomplicated with previous pulmonary trouble.

There has never been a suspicious case of yellow fever in this section of the state. In fact, Orlando is kept so remarkably clean that its antiseptic surroundings are a source of favorable comment by our many visitors.

The secret of our success in the treatment of pulmonary disease in Orlando, lies in the fact that the invalid can spend nine-tenths of his time out of doors. During most of the winter nights it is not neces-

can be raised each season, while cattle and poultry raising are very profitable. One of the largest industries around Orlando, outside of orange growing, is raising pine-apples. Perhaps \$200,000 has been invested in the business in this part of the country, the profits being estimated at \$1,000 per acre. We have in the county about five thousand acres of orange groves, and will ship considerable fruit the coming season.

One of our chief attractions is found in our paved county roads, affording the finest advantages for



LAKE ELA, ORLANDO, FLA.

sary to close the windows, and there is no danger from malaria in the night air of summer. I need not dwell upon the advantages of sunshine and pure air in the treatment of consumption.

I do not, however, wish it to be understood that we have nothing in Orlando except climate. Perhaps as many avenues to business success are open here for persons of small capital as in other states. Three crops of garden vegetables

wheeling, riding and driving. We have excellent public schools and within five miles a flourishing college for both sexes. Messrs. A. H. Darrow & Son, of Chicago, Ill., proprietors of "Darrow Villa," Minocqua, Wis., have just completed a most charming winter hotel, "The Darrow" was built with a view to air and sunshine and is well appointed and conducted. Broad piazzas extend entirely around the house, which is adorned with ample, orna-

mental grounds. Nothing seems to have been omitted to promote the health, comfort and enjoyment of guests, the provisions for their happiness being carefully devised and thoroughly executed. There are other good hotels in Orlando, but the "Darrow" was constructed with a special view to the benefits

of outdoor life and the value of nature's hygiene.

In conclusion, let me repeat then, while Orlando is not a "cure-all," the invalid can anticipate speedy restoration here under climatic conditions unsurpassed in any other section of the country.



WINTER PARK, ORLANDO, FLA.

ARIZONA AS A HEALTH RESORT.

A. W. Craig, M. D., Phoenix, Arizona.

Arizona may not be the richest of the nation's possessions, and there are more inhabitants in the single city of Milwaukee than are to be found in the entire territory, but in the matter of climate she has no equal.

Located between two great ranges of the Rocky Mountains is a vast plateau, as significant in its climatology as any ocean. The relations of the immense irregularities of this vast area to the atmospheric

bine to make the Salt River Valley the ideal winter resort.

As the manifold climatic advantages, (chief among which are a uniformity of temperature, minimum humidity, and a maximum amount of sunshine,) are becoming more and more clearly recognized by the medical profession in the east and north, the tide of winter travel is tending in this direction, until Phoenix has come to be accepted as the Cairo of America. Even more than Egypt, Arizona, with its deficient rainfall, absence of cloudy days, and high rate of evaporation, is "The land of Sun-



COURT HOUSE. PHOENIX, ARIZONA.

currents and to the storm centers render certain parts of it a vast sanitarium for the alleviation or cure of every variety of pulmonary disease and various other ailments requiring a dry, warm climate.

Far to the south on this plateau is Arizona, which has certain marked climatic characteristics that distinguish it from any other portion of the arid belt. Five hundred miles from any large body of open water, surrounded on every side by vast, sandy deserts, it has the natural conditions which com-

shine." As it is not within the path of storm frequency the sequence of weather is more uniform than in more northern latitudes, or on the same parallel farther east. In consequence of its distance from large bodies of water, there is an absence of fogs, which are so objectionable at the winter resorts of Florida and California, and the difference of 15° F. in mean temperature between Colorado and Arizona, allows an almost exclusive outdoor life, so essential to the existence of the tubercular patient but

which is impossible in Colorado.

The variation in altitude to be found in Arizona is one of its most striking advantages. With the same general conditions as to temperature and dryness of air, the physician is able to select nearly any altitude he may desire, ranging from about sea-level, at Yuma, to six thousand eight hundred feet, at Flagstaff.

The two principal towns in the southern portion are Phoenix and Tucson; in the north are Prescott and Flagstaff. The latter, a beautiful little city of 2000 population, was certainly intended by nature as

Flagstaff has an additional advantage of being the nearest railroad point to the Grand Canyon of the Colorado, certainly the greatest scenic wonder of the western continent. After a single day's ride by stage through beautiful natural parks the rim of the canyon is reached, and the best of accommodations allow the traveler sufficient time to thoroughly enjoy the most impressive of nature's panoramas.

Within easy walking distance from Flagstaff are Montezuma's Castle, a famous Aztec ruin, Montezuma's well, The Petrified Forest, Cataract Canyon, and Walnut Creek



ARIZONA VIEW.

a summer resort, and I believe that it is as beneficial for tubercular cases as Phoenix in summer or the Salt River Valley in winter. At an altitude of nearly 7000 feet, it stands in the midst of a great plateau extending over 20,000 square miles covered by immense forests of pine and cedar. During the hottest summer months the mercury rarely rises above 80° F., and at no time is it so warm that blankets are not a necessary adjunct to the camping outfit.

Canyon, with its cliff and cave dwellings. In the mountains and canyons in this locality may be found bear, deer, antelope, mountain lion and numerous varieties of small game.

Oak Creek, twenty miles from Flagstaff, is a favorite camping resort on account of the fine mountain trout-fishing to be found there. The forests, clear of brush, are one vast park. Add to this the essentials for the recovery of pulmonary complaints, viz: altitude, minimum

humidity, and the invigorating mountain air, and we begin to know a few of the attractions that make Flagstaff an ideal summer resort for the tubercular patient, as well as for the tired overworked business or professional man needing only rest and relaxation.

By passing the summer in Flagstaff, the fall in Prescott, and the winter and spring in Phoenix, the visitor can live constantly in a climate combining the salubrious features of the Riviera and the famous resorts of Switzerland and Egypt, with practically none of their disadvantages.

now, ancient canals may be distinctly traced, demonstrating that at one time a most extensive and elaborate system of irrigation existed.

Near Phoenix, Casa Grande, and Tempe are the ruins of prehistoric cities that were beyond question more populous than any now in existence between Denver and the Pacific Coast. Extensive researches have been made in these ruins by representatives of the Smithsonian Institute, and by various ethnologists, and many very fine collections of pottery, stone hatchets, onyx and turquoise ornaments, etc.



PALM DRIVE, PHOENIX, ARIZONA.

The Salt River Valley, of which Phoenix is the commercial center, is already the Mecca of the invalid seeking to escape the rigors of the northern winter. It is about sixty miles long and twenty miles wide, the larger portion of it being as level as a floor, with a gradual slope to the south and west. This valley was apparently the center of Aztec civilization, and it has been estimated, from the immense ruins found in various parts of it, that this region at one time had a population of over 300,000. Even

have been made here.

Phoenix, the largest city and the capital of the territory, is located in this valley and is a thoroughly modern town of about 15,000 inhabitants, made up very largely of people who have immigrated to this territory within the last ten years to enjoy the climatic advantages found here.

This valley is largely given up to citrus fruit growing, and the orange groves within five or six miles of Phoenix are one of its most attractive features. A belt

stretching for miles along the foothills produces the finest oranges grown in the United States, and a ride along some of the driveways skirting the canals which supply the water for irrigating these fruit orchards, is of more value than any tonic known to the medical profession. Killing frosts are practically unknown, and even during January and February, the coldest season here, the apricot and almond trees are in bloom and alfalfa fields are as green as an Illinois lawn in June.

Charles Dudley Warner describes Arizona as the Persia of America

of a famous humorist and purporting to be taken from the columns of the *Arizona Kicker*, a purely imaginative publication supposed to be located in Tombstone, Arizona, have created an exceedingly widespread, false impression of Arizona in the minds of large numbers of eastern people. Many people come here with an idea that they will be compelled to forego most of the advantages and comforts of civilization, to find that, contrary to their expectations, the best hotels are at their disposal, and that there are as many churches, and perhaps more school-houses, than are to be found



VIEW IN PHOENIX, ARIZONA

as follows: "It is the home of the rose and the mocking bird. In the valleys the cypress and myrtle abound, the fig grows wild, the olive and almonds are cultivated in large plantations; the vineyards yield strong and highly flavored wines; apples, pears, apricots, peaches, oranges, lemons and pomgranates of unsurpassed quality are raised in the orchards, and the gardens teem with roses and geraniums."

Articles emanating from the pen

in towns of equal population in Illinois or Ohio.

The leading winter hotel, which has accommodations for about 500 people, compares very favorably with the best hotels of the resorts of Florida and California. In addition to this, good accommodations are to be had in private boarding houses at extremely moderate rates.

A good climate alone will not cure pulmonary tuberculosis, but must be supplemented by good food and sufficient occupation and amuse-

ment to prevent the patient from falling into a melancholia which can but prove disastrous.

Other conditions being equal, there is no question that tubercular cases improve much more rapidly, and a very much larger percentage of permanent recoveries are found where the relative humidity is the lowest.

While there are many good climates, there are none presenting exactly the conditions found in the vicinity of Phoenix, viz: highest annual temperature, lowest relative humidity and least wind movement. No other region even approximates to these advantages.

The average annual rainfall is about 7 inches, as compared with 34 inches at Ashville, North Carolina; eight-tenths of this falls during the months of July and August. The relative humidity at the Phoenix weather station is 36%, which is lower than that of any other city in the arid belt.

The method pursued by the more modern sanitarium at present, particularly in Germany and at Davos, Switzerland, is to give the tubercular patient as nearly as possible an absolute out-door existence. There is no place in America where this end can be attained with greater success than in the Salt River Valley.

Undoubtedly the best results are being secured in pulmonary cases by a tent-life on the desert at the foot-hills which extend to within ten miles of Phoenix. Indeed, many people sleep in the open air all winter, although it is not so common a practice as it should be when carried out under intelligent directions.

Phoenix can probably offer more inducements in the way of amusement than any town in the territory. A good theatre offers some of the best attractions on the road, Phoenix being on one of the transcontinental lines of railway and an easy

stopping point for companies going from the East to the Pacific Coast.

In midwinter a week is devoted to "La Fiesta," a thoroughly curious and interesting event, modeled somewhat after the holiday amusements of Old Mexico.

Good horses are numerous and cheap and there are plenty of vaqueros (cowboys—the genuine article) to show what horses can be made to do.

The roads for fifteen or twenty miles on either side of Phoenix are good. The desert itself is as easy to drive over as the average eastern roadway, and the whole valley is a paradise for bicyclists and horsemen.

While the Salt River Valley is the climate *par excellence* for the relief of pulmonary tuberculosis, there are many other diseased conditions that do well here. Asthmatic patients usually receive prompt relief and are permanently cured. Bronchitis and laryngitis disappear as if by magic, the dry, warm air acting as a most effectual stimulant to the mucous membrane of the respiratory tract.

Kidney cases seem to do remarkably well in summer, as the perspiration is copious and the skin performs the largest part of elimination.

Rheumatic affections are generally much improved during the winter, but it is in the summer that the best results are attained, as the constant perspiration, maintained for months, has a greater eliminative effect than a sojourn at the most famous springs. This territory might well be included with Mexico as the "Land of Manana" (tomorrow), and the perfect rest and relaxation that tired nerves experience in this balmy air act almost as a specific for nervous prostration and insomnia, as well as affording a new lease of life to the consumptive.

STORY.

SPANISH-AMERICAN SKETCHES.

I. *Doctor Sangrado.*

BY "VIATOR."

To have seen the living image of which Le Sage's redoubtable hero is the prototype, chatted with him, and marvelled at the arcana revealed by this oracular personage, is indeed a privileged recollection. Yet him I knew in the flesh—such corporeal semblance of it as frugal nature and the pitiless lien of science decreed to him—and, amid the paraphernalia of his august calling, I now behold him, lost in exploration of those venerable recesses whence life and light have issued to mankind.

The sphere in which his ponderous attainments were unearthed to men—and alas! too often entombed by them—was a small town situated upon a bluff overlooking the upper waters of the Uruguay, within the territory included by the republic of that name, commonly known as the Banda Oriental.

Yet, though his earthly realm was limited compared with the supernal regions compassed by his glowing imagination, within its borders he reigned supreme. To him all eyes were turned in seasons of distress, and, as I have hinted, the cemetery in the neighborhood bore ample testimony to the fidelity with which his task was performed.

It was during an overland journey that I became acquainted with him. He was returning, as I afterwards learned, from a visit to an early friend whom chance had cast upon these distant shores, a compatriot, as he told me, from the province of Arragon in Spain, with whom many boyhood memories were associated. This I heard as

we sat before a native ranche, where, the day being far advanced, we sought shelter for the night.

It needed not the natural impulse of a fellow-traveler to urge acquaintance with this singular man, whose strong character and bonhomie invited scrutiny. I had observed, as we rode along, the extreme tenuity of his person; the cassock-like garment which enveloped his figure giving emphasis to the general emaciation he presented. I had remarked, too, a compensating breadth of intellect illumining his features, the searching penetration of his small gray eyes, and the glossy luxuriance of hair much too youthful, I thought, to be indigenous. A pot hat, very tall in the crown, and a brim scarce wide enough to exceed the projection of his enormous ears, together with an antique eye-glass dangling about his neck were also matters of reflex observation.

The profile, as I saw it was certainly uncouth, if kindly, being signalized by one of those unhappy results of nasal construction which suggest a temporary abandonment of original design, a sudden glimmer of proportion, and final renewal of the task ending in irreparable failure. In short, his was a nose only to be redeemed by long familiarity with its idiosyncrasies and the discovery of amiable traits in the proprietor.

I am explicit concerning the above feature of the good doctor's physiognomy, since, being the salient object of regard whenever I looked at him, it came to be inseparably blended with his personality, and also because experience has taught me to view auspiciously the possessor of a distinction I have ever found to be united with saving graces of mind and heart. Nor was

the batrachian cavern that yawned beneath the aforesaid precursor of jollity less indicative, as I learned in time, of the doctor's strength and tenderness. And so I felt in knowing him that one perplexity of life was solved, and never thereafter have I looked upon these worthy blemishes save with confiding admiration.

Sitting in the twilight that evening, my friend was mellowed to the sympathies that lurk unseen throughout the world, awaiting the kindred touch to be called forth in glad expression. He narrated to me much of his early career in Spain, and dwelt with fervor upon the stately history of his beloved country. He painted with an epic zeal the lofty motives which, to his patriotic thought, exalted above all others the age of knightly bearing and of chivalric exploit, and, warming with his theme, poured forth in sonorous phrase a lament that genius and manners were no more. Then, turning to the field of literature, he drew, in illustration of his argument, such pictures of the immortal Quixote as I had never met with in Castilian commentary; presenting Cervantes' vision as the type of heroic adoration of the Ideal, the spiritual exemplar of stainless valor in defence of truth and love and pure nobility of soul. To him the thrilling chronicle was a divine allegory, and there was infinite pathos in the attitude of this battered and forlorn champion of heaven rushing upon destruction, braving wounds and contumely in impassioned search of that which perished in Arcadian vales.

Continuing our journey, my companion, who despite his three-score years, sat his horse like a native, dilated upon the charms of the scenery around us: the low, undulating hills lying in the clear sunshine, the tender gradations of color where the soft outlines merged in the horizon, the picturesque grace of copses nestled in the hollows or

arching the shallow fords by which we passed.

Of his actual life and profession I as yet knew nothing, his allusions to himself, save so far as they related to a distant past, being marked by great reserve, in which I fancied he wished to veil from me his identity, not all unclouded, as it appeared.

My way led near his own, and, accepting a cordial invitation to visit him, I changed my route, and at dusk entered the quiet village where he dwelt, my friend proceeding to his room and I seeking quarters in a French hostelry, after an agreement that I should breakfast with him the following morning.

It was some time before I reached next day the dwelling he had indicated, the dilapidated streets of the town necessitating many detours, and my attention being constantly drawn to some object of interest by the way. It must have argued insensibility, moreover, not to perceive the archness of many a senorita's glance as I availed myself of a stranger's privilege to scrutinize the dainty courts adorned with orange trees and oleanders, or looked within the ornamental grilles that barred intrusion while challenging curiosity. There was an enchanting sense of reality mingled with remoteness in the sound of music and laughter, and, now and then, a bold yet innocent greeting which enlivened my passage, suggesting, to an Anglo-Saxon journeying so far from natal associations, a sense of bewildering solitude, the more oppressive by contrast with the perpetual gayety around him. *Ce n'est pas vivre, c'est exister.*

The cathedral bells were clanging high noon as I stopped before a low archway, over which a faded legend announced that within might be obtained alleviation for mortal ills, the elixir of life being constantly available from sources forever replenished. I had not mistaken the number, and became

aware that my host was of Æsculapian proclivities. A dark-eyed child with an uncomfortable stammer in her speech answered my summons—the clapping of hands and the call of "Ave Maria!"—and conducted me across a little area, tiled with marble and protected from the sun by means of a spacious awning, beneath which canopy rows of myrtle and arbor vitæ flourished, the central space displaying an ancient basin in which a slender fountain plashed and murmured.

Leading me to a massive doorway opening on the court, the child pulled at a bell-chord hanging outside and scampered away. The doctor, since so I must now hail him, advanced to meet me, issuing from an interior apartment, evidently pleased to renew the relations of the previous day. His appearance was more professional, his alien locks being surmounted by a black skull-cap, and an apron, dotted with the cabalistic record of his medicinal prowess, heightened the impressiveness of an already unique exterior. I saw by the gory symbol of his craft in his hand that he was occupied in cupping some helpless seeker after lethean calm, and seating myself in the patio or court, awaited the close of the tattooing. Surely this was Sangrado himself, and perchance the gentle Blas was not far off.

I saw the victim, decorated yet distressed, vanish by a distant portal, and soon the doctor reappeared, still wearing his cap but otherwise arrayed for company.

The breakfast table was laid in an adjacent court, also sheltered by an awning and ornamented with tiers of pelargoniums (an aversion among the natives, by the way), Chilian jasmine, and superb tea-roses trailed against the walls and shedding a delicious perfume, huge shrubs of althea and pomegranate occupying the more open portion of the enclosure. The ubiquitous par-

rot reiterated his preternatural gurgle near by, and birds of gay plumage and no song, and others gifted with witching melody though clad in sombre livery, were ranged about us. A tame weasel, handsomely marked with black and gray, bounded playfully or wandered at will amid the shrubbery, purring as he went.

The young girl who had been my cicerone upon arrival brought our repast, her swarthy features and straight black hair, together with the sullen expression of countenance resulting from generations of vileservitude, indicating the class from which there is no ascent in these semi-barbarous regions.

The meal was served after the prevailing fashion of the country. A savory broth, with hard biscuit or French bread, in the attractive, club-like form, was followed by boiled beef and potatoes, the tid-bit of the course being marrow laid on bread and sugared plentifully; then a roast, consisting of beef ribs cut in convenient pieces, with salad of fresh lettuce, and, for an entrée, stuffed onions; and, finally, dessert of quince marmalade and cheese, eaten together, with black coffee bearing the seal and flavor of the genuine beverage. An occasional sip of red wine mixed with water during the repast served to give zest to appetite—never to conversation here, in the coarser Saxon sense.

My host astounded me by the inscrutable capacity in which he revelled. That viands so stimulating should result only in proportions so cadaverous led me to wonder whether some mysterious divination of occult truth were not vouchsafed to him. With luring adroitness I questioned him upon various topics relating to hygiene, hoping to discover the laws by which through the purveyorship of that formidable omnium gatherum which gaped before me, he was enabled to assimilate so sturdy an allowance,

while retaining such litheness of development. His only reply was a learned disquisition upon the minutiae of animal economy, by which it appeared that, given certain conditions of physical being, certain concomitant phenomena must ensue, or some equally lucid thesis of the kind, leaving me more perplexed than ever.

Doubtless the discourse was intended to produce in the mind of a layman that veneration he was wont to receive from those to whom this erudition was the credential of all knowledge possible to man; and, rather than betray sign of dissent, I suffered the worthy orator to finish his grandiloquent harangue. It was nevertheless a relief to my mind when, rising from the table, he led the way to his office, bidding me follow him.

In an apartment of moderate dimensions were collected the visible insignia of his profession, forming, as I remember them, a motley array of odds and ends, some of them of obvious import, but by far the greater part, crowding the shelves and suspended from the ceiling, corresponding to no purpose within my comprehension. Human anatomy in its harmonious entirety may truly command our grateful admiration—it is well for us indeed that we have been so carefully devised and put together; but I could never experience a proper awe when confronted with dismembered remnants of mortality, steeped in embalming fluids, or finding melancholy sepulture in some ticketed recess, to be exhibited as “beautiful specimens” from time to time.

As I surveyed the ghastly assemblage of commemorative reliquiae around me, I could not but suspect that the neighboring depository of departed townsmen was in the fullest sense the palladium of the doctor's conquests, and the possibility of his depredations in behalf of science recalled an anathemæ of my acquaintance who,

during a revolution in an adjacent province, stealthily exhumed the remains of a departed parent and deposited them in a soap-box, laid upon the hallway shelf, awaiting an auspicious occasion for reinterment.

Yet in this weird laboratory where I stood had dwelt and labored and aspired a human soul, thirsting for the verities of life, discarding non-essentials and, from the harvest of fruitful years, winnowing the precious grain in happy service to mankind. And if occasionally, beneath the kindly influence of the good doctor's ministrations, some fellow-mortal was laid to rest before his time, or a superfluous anguish was visited upon some too sanguine subject of experiment, it must be admitted that these derelictions from virtue, if such they really were, found ample atonement in the reflection that they did but mark the boundary of the physician's wisdom, and were compensated by the vast amount of misery actually mitigated by his skill.

As we took seats in the front patio, the doctor descanted upon various themes touching medicinal aid, elaborating his thoughts as he proceeded, but always adhering to primitive methods and theories in connection with pathology and treatment. I could not but note the elegance of his diction, and his frequent use of pure Latin words, which give to the Spanish language so concise and impressive a tone. His command, too, of provincial apothegms was remarkable, many of them conveying in graceful inuendo the philosophical thoughts to which his countrymen are prone.

The afternoon was fine; the sun's heat was tempered by a cooling breeze from the south, and we sauntered forth towards the limit of the town where the doctor was accustomed to gather certain herbs of subtle curative properties, the se-

cret of which passed not out of his alembic.

Not far from his dwelling we came upon a group of children playing by the roadside. I saw by their deportment that only the parish priest was held in equal reverence with my companion. Yet his greeting to them was devoid of formality, and in his speech and manner were at once distinguishable the genial traits I had observed in him. There was no approach to familiarity on the part of these merry urchins, nor trace of servile regard in the way they doffed their caps and stood aside to offer the customary civility, "the wall."

Further on we met a charcoal vender, straddling his grimy panniers and singing as he rode along. To him also my friend addressed a courteous salutation, inquiring heartily whether accident had befallen him that he had not visited the town in such a while.

Then we took a path leading across the fields, where towering aloes filled the air with slumberous odors, and terrible barriers of prickly pear stayed the inroads of roving cattle. Over the bright sward were scattered clusters of wood sorrel, salvia, lantana, ageratum and verbena of different hues, forming here and there patches of tropical color; along the border of hills which skirted the landscape beyond us a slow procession of sunlit clouds moved majestically onward, and in the middle distance the eye rested upon willows, poplars, and soft masses of mimosa in varied gradations of shadow; while permeating all, being imperceptibly mingled with the meditation awakened by the tranquil scene, we felt and breathed that delicious atmosphere which enchanted the early explorers of La Plata, leading the sailors to exclaim: "Ay, que buenos aires!" "Ah, what balmy aires!" thereby christening the land.

The doctor had removed his hat

that he might catch the soft breeze upon his temples, and stood with placid countenance regarding the lovely features of the spot, quite forgetful of the simples which were his quest, and calling upon me to admit that, if man can of truth draw nigh to the heart of nature, comprehend her moods, and invest her with something akin to human thought and emotion, it must be in some fair solitude like this. And then he drew from his pocket a favorite volume, Garcilaso, and read with thoughtful comment many a noble stanza and idyllic verse.

Turning homeward at last, we passed a band of gauchos, riotous with strong waters, their faces hideous with traces of the wild passion to which their nomadic, freebooting life lends fatal fury. It needed little observation to be persuaded that, with so irresponsible a soldiery to command, any leader of wealth or influence might establish a revolutionary government, evading capture and terrorizing the country for years, if not finally successful in his schemes. Yet these same ruffians, as I knew, could be as peaceful as the Swiss peasantry, and, as the Tyrolese lover wakes the tender music of his zither, draw from their guitars such plaintive melody, so sad and of so heart-breaking a pathos, that one listens to it as to some pastoral lament of Dorian days set to rhythm of a later age.

I had spent a rare evening with this engaging friend, and returning to my hotel bethought me of the riches to be met with everywhere, so we seek them in earnest. I remembered having first found and read Plato's Phaedrus, while, hemmed in by dreary sand heaps, our regiment awaited an army transport near Point Isabel, in Texas; of discovering, in an inland village far up the Rio Grande, Chateaubriand and Montesquieu, and the Divine Comedy, with the

ethereal Vita Nuova; and, still again, Chapman's Homer and Faust amid surroundings unspeakably dismal. I recalled with grateful emotions many a chance relation with those whose peers are hard to find—warm, elevating friendships of a day, vanishing with the journey's end and thereafter irrevocable, leaving the memory of something grand and sweet, to be cherished forever.

So from the wilderness around me had stepped forth the venerable doctor, quaint, ill-favored, and shrunken with lonely vigils, yet every inch a gentleman, and bringing with him, in the characteristics of his calling, recollections of the learned personage whose portraiture adorns the classic romance of *Le Sage*.

SENSE OF HUMOR.

And the sixth sense is the sense of humor.

Without it a man is like a boat without a rudder, a peacock without a tail, an ostrich without a feather, a political aspirant in the United States without money, or a girl without beaux. He is tossed, subject to every wind and wave; he eddies along, now in this port, now in that, for no long space anywhere, and often lands in the safest place for him—an insane asylum.

No real humorist ever went crazy; none ever committed suicide; I doubt if any ever killed, with intent, his fellow-man.

In fact, humor is a saving sense. It is as necessary for the voyage of life as life-preservers are for a sea voyage. It keeps a man from growing utterly bad, just as it keeps him from becoming absolutely good—that perfect state reached by some. It is a balance-wheel, adjusting all the unequal volume of a man's nature, placing so much on this side, and so much on that; and

is as sure as the law of equivalence in chemistry.

I doubt if the sense can be imparted to one whose parents failed to attend to the matter in time, that is, before birth; but if it can, I think that the subject ought to be taught in the schools. This education might be compulsory upon those who can see the point in a French joke.

At any rate the sense may be cultivated.

The true humorist includes himself as an object. Some men have a perception of fun, and see others that stand in a ridiculous situation, while their own absurd actions remain invisible to them; these men are egotists. No person with a well-defined sense of humor can be egotistical, or brag of his own exploits. A friend of mine who has some notable talents along with a delicate sense of humor, wished to tell me what had been said in praise of his work, but could not. "If I did," said he, "I should die laughing."

For, a well developed sense of humor is the gift Burns wished some power "wad gie us" that we might see ourselves "as ithers see us". We have the capacity to laugh at ourselves. The man that fell off his bicycle into a mud puddle, and was found there laughing boisterously at himself, had a proper appreciation of the ridiculous.

I am almost prepared to say that no really humane man is without a sense of humor, and the want of it in a system permitted the inquisition, the burning of Servetus, and the hanging of witches.

Indeed, orthodoxy and humor are antagonistic, and where the former gains the ascendancy the latter disappears. Orthodoxy and oxygen are not miscible.

The properly constituted physician is a humorist, and, as a result, he grows tender, sympathetic and charitable towards the weak and **sinning** of the world. He can see

that even death-bed scenes are not devoid of a funny side that acts as a sedative in suffering.

It was a humorist who complained that he took an unconscionable long time dying. Death may kill the body but it cannot kill humor. Even the dyspeptic along with his crackers may crack dry jokes.

It was a plucked student who remarked upon looking at some spoons in a drug store, "even the spoons are graduated."

The gawk and the boor are men devoid of humor, for the country lad possessed of it will be warned what to do when he gets where his knowledge ends.

I shall mention a few of those that do not have the sense in a sufficient degree:

Those that wear electric belts and lead rings.

Those that die because they are jilted.

Those that return long thanks for short rations.

Those that wait on the house tops for the coming of the Lord.

Those that believe in Christian Science, while they deny the existence of a broken leg.

Those that deny the existence of God and buy liver pills.

Those that write some kinds of poetry.

Those that don't read some other kinds.

Those that endure the itch.

Those that laugh at their own sallies.

Those that never laugh at any one else's.

Those that wear paste diamonds and brass chains.

Those that wear photographs instead of rose buds.

Those that profess infidelity, then seek a feather bed during a thunder storm.

Those that stint all their lives in order to pay for a posthumous newspaper paragraph.

Those that can't understand why a woman can't be a man.

Those that can't bear children's noise.

Those that have no children to make a noise.

Those that fear that they have committed the unpardonable sin.

Those that are undertakers.

Those that try to interrupt the course of true love.

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

IRRIGATION OF TEA

An investigation recently inaugurated by the United States Department of Agriculture promises, if successful, to promote such development. This is the irrigation of tea at Pinehurst, the home of Dr. C. U. Shepard, near Summerville, S. C. The labors of this gentleman have already produced interesting results. He has about 50 acres planted to tea, which will when in full bearing produce each year about 10,000 pounds. Last year it produced about one-third of this amount. His investigations have been continued long enough to make it manifest that in any part of the South where the temperature does not usually fall below 25° F., and never falls below zero, tea can be successfully grown, but that in order to make it a complete success in all cases irrigation is necessary. The great obstacle in the way of making this industry a commercial success is the cost of production, and the readiest means of reducing this cost is to increase the yield per acre. If more pounds per acre can be grown, it means a less cost per pound for fertilizers and for cultivation. Picking will also be made cheaper because less ground will have to be traversed.

The need of irrigation to stimulate the growth of foliage is shown by a comparison of the rainfall at Summerville with that of other tea growing districts. This is given in Dr. Shepard's report (No. 61, United States Department of Agriculture), and shows that the precipitation during the growing season at that point is only about one-half to one-quarter of that of tea-growing districts of India and China. Summerville is within 20 miles of Charleston, S. C. The rainfall at Charleston from May to September is only 1.3 inches,

while the rainfall of the tea-growing districts of China for the same period varies from 60 to 111 inches. Through the co-operation of Dr. Shepard and Elwood Mead, the irrigation expert of the office of Experiment Stations, plans have been made for the construction of a storage reservoir sufficient to hold water enough for a season's irrigation of one of the tea gardens. This reservoir will be filled from a well dug to a depth of 20 feet and supplied by the underflow of a neighboring stream. The tea garden to be irrigated is planted in rows five feet apart. These rows have a fall of four inches in one hundred feet, which gives ample fall for distributing water and for underdrainage should this prove necessary. In order to test the relative merits of surface and sub-irrigation, about one-half of this plat will be watered by means of tile placed one foot beneath the surface and laid down between the rows. The distance between these tiles will therefore be five feet, and the water will have to percolate laterally two and one-half feet to moisten the ground around the plants. Another portion of the garden will be irrigated by surface furrows run on each side and one foot from the plants. In order to test the difference between the growth and productivity of the irrigated and non-irrigated portions a small part of this garden will be left unwatered.

An interesting feature connected with this extension of irrigation is the fact that a part of the farm on which tea is being grown was formerly devoted to the production of indigo, and was irrigated. The production of this crop finally became unprofitable and was abandoned, but the remains of the ditches can yet be seen.

It will probably require several years to fully determine the extent to which this form of agriculture can be extended in the South. Even without the aid of irrigation tea has been grown with profit, but if, as is believed, a material increase can be made in the yield through the addition of this stimulus, and improvement in the quality of the product as well, there is little reason to doubt that the time is near at hand when this country will have made another significant addition to its capacity to be entirely self-sustaining.

WILL RAISE TIMBER.

The Division of Forestry is in consultation with three important railway companies over a contemplated innovation in American railway methods. These roads—the Atchison, Topeka & Santa Fe, the Chicago, Milwaukee & St. Paul, and the Zanesville & Ohio—are considering raising tie and pole timber on a large scale on their now non-utilized right of way lands. Other large Western roads are also interested.

This action is due chiefly to the failure of the natural supply of this material in all but the newer portions of the United States. About one million acres of timber are consumed annually by railroads in buildings and repairing, and, at the present rate of timber depletion, the increased cost of such material will soon be a serious factor in railroad economy. The Santa Fe line has already done some experimental planting, and the results have done much to stimulate interest. This road planted 1 280 acres in catalpas fifteen years ago. The total expense was \$128,000; but it is estimated by the railroad officials that in ten years more the tract will have produced \$2,560,000 worth of poles, ties and posts.

Having become convinced of the necessity of growing their own timber, the railroads naturally wish to take advantage of the assistance offered by the Government for tree planters—which consists of expert advice, and of the working plans for planting, based on personal examination. The

object of the Government is to demonstrate the value of tree plantations to land owners, especially those in the treeless regions of the West.

FREAK FARMS IN INDIANA.

Indiana shows up with a number of what may be called freak farms. In that State there are six farms given up to raising skunks, and some of them by the tens of thousands each year. As a black skunk's skin is worth \$2 and a black striped ones from \$1.50 upward, these farmers are said to be growing rich. There are two or three weasel farms, and the weasels are also grown for the value of their skins.

There are three large rabbit farms, the largest containing 30 acres. This is being stocked with Belgium hares, and the company owning it has an agent buying them by thousands in France and Belgium. When fully stocked it will keep about 32,000 hares, and they should market 1,000,000 hares each year. These sell when dressed at about the price of poultry, and the skins are worth from 10 to 25 cents each. Many also can be sold as pets or for breeding purposes.

A number of farms have been devoted to raising Angora cats, most of them in the vicinity of New Harmony, and a cat broker in Evansville has put 3,000 of them on the market during the past three years since the business started there. Farmers get good prices for good males and think that is better than dollar wheat. A good market is found for many of them in the stores in Philadelphia, Pa.

There is one farm where the main business is the growing of leeches. The stock was imported from Germany, and they are grown in moss-lined vats. While the demand is not as good as a few years ago, the owner sells several hundred thousand each year. There are several goldfish farms in Shelby county, one of them the largest in the world, shipping away more than 2,000,000 fish last year, some of which went to the fountains of royal gardens in Europe.

On three or four farms ginseng is the main crop, and one farmer in Jackson county is putting in 160 acres of it. It requires 40,000 seeds to plant an acre, and they are worth \$85. After planting they require seven years to grow, and then the roots weigh from one half-ounce to three ounces each. They are cured and shipped to China, where they sell at from \$3 to \$2000 per ounce, according to the quality and texture, so that he expects to be paid for the expensive planting and cultivation and long waiting for the crop to grow.

Another crop which requires even longer waiting is the hickory nut or shellbark, of which many farmers are now setting out large orchards. This nut, which used to grow wild and sell for 50 cents a bushel, now is in good demand at about \$3, and if the trees which were cut down in the early days of the state were now standing they would yield the most profitable crop of the farm.

Several farms make a specialty of raising frogs by the thousands, as they are worth from 50 to 90 cents a dozen. There is a large profit in them, but it requires much care to protect them from their enemies, which include crows, hawks, herons and many prowling small beasts.

Some farmers raise watermelons and promote their growth by slitting the stem and putting in a cotton fuse or wick, which projects out and passes through a cork into a bottle filled with sweetened water. A thrifty vine will use up a pint of this water a day and grow melons of 70 to 80 pounds weight of a texture and sweetness never before known.—*St. Louis Globe Democrat*.

NOTES ON FORESTRY.

A system of co-operation for the coming summer has been arranged between the Division of Forestry and the forest reserve work of the U. S. Geological Survey. The latter is a branch of the Department of the Interior. Field parties of each division will collect information desired by the other, and, in some instances, exchange of

men may be made. This system marks a distinct change from conditions of a few years ago, when there was sharp rivalry between the scientific branches of Government service. The Geological Survey will give especial attention to collecting data on forest fires for the Division of Forestry.

Investigation of the causes, effects, and means of prevention of forest fires in the West, will be carried on this summer in Washington, Oregon, California, Arizona, New Mexico, Utah, Colorado, Wyoming, Montana, Idaho, South Dakota. Besides field study, designed chiefly to discover means of preventing the evil, the Division is making a historic record of all important fires which have occurred in the United States since 1754. Although yet incomplete, this indicates that the annual recorded loss by forest burnings in the United States is, at the very lowest, \$20,000,000. It will probably run above this sum, as the Pacific coast States have been only partially examined. Accounts of over 5,500 disastrous fires have been obtained in the seventeen States already examined. Michigan, Minnesota and Wisconsin have suffered the most severely. These records are taken chiefly from newspapers, and where it has been possible to compare them with the figures of practical lumberman, it has been found that the tendency of the press is to underestimate the damage.

The former official estimate of the wooded area of the United States, placed at 27 per cent. has been raised to 37 per cent. by the latest computations of the Division of Geography and Forestry of the U. S. Geological Survey. That office has issued a bulletin containing new figures on American forests, some of which tend to prove the national timber resources greater than is supposed.

The two latest States to be examined are Oregon and Washington. The former is estimated to contain 234,653 million feet, B. M., in standing timber; the latter, 115,778 million feet. Destruction by fire has been exceedingly serious in Washing-

ton. On the assumption that the burned areas contained on an average as much timber as the untouched portion, 40,000 million feet have been destroyed since lumbering began. This amount would supply all the sawmills of the United States for two years, and at a value of only 75 cents a thousand, means a dead loss to the State of \$30,000,000. The amount actually lodged in the same period has been 36,000 million feet, making the estimate by the same comparison of areas. Oregon has suffered less from both fire and lumbering, owing to the smaller facilities for marketing the product.

NATIONAL SYSTEM FIRST.

San Diego Vidette: There seems to be a conflict between those in favor of national control of irrigation and those who favor State control. The *Vidette* is heartily in favor of either or both, but we hope the advocates of each will not foolishly antagonize the other, as such antagonism will injure both. There can be no doubt in the mind of any sane man as to the general benefit to be derived by irrigating the arid western lands. The vast empire, a part of which is in California still owned by the national government, should and must be reclaimed and developed by the general government. The State lands might be irrigated by the State, but when the great result is shown by government it will be easier to enlist the States in doing something for themselves. Let us work for a national system first.

AMONG OUR EXCHANGES.

SCRIBNER'S.

Among the features of *Scribner's Magazine* for April, the animal story by Ernest Seton-Thompson, illustrated by him, will attract the large audience which has been fascinated by "Wild Animals I have Known." In this story is given the life and adventures of a curious little animal of the southwest known as the kangaroo rat. Henry van Dyke has another outdoor story, the scene of which is laid in

a light-house on the St. Lawrence. The title is "The Light that Failed Not." It contains several dramatic situations. The illustrations by Mr. Clark have the distinction which all who admire his work expect from that young artist. Mr. H. J. Whigham contributes the account of the British defeat at Magersfontein, thus bringing the narrative up to the time when Gen. Lord Roberts took command of the column.

MCCLURE'S.

In sureness and variety of attraction it would be hard to surpass *McClure's Magazine* for April. The account of the interior of China, especially with reference to its rich promises as a market for America, written by Mr. W. B. Parsons, Chief Engineer of the American-China Development Company, from observations made on his own journeys and illustrated very fully from photographs taken by him; the account of Professor Huxley's life in London between his twenty-sixth and thirtieth year, when he was having a terrific struggle to maintain himself by purely scientific work, with its self-revealing passages from his unpublished correspondence and its new portrait of him; and the account of the Russian ship, "Ermack," the marvelous new ice-breaker that gives promise of being able to cut a passage for herself to the pole—these are all, in their several ways, articles of the strongest interest and the highest value. And just as much may be said for Mr. Wellman's "An Arctic Day and Night," a chapter from his own experience in house-building, house-keeping, and daily work and sport, including some thrilling bear-hunting up near the north pole. In addition the number offers, on the more strictly literary side, two excellent poems, a heroic story of railroading and Indian fighting on the plains, a story of English prison life, a story of American newspaper and political life, a love story having to do with a Pacific coast "boom" and an Atlantic coast maiden, and a humorous story by Robert Barr of "a scientific miscalculation," that involves, especi-

ally, England and America. Nearly all of the articles and stories are fully illustrated.

THE FORUM.

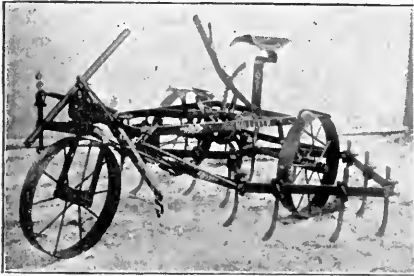
The *Forum* for April, among its thirteen noteworthy articles, contains the following: "The New Financial Law," by Frank A. Vanderlip, Assistant Secretary of the Treasury; "The Puerto Rican Relief Bill," by Congressman Albert J. Hopkins; "The Hay-Pauncefote Treaty," by James G. Whitely; "Immediate Navy Needs," by Capt. William H. Jaques; "A Tuberculosis Quarantine not Practicable," by Dr. William P. Munn; "Canals from the Great Lakes to the Sea," by Maj. T. W. Simons of the Special Canal Committee appointed by Gov. Roosevelt; "The Truth about Zionism," by M. Gaster, Founder of the English Zionist Federation, and "Literature as a Profession," by Prof. Brander Matthews.

THE LADIES' HOME JOURNAL.

Mrs. Rorer's solution of the servant-girl problem will be presented in the May *Ladies' Home Journal*. She will tell "How to Treat and Keep a Servant," fixing the responsibility for the unsatisfactory domestic service that makes house-keeping such a hardship today. It is Mrs. Rorer's contention, and she thoroughly maintains her point, that it is no more difficult to secure efficient employes in the home than it is for any other kind of work. But the point of view of mistress and maid must be materially changed first.

THE SATURDAY EVENING POST.

The *Saturday Evening Post* has made arrangements for the publication of a biography which will interest the great number of people to whom Moody was known, it being the life of the renowned preacher written by his son. The first paper, entitled "Moody as a Boy and Business Man," appeared in the *Post* of April 7.



CULTIVATION

is now an indispensable part of all good irrigation. But cultivation is **stirring**, not turning over, of the soil. Turning the soil turns weeds under to form air spaces to dry out and throws damp ground to the surface to dry out.

Cultivation must also be deep, no weed cutter can run deep enough. Deep stirring is also necessary in many soils to

keep a hard pan from forming at the bottom of the plow's path.

The Killefer Cultivator has been specially made to meet the case and has given the greatest satisfaction in California where people have had the most experience and are very particular.

Extra teeth go with it so that it can be quickly changed into a weed cutter when needed, also into a furrower. But if used enough it will never be needed except as a stirrer. It is also all the plow needed for most loose soils, such as those of the desert.

It cuts from five to nine feet with from thirteen to thirty-seven teeth as desired.

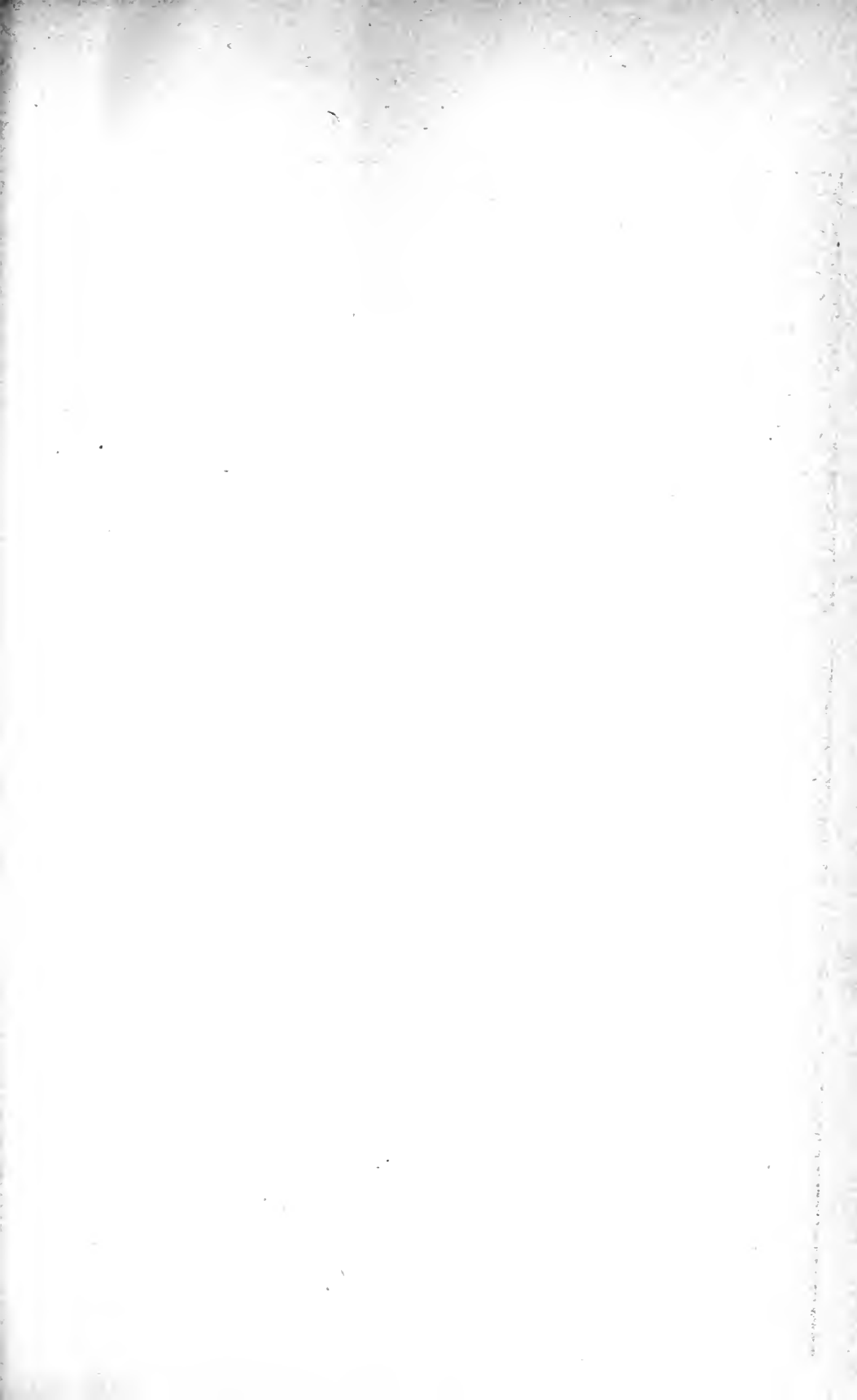
The tongue guides the castor wheel without draft so that the machine can run much nearer to the tree without danger or strain on the horses than any other.

Fine teeth, plenty of them, running deeply and evenly, readily raised or lowered, and quickly changed to any form, are absolutely essential for orchard work. These you get in the Killifer Cultivator, with the easiest draft on the team, and the easiest guiding principle.

KILLIFER CULTIVATOR CO.,

1535 PALMETTO STREET,

LOS ANGELES, CAL





“PAPA WILL SOON BE HOME, MY DAUGHTER.”

THE IRRIGATION AGE.

VOL. XV.

CHICAGO, MAY, 1900.

NO. 8.

THE PROGRESS OF WESTERN AMERICA.

Leaving the Old Ship.

The cartoons in the various publications are making merry over Admiral Dewey's decision to become a presidential candidate. It is hinted that there is a "woman in it," and that the decision to enter the political arena is Mrs. Dewey's, not the Admiral's. One of the best cartoons, which is more pathetic than humorous, is called "leaving the old ship" and pictures Admiral Dewey descending the ladder from the ship, carrying under his arm his "honorable record," with the purpose of landing in the jungle of politics—a briery, inhospitable coast. It is lamentable that Dewey was persuaded to reconsider his first decision to keep out of politics. Like the dog in the fable, he is dropping the substance for the shadow—giving up the love and admiration of the American people for a political strife in which he has but small prospects for success.

The Labor Troubles.

We are having what is termed by the *American Review of Reviews*, an "epidemic of strikes," the storm center of which seems to be in the city of Chicago, where the machinists originated a strike which spread to other cities, involving thousands of laborers and threatening to tie up business along this line of work. The strike among the building trades in this city has assumed so serious an

aspect as to practically tie up building operations, while the body known as the Building Trades Council, composed of carpenters, masons, plumbers, etc., has dictated to the contractors in a manner heretofore unknown. The editor of the *Review* regards the numerous strikes throughout the country as an evidence of better times, not of hard times as would appear at first sight. He says: "The first effect of industrial revival is the general employment of the unemployed; the next effect is a succession of strikes to secure an advance in wages corresponding to the advance in price. It is the second effect which the country is now experiencing." Organized labor, as embodied in labor unions, is a good thing and productive of good results, if the power gained by members is not abused, but the trait in humanity which claims "might makes right" is just as prominent in the laborer as in the capitalist, and the former is just as apt to abuse power as the latter. This is proven by the present state of affairs, many of the demands of the unions being arbitrary and unjust and the resort to violence and intimidation is injuring the cause of the union in the minds of unprejudiced people. In any great reform its promoters are apt to become extremists, but in time the balance of power is restored and normal conditions resumed and much good ac-

complished. We are passing through an industrial crisis in which labor is arrayed against capital but the present evils of this strife may result in an agreement between the two factions, which will lead to more amicable relations between them—it may be the storm which will clear the atmosphere; the fight after which victor and vanquished shake hands.

**Worthy
of Notice.**

The *Minneapolis Tribune*, of recent date, calls attention to the fact that one feature of President McKinley's last message to Congress which did not attract much attention at the time but which is worthy of notice, is the paragraph directing attention to the subject of good roads. He said: "There is a widespread interest in the improvement of our public highways at the present time, and the department of agriculture is co-operating with the people in each locality in making the best possible roads from local material and experimenting with steel tracks." This is the first time in recent years, since the advent of the railroads, that the subject of the common roads has been deemed of sufficient importance to be made one of the topics of the president's message.

In accordance with the above declared policy the department of agriculture has just shown its interests in the subject by issuing at the public expense in pamphlet form an elaborate article by W. H. Moore.

**Both Food
and Drink.**

Irrigated farms never wear out. It may occur to farmers who are in the habit of applying a large quantities of manure and fertilizer to their lands and raising only moderate crops, that where irrigation is practiced and immense crops grown every season without intermission, either increased manuring is necessary or in its absence, the land, from the increased drain put upon it, will gradually lose fertility. This is not shown to be the

case however. Where the irrigating water is drawn from surface supplies, it itself furnishes an everlasting source of fertility. The lands irrigated by the Nile floods, are of surpassing richness and their tillers never heard of such things as crop rotation, plowing under clover, manuring, or fertilizing. The ancient irrigated rice fields of the Philippines, which yield from four to six times the crop of the dry-farmed sections, have never known artificial fertilizing, and in the United States we have evidence of New Mexican farms which have been under cultivation for 250 years and are to-day as productive as virgin land. Irrigation water is both drink and food.

**Conditions
in India.**

The famine in India, occasioned by the failure of the monsoon rains, is a topic made familiar to the reading public by the newspapers, but after all it is doubtful we have any adequate conception of the awful want and suffering there. This is said to be the worst famine ever experienced by the country and to make matters worse, England is so engaged in the South African war as to be unable to give the help she otherwise would. Three years ago England gave \$3,000,000 for the relief of the famine sufferers but now the sick and wounded soldiers claim her attention. The viceroy of India gives the number of persons affected by the famine as 61,000,000 and the distress constantly increasing, while there are 5,500,000 people on the relief works established by the government. An India correspondent to a London paper claims that much of the distress might have been avoided if the government had pursued the proper policy, there being plenty of food in India but the high land taxes and high rents had deprived large masses of the people from the ability to pay for it. If this statement be true, then the government should send out foraging parties, just as is done in time of war, to seize the necessary food for distribution among the

starving people, leaving the treasury department to settle for the food later on, for the famine is so widespread and disastrous that private charity can do but little to relieve the distress. While any effort of charitable people of this country to aid "starving India" is praiseworthy, the *Washington Times* cautions such benevolent persons not to persist in collecting American corn or maize to send to India, for even if the grain is not damaged by the long voyage through the tropics, it is refused by the natives as food.

Orientalists are so unlike the western people that it is hard to understand the attitude they take, but it is said by English dwellers in the East that they have been known to die of starvation rather than eat food that they were unfamiliar with. Death does not have the terror for the Oriental that it has for us, and he prefers to die from a familiar cause, such as famine, than to live by eating an unfamiliar food such as corn or millet. So if it is really desired to help their distress and help it at once, charitable people should send money, to India as that can be cabled and so reach them at once and be invested in rice—a food they are familiar with.

The irrigation surveys and investigations have been so great and the demand from all parts of the country for authentic information regarding the water supply has been so persistent that the original appropriation made by the last congress to the Geological Survey was long ago exhausted. Owing to the praiseworthy efforts of such friends of the irrigation movement as Senators Carter, Bard and Perkins and Congressmen Needham and Kahn, Congress has finally been persuaded to make a deficiency appropriation of \$20,000 immediately available for carrying on this work until June 30, 1900. Speaking of this appropriation Mr. F. H. Newell, Hydrographer of the Geological Survey, says: "I am particularly gratified at this action of Congress, not so much in allowing the appropriation,

though we need that badly, but in so declaring its temper in regard to the work. This work we are doing meets more than the western demand, and it is a good sign for the West that it does. All through the East there is a demand for water gauging and stream measurement by the government, for basing estimates in erecting manufacturing plants proposing to utilize water power. All this work which we have been doing in stream measurement, surveys of reservoir sites and underground water flows in the West has been stopped for lack of funds, but I have now telegraphed to continue with it and it will go on at least until the 1st of July."

Irrigation in Congress.

The fact that the government has not as yet appropriated any money for the construction of storage reservoirs, does not prove, as some assert, that no progress is being made along this line and that the West had best give up the effort to obtain aid in this very necessary work. "Irrigation," says Guy Mitchell, "receives more recognition than is generally credited to it. Great undertakings are not accomplished in a single year of agitation and some of the most beneficial measures ever enacted were before congress for a long period of years. The records of congress show that until the last two years, almost nothing has been attempted in the way of introduction of bills, urging the matter before committees or any other direct work done to accomplish the construction of storage reservoirs." Such being the case, the fact that congress is sufficiently alive to the importance of the irrigation subject to appropriate considerable sums regularly for investigation, stream measurements, etc., is a very encouraging sign and an omen of future good. Mr. Mitchell further says: "The present agricultural bill carries \$35,000 for irrigation investigations by the Department of Agriculture and appropriations have been regularly made by Congress for such work since 1890. The

Department is now doing active work along this line."

"There is need," says Professor Elwood Mead, who is carrying on this work in the field, "for a systematic investigation to determine the volume of water used in the growth of crops, both to ascertain the requirements of different crops and of different climates, and to determine the relation between the variations in the demands of crops and the fluctuations in the flow of streams. This information is needed as a basis for the proper diversion of streams by administrative officers. It is needed by canal builders in order to properly design these structures and it is needed by farmers to promote the saving of water and thus limit losses through an inadequate supply, or to extend the acreage which

can be cultivated. "Measurements should be made to show the utility of storage reservoirs and the part they can be made to perform in both saving the crops of farmers, now living along streams and making it possible for others to settle there. Without a definite knowledge of the variations which exist between the use of water in different months of the irrigation season and the fluctuation in the discharge of a stream, we can only conjecture as to the amount of flood water available for storage. It will be no small task according to Mr. Mead to put into shape a correct and intelligible guide which may be relied upon as an authoritative summary of the data on which the development of the irrigation system of the great West should be founded.

IRRIGATION OF THE ANCIENTS.

THERE'S NOTHING NEW UNDER THE SUN.

Years ago—and not so many years either—to mention irrigation was to call forth the query: “Irrigation, what’s that? Oh, yes, they use that out west in the deserts.” Such ignorance has now become enlightened through the work of the irrigation congresses, and of individuals, and irrigation is recognized as a potent factor in agriculture in the humid as well as the desert regions. But we are still prone to regard this artificial watering as something new, forgetting the many years it has been practiced in other countries and by other people. It is new to us but history proves it to be almost as ancient as agriculture itself.

The first reservoir or artificial lake of which there is authentic record was constructed, so it is claimed, in 2084 B. C., and was supposed to have been built for the purpose of regulating the floods of the Nile. From this date we can gain an idea of the antiquity of irrigation. The subject is a very interesting one and is ably treated by Prof. F. H. King in his recently published work on “Irrigation and Drainage,”* under the chapter heading of “The Extent and Geographic Range of Irrigation.” In this chapter a concise history is given of the early irrigation works, beginning with Lake Maeris, the first reservoir ever built, and which communicated with the Nile through a canal 12 miles long and 50 feet wide. Of this Prof. King says:

“When the river rose to a height of 24 feet, and was likely to be disastrous to crops, the sluices were opened and the river relieved by sending the flood into this lake, which modern travelers give a circumference of 50 miles; but at times of low water, when drouth was threatened, the gates could be opened and the volume of the stream reinforced by the water stored in this reservoir.

“Sesostris, who reigned in Egypt in 1491 B. C., is said to have had a great number of canals cut for the purpose of trade and irrigation, and to have designed the first canal to connect the Red Sea with the Mediterranean, which was continued by Darius but abandoned by him, and ultimately completed under the Ptolemies. So numerous are the irrigation canals of Egypt that it is estimated that not more than one-tenth of the water which enters Egypt by the Nile finds its way into the Mediterranean Sea.

“The Assyrians appear to have been equally renowned with the Egyptians, from very ancient times, for their skill and ingenuity in

*Irrigation and Drainage. By Prof. F. H. King. The Macmillan Co., New York, publishers.

developing extended irrigation systems, which converted the naturally sterile valleys of the Euphrates and Tigris into the most fertile of fields. We are told that the country below Hit, on the Euphrates, and Samarra, on the Tigris, was at one time intersected with numerous canals, one of the most ancient of which was the Nahr Malikah, connecting the Euphrates with the Tigris. The ancient city of Babylon seems to have been protected from the floods of June, July and August by high cemented brick embankments on both banks of the Euphrates, and, to supplement the protection of these, and to store water for irrigation, a large reservoir was excavated 42 miles in circumference and 35 feet deep, into which the whole river might be turned through an artificial canal. There were five principal canals supplied by the Euphrates—the Nahr Malikah, the Nah-raga, the Nahr Sares, the Kutha, and the Pallacopus; while the Tigris furnished water for the great Nahrawan and Dyiel, besides several smaller ones. Along the banks of the former of these canals fed by the Tigris are now found the ruins of numerous towns and cities on both sides, which are silent witnesses of the great importance it held, and the great antiquity of the work. It started on the right bank of the river, where it comes from Hamrine Hills, and was led away at a distance of six or seven miles from the stream towards Samarra, where it joined a second canal. Another feeder was received 10 miles farther on its course to Bagdad, a few miles beyond which its waters fell into the river Shirwan, and were again taken out over a wier and led on through Kurzistan. It absorbed all the streams' from the Sour and Buckharee Mountains, and finally discharged into Kerkha River, but only after having attained a length exceeding 400 miles, with a width varying from 250 to 400 feet. This great canal, with its numerous branches on either side, leading water to broad irrigated fields, while it bore along its main waterway the commerce of those far distant days, stands out as a piece of bold engineering hardly equaled by any thing of its kind in modern times.

“The Phœnicians, in the time of their zenith, were celebrated for their canals, used both for irrigation and city purposes; and at the time of the invasion of Africa the Syracusan General Agathocles wrote that ‘the African shore was covered with gardens and large plantations everywhere abounding in canals, by means of which they were plentifully watered;’ and fifty years later when the Romans invaded the Carthaginian dominions, their historian, Polybius, drew a similar picture of the high state of cultivation of this country.

In the early days of both Grecian and Roman history, great progress had already been made by these peoples in handling and conveying water by gravity over long distances for domestic purposes. At Patara the Greeks, according to Herodotus, carried an aqueduct across a ravine 200 feet wide and 250 feet deep, constructing a pipe line by drilling 13-inch holes through cubic blocks 3 feet

in diameter, fitting these blocks together with curved necks and recesses, whose joints were laid in cement and held secure by means of iron bands run with lead. This was an inverted syphon, now so often used to cross a ravine or canon in the west, but made from stone instead of steel or redwood hooped with steel, so commonly used today.

“Rome was supplied with water in Nero’s time by nine separate aqueducts aggregating a length of 255 miles, and which delivered daily 173,000,000 gallons of water, which was later increased to 312,500,000 gallons. The Aqua Martia conduit, which brought the drinking water for the city, had a diameter of 16 feet, and was 40 miles long.

“When the Romans invaded France, they constructed great systems of water works for cities in various places—at Lyons Souy, Nismes, Frejus, and Metz. The Nemes conduit was constructed at the time of Augustus, 19 B. C., and delivered 14,000,000 gallons per day. It is noted for the great Pont du Gard, which carried it across a ravine, and which is spoken of by Humble as one of the grandest monuments the Romans left in France.

“China, like Egypt, dates its early enterprises of irrigation and transportation by water far back in antiquity, for she has numerous canals, some of them the most stupendous works of the kind ever undertaken. The Great Imperial Canal has a length of 650 miles, and connects the Hoang-Ho with Yang-tse-Kiang. It has a depth seldom exceeding 5½ to 6 feet, and in it the water moves at the rate of 2½ miles per hour. In its path there are several large lakes, and across these the canal is carried on the crest of enormous dykes.

“If we leave the Old World and come to the New for records of an early development of the cultivation of land by irrigation, we shall not be disappointed, for traces of an early civilization in Colorado, New Mexico and Arizona, and extending through Mexico and Central America on into Peru, are found in the ruins of ancient towns and irrigating canals in many places. When the Spaniards invaded Mexico, Central America and Peru, they were greatly surprised to find in these countries, and particularly in Peru, the land of the Incas, very elaborate and extensive irrigation systems, laid out and in actual general use by these people.

“Prescott, in his ‘Conquest of Peru’, speaking of the use of water for irrigation, writes that ‘water was conveyed by means of canals and subterraneous aqueducts executed on a noble scale. They consisted of large slabs of freestone nicely fitted together without cement, and discharged a volume of water sufficient, by means of latent ducts or sluices, to moisten the lands in the lower levels through which they passed. Some of these aqueducts were of great length.

One, that traversed the district of Condesuyos, measured between 400 and 500 miles. They were brought from some lake or natural reservoir in the heart of the mountains, and were fed at intervals by other basins which lay in their route along the slopes of the Sierra. In their descent a passage was sometimes opened through rocks, and this without the aid of iron tools; impracticable mountains were to be turned, rivers and marshes to be crossed—in short, the same obstacles were to be encountered as in the construction of their mighty roads.’”

When the Buds Begin to Swell.

When the buds begin to swell,
 Nature wakes from icy sleep,
 Winter sounds its parting knell,
 Pulsing spring with bound and leap,
 Brings new life to field and dell
 When the buds begin to swell.

Robin red-breast sings his lay;
 Barn-yard monarchs swell with pride;
 Coursing bees outline the way
 Where the sweets their riches hide.
 Ev'ry thing of life can tell
 When the buds begin to swell.

Warm the sunshine, bright the day,
 Soft the zephyrs, sweet the air.
 Spread with jewel'd milky-way,
 Night-time curtains ev'ry care.
 Nature's watchword, "all is well,"
 When the buds begin to swell.

When the buds begin to swell
 Ev'ry pulse-beat thrills with joy,
 Puts new life in vein and cell,
 Makes the man again a boy.
 Winsome gladness weaves its spell
 When the buds begin to swell.

IRRIGATION IN SOUTH AFRICA.

BUT LITTLE HAS BEEN DONE IN A SYSTEMATIC WAY.

By GUY E. MITCHELL, SEC. NATIONAL IRRIGATION ASSOCIATION.

WASHINGTON, D. C., May 7, (Special)—A picturesque figure at the National Capital for the past week, though in no manner connected with politics, has been "Col." Joab L. Meacher, who has just returned to the United States from South Africa, where he has been looking into the present possibilities of stock raising. Col. Meacher is an adopted westerner, being originally from the hills and rocks of Vermont, but he has for some years been connected with one of the large irrigation systems of Colorado. He is a big, raw-boned typical American of the style which is recognized the world over as "Yankee."

"Upon my arrival at Cape Town, this being my third visit," he said in talking of his trip, "I was treated with much good fellowship, the residents vying with each other in an endeavor to show a feeling of friendship growing out of the conditions arising from our Spanish war.

"Cape Town has in the last few years grown to be a large and prosperous city, thrifty and neat. The Parliament buildings would be a credit to any city. The suburban villas, surrounded by gardens, rich in variety, and of luxurious growth, form a pleasing landscape. The colony is now largely engaged in stock-raising. While the lower coast regions having sufficient moisture, produce green crops in great abundance, the arid character of the vastly larger portion of the colony, renders it at present unfit for any purpose other than grazing. Nearly two-thirds of the surface of the Cape consists of a barren plain. After the periodical rains this plain is covered with grass, but the summer heat soon changes its aspect. Sheets of shallow water termed vleis are formed at many places in the flat lands of the interior by the rains, and these spots, during the dry season are covered with rich grasses affording excellent grazing.

"The first act requisite for settlement is the construction of a dam or reservoir for the collection and saving of a water supply. As such dams have always been built by individuals the water saved is only sufficient to supply what is required for stock and domestic purposes. There are great opportunities for irrigation on a large scale in a number of sections of South Africa, but with the exception of unimportant attempts to water small patches but little has been done in the direction of systematic irrigation for agriculture. The soil is

fertile as shown by the rich growth of grasses during the rainy season, and if irrigation works on a large scale were established as they have been in India and our own West, and the waste water of the rainy season saved, millions of acres could be devoted profitably to agriculture.

“In the valleys of the Oliphant River and its tributaries, emptying into the Atlantic, the Breede River which flows into the Indian Ocean and the Zak and Hartebeeste, tributary to the Orange River, many farms have been established. The crops of these sections depend entirely upon the annual overflow caused by rains in the mountains where these streams rise. The Dutch farmers who cultivate most of this land, prefer to depend entirely upon nature. If urged to take steps to irrigate in periods of long drouth, they invariably say: ‘Oh it vill rain again.’ Such uncertain and loose methods must necessarily give way before modern ideas and improved farming; much of the land will eventually be reclaimed through the use of the vast volume of water now running to waste and a dense and progressive progressive population will build up the country.

“The lands of the Transvaal Republic are of the same character as those of the tableland of Cape Colony. On previous trips I have been all through the Transvaal. Generally through the rainy season, farmers can produce a crop of maize. But this is by no means sure, owing to the uncertainty of the rainfall. The Transvaal strikingly recalls to me our western plains. The monotony is relieved by occasional table-shaped and conical mountains. During the dry months, the Boer farmer migrates with his cattle and his family to the lowlands along the rivers or coolies. He spends his time hunting, while the children and Kaffir servants herd the cattle and sheep. Under the existing conditions the grazing development of this part of the world is limited. Transportation is too costly as yet to insure a profitable marketing. But with the stimulus to home markets, incident to the continued development of the mining industry, with its immense army of laborers, the agricultural and pastoral industries will be put on a different footing. Eventually they cannot but be of more importance than the mines themselves.

“I could not but think,” concluded Col. Meacher, “while traveling over some of the great stretches of unoccupied land of South Africa, through which flow large rivers, how much land there is yet in the world which will be eventually reclaimed to great productiveness through the storage of storm and waste waters. In simply these two sections of the world with which I am acquainted, western America and South Africa, there must be upwards of a hundred million acres of very fertile land which can all be made highly productive, and mostly by the building of large storage reservoirs.”

IRRIGATION IN OLD SPAIN.

LARGE AREAS ARTIFICIALLY WATERED.

NATIONAL IRRIGATION ASSOCIATION.

The most prosperous agricultural provinces of Old Spain are the two in which the soil is probably the poorest in the Kingdom. But the valleys of both provinces are thickly seamed with irrigation canals and the slopes are carefully terraced for cultivation. This explains the paradox.

A very large proportion of Spain's cultivated area is under irrigation. Almost all the vegetables and garden fruits, lemons, oranges, and rice are grown by irrigation, while the grains, vine, and olives are chiefly dry farmed. Supplemental irrigation is practiced, irrigated crops being grown alongside of non-irrigated. Ancient and modern methods of irrigation seem to go along almost hand in hand. Simple water wheels are in common use to obtain water from wells, the power employed being a horse, and the method of conveyance small buckets, after the ancient Egyptian fashion. On the other hand many artesian wells have been sunk for irrigation, and modern wind-mills are coming into use.

ROMAN AND MOORISH WORKS.

The total irrigated area of Spain is nearly 3,000,000 acres, and some of this comprises systems of great age and of expensive construction. In Valencia and Catalonia the water used is derived from swift mountain streams whence it is conveyed by long canals or *acequias* along the mountain sides or by lofty aqueducts to the fields on which it is to be used. Some large storage reservoirs called *pantanos* have been constructed, feeding a dense network of canals distributed over broad plains. Many of the old irrigation works, such for example as those of the plains of Tarragona, date from the time of the Romans, and many others from the Moorish period, while new ones are being laid out at the present day.

POPULOUS UNDER IRRIGATION.

The effect of this irrigation is shown by the significant fact that the irrigated portion of the province of Murcia has a population of 1681 per square mile as against only 101 per square mile from the entire province while Orihuela has a population of 767 per square mile as against 194 from the whole province. This shows the accomplishment of irrigation in a humid region. Of course in our own territory the difference in population between many irrigated and non-irrigated sections is far greater and might be as 1 to 100 if not 1 to 1,000.

When the great progress being made in irrigation in other countries is considered and it is remembered that the work has scarcely begun in the United States where tens of millions of acres lie waiting for reclamation, it must be acknowledged that half the productive capacity of the world has not yet been reached.

PREHISTORIC CIVILIZATION.

TODAY'S DESOLATION WAS ONCE A GARDEN. EVIDENCES OF ANCIENT IRRIGATION.

FROM NATIONAL IRRIGATION ASSOCIATION.

One of the most marvelous engineering accomplishments of ancient or modern times is shown in discoveries which were made last year in the lava beds of New Mexico. Thousands of years ago, the geologists tell us, a system of irrigation reservoirs and ditches was operated in the Southwest which is not paralleled by anything of this nature in the United States today. The builders of these works, a people older than the Pueblo race, cultivated thousands of acres of now arid territory. Reservoirs were constructed at the bases of mountains to catch the flood waters before they were absorbed into the loose and bottomless sand, and the ditches, where they ran through sand, were cemented to prevent the water's escape.

Lava has flowed into some of these ditches, once filled with sparkling water in centuries gone by. What can have been the history of this pre-historic race or what can have caused their disappearance, can only be conjectured.

Unlike the ancients of other lands these people have not left a complete record of their glory and their downfall and whether it was the result of climatic conditions or great upheavals or whether they were supplanted by more warlike and stronger races, is a mystery. That they were highly developed, however, in agriculture, which is the mother of civilization, is shown by the evidences which they have left. Their canals wind in and around for miles, showing a superior engineering knowledge in securing an exact and uniform fall; remarkable viaducts were used in crossing canyons, while a network of distributing ditches brought every available acre into use for tillage. Vast fields of waving grain and laden orchards must have stretched away, down the fertile valleys, under the magic touch of water—for arid America where it has been reclaimed through irrigation of today yields extravagantly—and with such development of a peaceful art must have been likewise an advanced state of civilization. Here was no irrigation by individual owners or diverters of water; but a great system covering a large area, carefully thought out and operated by a central head for the greatest good of the many and the utilization of the greatest possible acreage.

And it seems strange in the present era of great progress, and vast undertakings that this section of country, once the most highly cultivated of the continent, should now be an arid and cheerless waste with a torrid sky and parched earth, even while the same rainfall of ages past still continues year by year, and the water supply is still there, only awaiting its utilization by man.

SUGGESTIONS IN IRRIGATION DEVELOPMENT.

By CHAS. E. RICHARDS, Cal. Sec. National Irrigation Association.
(Read before the Farmers' Clubs' Institute, Los Angeles, Cal.)

The investigations into and discussions over the problems of irrigation, which have been carried on for the last few years, particularly the last year, more particularly the last few months, most particularly on the 14th and 15th days of November last at San Francisco, all this agitation has above everything else demonstrated the fact that irrigation, though a complex and highly scientific problem, is nevertheless perfectly capable of solution. The factors, however, in this solution should be neither good guesses of incompetent men, nor foolish guesses of good men, but should be sound deductions from facts by scientific men, by keen business men.

That irrigation is absolutely necessary throughout all the arid and semi-arid West, is now a self-evident proposition; that in the near future a large portion of the garden truck and fruit produced in the Eastern part of our country will be raised under irrigation is the prediction of our eminent agriculturist, based upon close observation over a long period of years. The study of irrigation, therefore, should enlist attention, and demand scientific investigation in all parts of our country.

In Southern California, the center of intelligent and successful irrigation, it is unnecessary at this date to study the problem in its general application, for we all appreciate the benefits of irrigation and understand to a degree its principles; I will therefore confine myself to stating what should be the course in planning an irrigation system in any particular locality.

There are six cardinal points,—and not only should none of them be overlooked, but each should receive most careful preliminary examinations.

1. What is the exact legal status of the land to be irrigated and of the water supply to be used?
2. Is this location, this soil, suited to development under irrigation.
3. What crops can be grown and what would be the average per acre?
4. How much water will be required to produce an average crop?
5. What water tax can the increased productiveness of the land easily afford to pay?

It will be noticed that in order to answer these questions the service of lawyer, a civil engineer, a chemist, an agriculturist and a financier are all needed and the conclusions of such a body of men, if guided by a large measure of common sense would be correct. An approximate answer can be given to every one of these questions and after making ample allowances for contingencies, there is no reason why an irrigation system cannot be as successfully carried on an engineer's plans as a house can be built upon an architect's specifications. Each of these six questions is a complex problem, and each should demand more time than I can devote to all but without attempting to make the paper exhaustive, I will give a few deductions from the experience of the last few years.

1. What is the exact legal status of land and water?

The legal status of land is generally not difficult to obtain, and it is self-evident

ed where there is drainage, but while some lands will retain and furnish sufficient moisture to fully mature deciduous crops, other soils, such as the foothill adobe, dry out very quickly, though at the same time if saturated with water in the winter and kept thoroughly cultivated in summer; they require comparatively little subsequent additions of water to perfectly mature the crop. It should be noted in this connection, that whereas crops have been raised in Southern California on one-half an acre foot of water and even less—that is about one inch to ten acres—yet the experience

ST. PETER'S DEFENSE.

Some years ago, David Parker, a distinguished poet in the state of Maine, after the birth of his first child wrote and published the following pretty poem:

One night as old St. Peter slept,
He left the door of heaven ajar;
When through a little angle crept,
And came down with a falling star.

One summer, as the blessed beams
Of morn approached, my blushing bride
Awakened from some pleasing dreams
And found that angel by her side.

God grant but this—I ask no more—
That when he leaves this world of pain
He'll wing his way to that bright shore,
And find the road to heaven again.

John G. Saxe, not to be outdone, and deeming that injustice had been done to St. Peter, wrote the following as St. Peter's reply:

Full eighteen hundred years or more
I've kept my gate securely fast;
There has no "little angel" strayed,
Nor recreant through the portals passed.

I did not sleep, as you supposed,
Nor left the door of heaven ajar.
Nor has a "little angel" left,
And gone down with a falling star.

Go ask that blushing bride, and see
If she don't frankly own and say,
That when she found that angel babe,
She found it in the good old way.

God grant but this—I ask no more—
That should your number still enlarge,
You will not do as done before,
And lay it to old Peter's charge.

A DOCTOR'S LIFE IN MEXICO.

BY CHAS E. HUSK, M. D.

Tepezala, Aguas Calientes, Mexico.

Our late unpleasantness with Spain has developed a rapidly growing interest in foreign countries, especially in Latin nations of Spanish extraction. Many descriptive articles concerning these countries have recently appeared in various publications, only a few, however, refer to Mexico, which, although our nearest neighbor and sister republic, is comparatively less known than many European countries.

Having followed my profession during the past two years in Mexico, I will try to give your readers an idea of a doctor's surroundings and work in a mining camp in this strange old Aztec land.

The part of the country where I have made my home for the past two years is at a mining camp, twelve miles from the station of Rincon de Ramas on the Mexican Central Railroad, in the state of Aguas Calientes, two hundred miles north of the city of Mexico. Although situated south of the Tropic of Cancer, all the unpleasant features of a tropical climate are eliminated, as the camp is in the heart of the Sierra Madre mountains, at an altitude of about 8,000 feet, and while you poor Chicagodwellers are sweltering under an August sun, or shivering in December gales, we are enjoying June days nearly the entire year. The thermometer

never reaches 95° F. and never falls below the freezing point.

Our dry season, from March to June, is the only time of the year in which we can complain, since then the dust and wind are rather unpleasant. But when the rainy season sets in, the pure mountain air; myriads of beautiful wild flowers, and perfect nights in a great measure atone for the few comforts of civilization, that we find wanting.

The Mexican law requires a company to employ a physician when their working force exceeds a hundred men, and as about 1,600 men are at work here now, and the nearest doctor lives in the city of Aguas Calientes, thirty-five miles away, I am employed to look after the workmen. According to custom, each man pays into a hospital fund monthly an amount equivalent to one full day's wages, from which fund the operatives are given treatment and supplied with food and medicine when sick or injured, and a wise provision is this for a lazy, drunken race.

The better class of workmen live in adobe houses, but very few of which contain more than one room. A great majority, however, are simple cave-dwellers, living in holes in the mountains and in the banks of canons. An ordinary house is about ten feet square, and the entire household possessions consist of a "patate" or braided rush mat

used as a bed, rarely more than one chair, a few earthenware cooking utensils, a flat stone used for grinding corn, a piece of log slightly hollowed, which serves as a wash-tub, receptacle for dough, table for meals, and, when not otherwise occupied, as a cradle for the ever-present baby. The above, with the

partaken of by the workmen year in and year out, of course washed down with "tequila" or "mescal", a wild alcoholic drink distilled from the magney or century plant, and tasting like a mixture of kerosene, wood alcohol and ammonia.

The workmen wear clothing of coarse white cotton, consisting of a



THE DOCTOR STARTING ON HIS ROUNDS.

addition of from two to six mangy, snarling, flea bitten dogs of the cur variety, comprise a family's entire belongings.

All cooking is done over open fires in a thoroughly primitive manner, and the food consists of "tortillas" or thin cakes made of ground corn, and "frijoles," or beans cooked soft, with a rather superabundant addition of "chile" or fiery red peppers. Meat is eaten about once a week and the above bill of fare is

shirt and wide loose pants or drawers, these, together with "Holy Land" sandals, wide, high-crowned, pointed straw hats, a bright-colored sash, and a heavy, gaudy, woolen blanket make a strange impression seeing them for the first time. The women wear a loose waist and a short, red flannel skirt with a green yolk. Corsets and other inventions of civilization are unknown, and therefore female disorders are rare, and they are enabled to follow the

Scriptural injunction to "increase and multiply the earth," without trembling, fear, or pain in the hour average from twenty to twenty-five miles per day. Luckily, a Mexican rarely sends for a physician at



WATER CARRIER.

of parturition.

The mines are situated near three small towns containing about 10,000 people, the greater part of whom are dependent on the mines for their livelihood.

The mountains being so rugged there are very few carriage roads, and all travel must be done on horseback over mountain trails. As I look after the families as well as the workmen of this mine, and also of two small ones owned by other companies, and have quite a little outside practice, both in neighboring towns and ranches, about five hours of my time every day are spent in the saddle, and I

night. For this there are several reasons. They are natural cowards and their native physicians do not respond to night calls, *manana*, "tomorrow," for them being always better than to day.

Strange indeed would it seem to a practicing physician in Chicago to make a few calls with me at the workmen's houses in Tepezala. On entering the house he would find the sick one on the ground or floor in the darkest corner of the room, covered head and foot with blankets. There is no light, and as little air as possible is admitted. A drink of water is never given unless it is first warmed well. Thin corn

gruel or bread soup serve as nourishment to the afflicted, and if ever a place on earth existed where the effects of medicine alone could be observed, all aid by diet, nursing and hygiene thrown aside, it is here.

Many ailments, the cardinal symptoms of which are so distorted by their mode of living, temperament and climatic influence, exist among these people, the exact nature of which is hard to discover. A disease called "neurima" is brought about by anger. Any fancied or real insult, family disturbance, or neighborhood quarrel with these people, whose livers are in a constant state of irritability, caused by their peculiar food and habits,

death resulting from pure anger.

All types of malaria, stomach disorders and nervous diseases are common; but pulmonary troubles are rare, only two cases of tuberculosis coming under my care in the last two years. Acute lobar pneumonia, brought on by exposure, is nearly always fatal here. During the last year we have had a constant epidemic of small-pox. No precaution whatever is taken to guard against the spreading of the disease, people visiting a person suffering with small-pox as if it was a case of malaria. Very few people are vaccinated, as they regard the disease of no little consequence, though none in this vicinity who have been vaccinated have taken



PLOWING.

may make them actually sick, the malady having all the symptoms of acute catarrhal jaundice, I have two well-authenticated cases of

small-pox, the natives regarding it as a children's disease. Of the 1,500 cases I have seen here, all have been under the age of fifteen

years. This rule, however, is not true of foreigners, several who refused vaccination having died in Aguas Calientes. Not over 2 per cent die among the natives.

surgical operations, and their tenacity of life is often almost beyond belief.

A short time ago a driver on one of the ore carts, which weighed



A DEAD CHILD.—'WE FAIL TO CURE SOMETIMES, VEN IN MEXICO.'

I have read that 60 per cent. of the native Mexicans are diseased, but my experience here with mine workmen, is that it is found in at least 90 per cent.

I use nearly all medicine in the extract from giving the powder or liquid, with no attempt to disguise its disagreeable taste, the natives believing that a remedy leaving no taste, or a pleasant one, is of but little value. They have enough of the Indian blood to endure pain with wonderful stolidity. I never give an anæsthetic to amputate a finger or perform similar minor

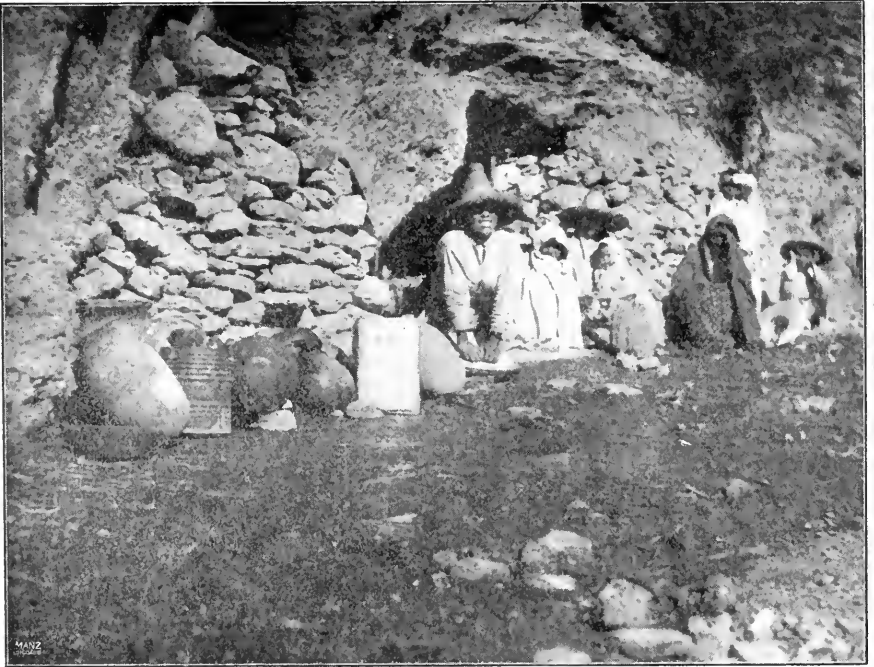
over seven tons, fell off upon hard ground, and the cart passed over his body, about seven inches above the symphysis pubes. When he was brought to the hospital, he was bleeding profusely.

Many strange experiences come to one placed in a position like mine. And, while all things are not quite as pleasant as they might be; the field for a young practitioner is almost unlimited.

One little incident, illustrating the density of ignorance among the natives, occurred in my practice a short time ago. On a visiting

a woman, with whom at a previous visit I had left some powders done up in papers, with instructions to take one every three hours. I was surprised when she asked me if I could not give her some liquid medicine that would answer as

well. On inquiry why, she told me that "she couldn't swallow the powders and that it was very hard to chew them." I learned that she had taken the whole "business" both powder and paper.



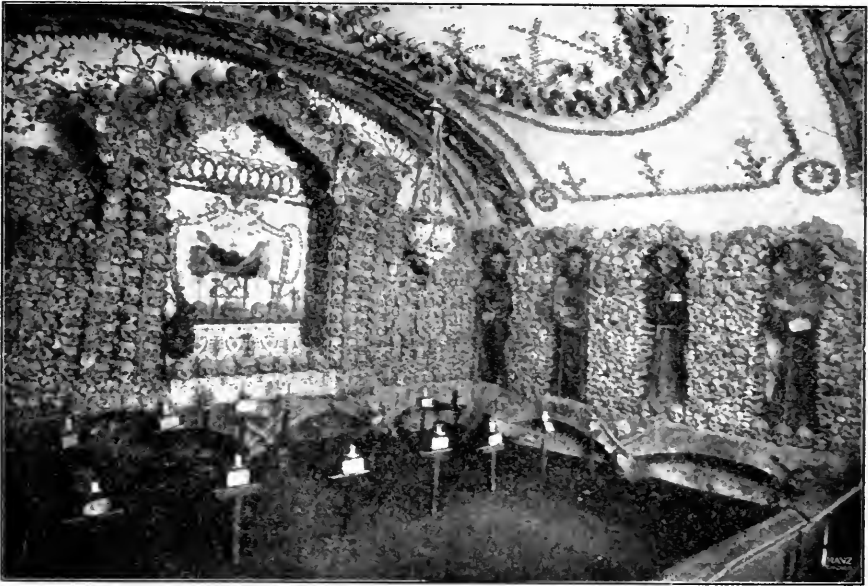
SOME OF THE DOCTOR'S PATIENTS.

CORRESPONDENCE.

The Catacombs of the Capuchin Monks.

One of the sights of Rome, which the medical man should not fail to see, is the burial place of the Capuchin monks in the church or rather beneath the church of Ara Coeli. The accompanying illustration represents a portion of one of several sections of the catacombs. In it the reader will recognize the skulls

graves. This ground is sacred for the earth was brought from Jerusalem and, because of the limited space, the body longest buried must give place to the last buried and his bones will then contribute to the artistic decorations of the apartment. It is of these catacombs that Mark Twain writes in "The New Pilgrims' Progress" and



A CORNER OF THE CHAPEL OF THE CAPUCHIN MONKS IN THE CATACOMBS OF ROME and various bones of the skeleton artistically arranged to form the altar, chandelier, ceiling, decorations and the partition wall separating this section from that adjoining. In the partition are four niches occupied by grinning mummies robed in the brown garb of the order and holding in their hands the crucifix—these are the saintly remains of the prominent members of the order. In the open space below are double rows of from his description we will quote some of his observations: "There were six divisions in the apartment, and each division was ornamented with a style of decoration peculiar to itself — and these decorations were in every instance formed of human bones! There were shapely arches, built wholly of thigh bones; there were startling pyramids, built wholly of grinning skulls; there were quaint architectural structures of various kinds, built of

shin bones and the bones of the arm, on the wall were elaborate frescoes, whose curving vines were made of knotted human vertebrae, whose delicate tendrils were made of sinews and tendons; whose flowers were made of knee-caps and toe nails. Every lasting portion of the human frame was represented in these intricate designs, and there was a careful finish about the work, and an attention to details that betrayed the artist's love for his labors as well as his schooled ability. I asked the good natured monk who accompanied us, "Who did this?" And he said, 'We did it'—meaning himself and his brethern upstairs. I could see that the old friar took a high pride in his work. How many monks were required for the ornamentation of these parlors, we asked. 'There are the bones of four thousand,' he replied. Thus different parts are well separated—skulls in one room, legs in another, ribs in another—there would be stirring times for awhile if the last trump should blow. Some of the brethern might get hold of the wrong leg, in the confusion, and the wrong skull, and find themselves limping, and looking through eyes that were wider apart or closer together than they were used to. I asked the monk if all the brethern upstairs expected to be put in this place when they die. He answered quietly:—'We must all lie here at last.'

"See what one can accustom himself to. The reflection that some day he must be taken apart like an engine or a clock, or like a house whose owner is gone, and

worked up into ashes, and pyramids, and hideous frescoes, did not distress this monk in the least. I thought he even looked as if he were thinking, with complacent vanity, that his own skull would look well on top of the heap, and his own ribs add a charm to the frescoes which possibly this lacked at present.

"Here and there in ornamental alcoves, stretched upon beds of bones, lay dead and dried up monks, with lank frames dressed in the black robes one sees ordinarily upon priests. We examined one closely. The skinny hands were clasped upon the breast; two lustreless tufts of hair stuck to the skull; the skin was brown and sunken; it stretched tightly over the cheek bones and made them stand out sharply; the crisp dead eyes were deep in the sockets; the nostrils were painfully prominent, the end of the nose being gone; the lips had shriveled away from the yellow teeth; and brought down to us through the circling years and petrified, there was a wierd laugh a full century old. It was the jolliest laugh, but yet the most dreadful, that one can imagine. Surely, I thought, it must have been a most extraordinary joke this veteran produced with his latest breath, that he has not got done laughing at it yet."

The Oldest Doctor in Rome.

The oldest doctor in Rome was born to the world in 1223 and to this day hundreds of the sufferers of Rome and even far beyond the Roman walls, receive daily the healing potion from this venerable doctor. We herewith reproduce a

brief sketch of the history of his life. In the year 1223 St. Francis was granted permission by the Pope to celebrate the Christmas time according to his own fancies. He therefore constructed figures to represent the birth scene of the Christ child. All this was done in wood and decorated in paint and appropriate robes. Mary and Joseph and the Christ child are the central figures and in the background are the shepherds with their sheep.

The Christ child, or Bambino as the Italians call Him, is a painted wooden doll dressed in white and crusted over with magnificent diamonds, emeralds and rubies. The Bambino rests in the inner Sacristy where it is daily visited by crowds of pilgrims who have come to pay homage to the miraculous child in which is endowed the power to cure all ills. Every morning the Bambino is taken in a carriage to the hospitals and to the homes of the sick. It has its own attendants and a private carriage. Devout peasants kneel as this blessed infant passes. Formerly it was left for some hours in the homes of the sick; but this has not been permitted since an attempt was made to abduct the child. A woman designed to appropriate to herself the holy image and its benefits. Accordingly she feigned illness, sent for the Bambino, dressed another doll of similar size and figure in the dress and ornaments of the Bambino and sent it back to the Sacristy. The fraud was not discovered till night when the Franciscan monks were awakened from their sleep by loud knocking at the west

door and furious ringing of bells. Going to the door they saw the Bambino standing alone on the steps shivering in the wind and the rain. So the false baby was sent back, and the real baby restored to its place never again to be trusted out of the Sacristy without an attendant.

The natives verily believe that the blessed child can heal all diseases and to this end they daily offer a prayer to the child in behalf of their sick ones. Letters are addressed to the Bambino from invalids who are unable to visit the Sacristy or to have the child brought to them.

On the 18th of January, 1894, His Holiness Leo XIII granted an indulgence of a hundred days, applicable to the souls in purgatory, to all that recite a prayer to the blessed child with devotion and contrition; the indulgence may be granted once a day.

“Murder Will Out”

The family of the Medici's, who ruled and ruined Florence in the 15th, 16th and 17th centuries, lie buried in the magnificent Medician chapel of the church of San Lorenzo of Florence. It was rumored that the coffins had been rifled and accordingly an investigation was made in 1857. It was then found that the rumor was well founded. A sad state of affairs was exposed. Some of them had been broken into and robbed, others were the hiding place of rats and vermin of every sort. All save two of the forty nine bodies were in a frightful state of decay or had been reduced to

ashes and crumbling bones. These were the bodies of the Grand Duchess Giovanna of Austria and her daughter Anna—they were as fresh in color as though they had just died. And so after centuries the truth became evident of the rumor that ran through Florence, that they had died of arsenic poisoning.

The University of Bologna.

The above is a view of the entrance to the University of Bologna



THE UNIVERSITY OF BOLOGNA.

—which claims the distinction of being the first university in which anatomy was taught and where a woman was permitted to lecture—though she was constrained to stand behind a curtain while delivering her lecture. A visit to this old university of the 12th cen-

tury is peculiarly interesting. The walls and ceilings are decorated with frescoes by the old masters but there is evidence of progress on every hand. The buildings are remodeled, the laboratories are well equipped and the anatomical museum perhaps the best in the world. This museum contains the rare collections of centuries and all are so arranged as to present a most attractive and valuable collection. About 600 students of medicine and 1100 students of art and literature are in attendance.

Dr. Arthur R. Edwards, Professor of Internal Medicine in the Northwestern University Medical School, was married in Rome, Feb. 15. The bride was Miss Susanna Harrison formerly of Troy, New York. To comply with the laws of Italy a double ceremony was performed, the first by the Lord Mayor of Rome in the Capitol, and the second by the Rev. Dr. Clark, president of the American Theological Seminary, assisted by the Rev. Dr. White pastor of the American and British Church of Rome. Dr. Edwards will remain with his bride in Europe until about June 1st. A number of the personal friends of the bride and groom were present at the wedding service.

Drug Stores in Pompeii.

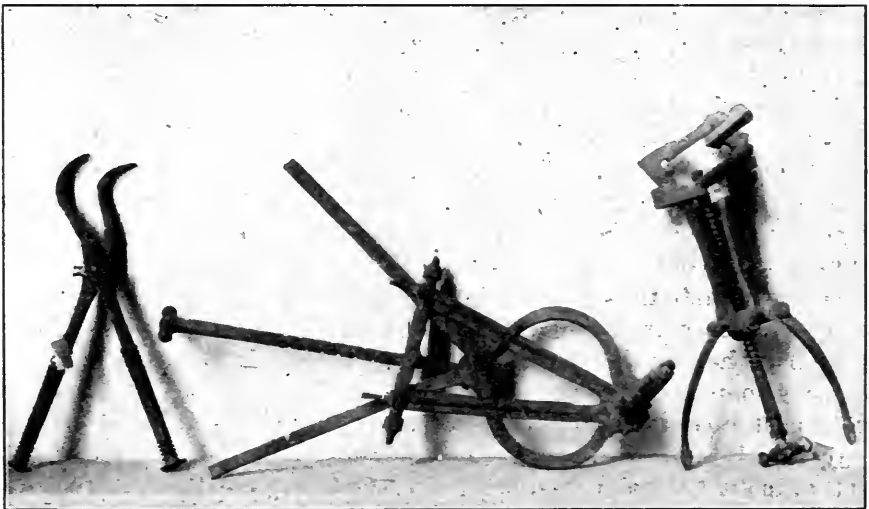
About one half of the city of Pompeii has been exhumed; and walking the streets of this city, destroyed nearly a century before the coming of Christ, one will see thre

buildings which are identified as drug stores by the sign painting on the walls, and by the bottles and jars of oils, and medicines which have been found in the ruins. It is estimated that seven thousand people inhabited that portion of the city now uncovered, and considering the limited pharmacopea of that day, three drug stores would indicate that the drug business was somewhat overdone in Pompeii. There was a large fantastic sign painted on the walls of a drug store which faces a street called Vagabond street. Below the sign is a warning to the loafers on the street—it reads "*this is no place for vagabonds, be gone with you!*"

Gynecology of the Pagans.

We speak of Gynecology as a modern science, and this is in great

Museum of Naples to see the instruments for the diagnosis and treatment of diseases of women that have been discovered in the buried city. The accompanying cut represents two vaginal specula, which, though somewhat complicated and difficult to manipulate, are essentially like the trivalve specula now used. Certain it is that at least a century before Christ these instruments were used for vaginal inspection, though there are no records to show that anything definite was known of the nature of the diseases, nor do we know that any rational treatment was employed. Along with these specula were found instruments closely resembling the curette and probably used for that purpose though it is not likely that they were employed in the treatment of uterine diseases.



SURGICAL INSTRUMENTS DUG FROM THE RUINS OF POMPEII

part true; but it will doubtless be a surprise to the gynecologist who visits Pompeii and the National

An old Hospital in Rome.

On the banks of the Tiber near the Cathedral of St. Peter stands

the venerable Hospital of Santo Spirito. This institution was founded in 1198 by Innocent III and affords accommodations for 1600 patients of every variety of disease. Upwards of 3000 foundlings pass through the hospital annually. When a person wishes to leave an infant in the hospital she rings the doorbell, when a little bed is turned toward the grille near the door and in it the child is deposited.

Just now the wards are greatly crowded to accommodate the epidemic of la grippe which is now in Rome. Fortunately there are no serious complications to the influenza this year.

The wards of the hospital are enormous, accommodating seventy five to one hundred beds. The ceiling is no less than thirty feet high and the row of small windows which constitute the only ventilation are at least twenty feet above the beds. The result is that the ventilation is always inadequate, the room frightfully warm in summer, while in winter the three small ovens between the rows of beds utterly fail to provide the sufficient heat. Even at this time when the spring is far advanced the attending physicians make their rounds with hats and overcoats on.

True to the artistic spirit of the past ages frescoes by the old masters adorn the walls. This old building is soon to give way to one of the finest hospital buildings in the world. It was of interest to learn that in all medical institutions of Italy, Gynecology as a distinct and separate science is not recognized. All operative gynecology is done by the general surgeon

while the obstetrician claims the field of the so styled medical gynecology.

Mentone as a Health Resort.

The exceptional situation of Mentone, France, and its pre-eminently privileged climate has long attracted the attention of medical men. Nowhere has the writer seen such a charming spot that at the same time affords such advantages as a health resort. Situated upon the Southern shores of France and surrounded by a girdle of picturesque mountains rising 4,300 feet above the level of the Mediterranean Sea, the temperature becomes the most equable of France. The average temperature in winter is 49.2° F.; in spring 59.5° F.; in summer 74.4° F.; in autumn 62.2° F., and the annual mean temperature 61.3° F.

The physicians of Italy, Germany, France and England have long appreciated the superior advantages of Mentone as a health resort, but as yet the American physician has little appreciated it. Reposing in the shelter of an immense amphitheatre of rocks, the town of Mentone, thus shielded from the cold North and West winds, lies stretched out on the shore, fully exposed to the sun's caresses, like a lizard nestling at the foot of a wall, and sleepily enjoying the ardent heat.

Stretching out below in its azure smoothness, is the "Bay of Peace," as the Romans called it

Here the olive trees attain their perfection. Their gnarled and twisted branches form one vast bower encircling and sheltering the

town. It is the royal tree of which the Bible tells us: "The trees went forth on a time to anoint a king over them; and they said unto the olive tree, reign thou over us." (Judges ix, 8). Below the venerable olive, almost hidden in its shadow, the lemon tree displays its hue of lustrous green ladened, with its golden fruit and fragrant flowers. Flowers wild and cultivated grow in profusion everywhere. There everything combines to rouse the imagination—to dazzle and fascinate. Waters falling in foaming cascades from prodigious height; rocks as warm in tone, so extravagant in form, and everywhere glimpses of mysterious growths; wild plants clinging to the steep crags—so many wonders assembled within such narrow limits, are enough to make one's head swim.

In addition to the railways which take one rapidly from point to point—in addition to a great number of capital roads for driving, Mentone offers to the admirers of natural charms a great variety of walks, which, radiating in all directions, seek the dappled shade; narrow pathways which wind among the evergreen, orange and lemon trees. If the climate is mild and kindly, so are the people. Their manners are simple and artless, and to all comers they show the same polite, amiable and hospitable disposition.

Of all the roads that wind around Mentone, that leading to Monte Carlo and on to Nice is the most frequented. Monte Carlo is but a half hour's drive from Mentone. Everyone is familiar with its un-

rivaled situation on the sunny hill slopes overlooking the blue Mediterranean. Here one can enjoy, afternoon and evening, one of the best orchestras in Europe, and the opera presents the best talent of world. The grounds are enchanting beyond description.

Cocoonut palms, coffee plants, sugar canes, clumps of chamærops, tall bamboos, date palms, aloes, cacti, and prickly pears make up the tropical flora of this, the most enticing of resorts for those who would enjoy the gaiety of such life. Surely Elisee Reclus, the geographer, was right when he said, "Mentone is the Pearl of France."

Pope Leo XIII.

The year of 1900 is Holy year in the calendar of the Catholic Church and pilgrimages from all parts of the world are flocking to Rome to be blessed by the Holy Father. Fifty thousand pilgrims were received by the Pope in the months of January, February and March, and every week finds thousands crowding at the doors of the Vatican. It was the privilege of the writer to be present at one of these pilgrimages. Seventeen thousand men and women crowded into the church of St. Peters. The Pope was borne through the crowd to the high altar, and as he sat in a sedan chair, carried on the shoulders of ten men, it seemed that his strength could not endure the excitement of the greeting of the pilgrims. Never have I looked upon such a kindly, radiant face; and his whole body seemed too frail and delicate to be human. As he was borne, to the altar he gasped for breath, and

had no more than strength sufficient to raise his hand in the pontifical blessing. But as he was assisted to the altar, and turned to recite the litany, his marvelous voice sounded far into the recesses of that wondrous church. Blessing the people, he sat down and received the representatives of the pilgrims, each of whom kissed his slipper and hand. As if inspired by the deafening cheers of the multitude, he rose to his feet and remained standing while borne back through the long nave of the church to the Vatican—all the while bestowing his blessing on either side. There was not one in the pilgrimage, whether Catholic or Protestant, Jew or Gentile, who did not enter heart and soul in greeting the venerable and saintly-looking old man. Almost everyone held up rosaries, handkerchiefs, or some precious object to be blessed. The Pope is now about 92 years of age, and it is said that he is busily engaged with his private secretary two to four hours daily, besides receiving many visitors to the Vatican. His manner of living is most simple. He always dines alone, and nothing but the plainest of food is placed on his table. His private physician attends him almost constantly, and no infant could receive more tender, watchful attention to every detail of life than does His Holiness.

Baby Incubators in Paris.

Ten incubators, each containing a living baby, are on exhibition in Paris every morning from 9 to 11 o'clock. These incubators can be secured for the home at a cost of \$12 per month.

The Students' Medical Association of the University of Paris is about to issue invitations to the medical students of America, as well as to all nations, to attend certain social and scientific functions connected with the medical faculty of the University of Paris during the time of the exposition.

In the latest report of the Health department of Paris more than one-third of the births recorded were illegitimate.

The Paris Exhibition.

Those who purpose visiting the Paris Exhibition will do well to prepare to meet the demands that will be imposed upon them during their stay in gay Paris.

Preparations for the coming exhibition are going on at a lively rate, but at best the buildings cannot be in readiness before the first of June. In fact, it will astonish the Parisians if all is in readiness before the close of the exhibition. This delay is due in part to the unusual cold and wet weather of the past winter; in part to the labor strikes, but more than all to the inherent disposition of the French to be always behind time in whatever they undertake.

Naturally the Americans will view the exhibition from a comparative standpoint; and in so doing, the Paris Exhibition will be at a great disadvantage because of the lack of building space. The buildings are so crowded together on either side of the river Seine as to make it impossible to fully appreciate their architectural beauty. At this time, (March 24) the buildings are sufficiently complete to

give a fair impression of how they are to appear, and it is safe to predict that they will be equal, if not superior to those of the Columbian Exhibition in Chicago. Unfortunately the space separating the buildings is so limited that only a relatively small number of people can be on the grounds without crowding.

Visitors need have no fears that Paris is not prepared to receive them and their money. In fact the city is ready and waiting with open arms and empty coffers for the opening of the exhibition on the 15th of April. All Paris has been banking on the exhibition for several years, and it will be her fault if the harvest is small. As early as March 1st prices were advanced on rents and provisions. Groceries and meats were advanced in price full 10 per cent, and the rents for apartments were almost doubled. By April 15th they will be doubled again. The first class hotels are now charging an average of ten dollars a day, and ordinary boarding houses charge from two to five dollars per day; and this does not allow for the incalculable fees for all sorts of services both real and imaginary. There are but few hotels being constructed, and those now existing are sure to be filled at their own price. But it is not alone the price of rooms and table board that will make a visit to the Paris Exhibition a thing to be shunned by all of moderate means—on every hand extortionate demands are made. Seats in the opera are almost wholly controlled by speculators who make the price proportionate to the demand. Even now

seats are sold for double the price of those in the far superior operas of Berlin and Vienna. Then there is a fee for checking your hat and coat, another one for the program, still another one for the usher; the trifling luxury of a glass of water costs twenty cents, and if you have not the exact change a commission is withheld for making the change.

The French as a whole are not lovers of classical music; they like better the ballet and the popular songs, with not a little of scandal and villany interspersed. In the boxes and loges the occupants are there to display their finery, while in the balconies men sit with their hats on, and women and men keep up a constant chattering. How different from an opera in Germany. There the people go because they love music—not a sound is heard from the audience during the performance.

During the exhibition in Paris there will be no limit to entertainments; there will be operas, theatres, varieties, gaieties and extravaganzas to please the most fastidious. The French may be depended upon to supply the demand for fake games and dazzling displays.

It is not an easy task to find one's way about the city without some knowledge of the French language. The omnibus system is very confusing, and is not to be depended upon because of their limited number, and the rule of limiting the number of occupants. The fare for these busses is six cents, which is double that of any other European city. The only reliable and convenient way of getting about the city is in carriages. These, while

cheaper than in America, are a half more expensive than in Italy or Germany.

All who come to the exhibition will expect to make purchases in the shops. If the present prices are any indication of what they are to be during the exhibition, one will do well to buy his Parisian wares almost anywhere else. They can be bought cheaper in London than in Paris, and quite as cheap in New York. Even silk in this land of silks is not sold as cheap as in England or Germany. I know of but one bargain in Paris and that is gloves. All this sounds as if I were prejudiced against the Parisians, and I confess that I would be ashamed of myself if I were not. Paris at any other time than the coming summer has art galleries, palaces, gardens, and entertainments enough, and to my notion these can be better enjoyed at such times. Then for the additional cost of visiting Paris during the exposition, one might visit Italy where there is a thousandfold more to see.

PALMER FINDLEY,
Paris.

MISTAKEN IDENTITY.

BY E. S. GOODHUE, M. D.

We were staying at a little hotel in Hilo, waiting for the volcano to begin, when I met Doctor Freidlander of Berlin, a German scientist particularly interested in Polynesia.

On being introduced, he asked me some questions about butterflies, mentioning one especially, the *Colias*, whose habitat he could not determine. If any one will be

kind enough to relieve the doctor of his perplexity, I shall be much obliged. I don't know the first thing about butterflies, only, that I used to chase them when I was a boy, and sometimes succeed in covering them with my hat.

I don't see why the man took me for a butterfly collector.

The Junior Partner had seen that my hair was cut before I left for Hilo, and I sedulously avoided any oddities of manner, trying to appear as much like a Hiloite as I could. It was of no use.

In the evening, the Professor asked me the name of a large tree that stood in the hotel yard. It was the one tree in all Hilo that I couldn't name. Letting myself down gently, I told my interlocutor that the tree must belong to the banyan family, and that I found out for myself that it was an India rubber tree, which I tapped to satisfy my curiosity.

I always make the acquaintance of the trees in a neighborhood where I am staying; for trees bear acquaintance, and in this respect, are unlike some persons you meet.

But knowing a thing for its visible impression upon you; coming in touch with objects in nature for the sake of the sensations they produce, is quite a different thing from learning names, and being able to classify each article under an artificial head. When I am in the woods, the study of botany appears to be a trivial matter.

The next day, as I sat reading by my door, an old Jew—I took him for a Rabbi he looked so venerable—came and sat by me, and looking intently in my face,

said with a slight German accent, "Are you one of us?" "Not that I know of," I answered, almost wishing that I could be one, and have as sweet a face as his, "unless we Anglo-Saxons belong to one of the lost tribes of Israel." The old man made no reply, and soon after sought his room.

I went into my cottage and looked in the mirror to see what was wrong, and came to the conclusion that I might have a slight Jewish cast of feature, but why I had been taken that week for Henry Irving, a preacher, a peddler, a spy, a plantation manager and a reformed drunkard, I couldn't understand. I now took out a yellow covered novel that I had carried in my pocket, "The Dynamiter," by Stevenson, and laid it aside to see what effect that would have.

I had learned not to struggle against the exacting demands of public opinion; demands which in my youth I strenuously resisted. And one of the lessons was from an experience with a Panama hat, an innocent, respectable looking, clean, paid-for, Panama hat. It caused more to offend than any piece of meat I ever heard about. I liked the hat and it was comfortable, so I took it with me from Honolulu to Chicago. When we reached San Francisco, I put it on, for it was May and very sunny. Few persons noticed either the hat or me; they are used to all sorts of people in this happy city, and don't stare at even a Turk. But when we reached Chicago, where I considered myself entitled to some respect, my hat worried several persons. "Well," said I to the Junior

Partner, "it is warm enough for the hat, and I will wear it. It is nobody's business what you wear, if you clothe yourself decently, besides, this is a city of over a million and there must be other hats like mine." "I haven't seen another Panama since we left," said the Junior Partner, "and if I repeated all I've heard street passers-by say about your hat, you'd discard it at once."

"Not at all," I replied with a deep determination not to conform, "I don't care what they say. Then I've seen white-felt hats in New York in midwinter, and that's out of season. If it were the fashion, you could wear an old wash tub on your head, and not interest anybody. I am not a sheep."

"Now," continued the Junior partner, "I overheard one say, 'See that fellow—wonder if he has anything under that hat?'"

Another sneered, "He ought to let his hair grow," and a pretty young lady said to her companion, "Do look at that long-nosed man under the wide brimmed hat; I'd like to paint him and call it 'Summer is here.'" And when we were going down State street yesterday, a young man said loud for effect, "The new race course is round that man's hat."

"That's mere twaddle," I said in answer, but I felt somewhat irritated, and made up my mind personally to challenge some of the impudent conformers. That same day an opportunity presented.

Three boys yelled out "Shoot that hat!" "Boys" said I, going up to them with death in my eyes, "I am sorry you haven't been properly brought up. If you had, you

wouldn't insult respectable people in the streets." "Oh," asked one of the boys with mock surprise "are you respectable?"

"I'll show you if I'm not," I answered. "Hullo there," I called to a policeman who was not far enough to get away, "Please come here." I explained the situation.

He reprimanded the boys, then turning to me, said with a humorous twinkle in his eye, "Ye can't oixpect may to kape the pace whin ye're arround wid a hat loike dat, kin ye?"

The next day when I suggested that we take a walk, the Junior Partner said she thought she wouldn't go. She didn't feel equal to the ordeal. "Well," I answered, "if you are ashamed of this hat after all the things you have said in its favor, why I think I shall not urge your company. But it's coming to a sorry pass when a hat comes in between man and wife.

"Now, dear," pleaded the Junior Partner, "give in to the popular prejudice. The mass is against you; you now belong to the classes."

"Then you mean to say that in this day and age, in this city of Chicago," I went on, with some warmth, "a man can't wear a white hat, just cannot do it, because his neighbors don't happen to like it. Pretty soon we'll have to give up our children because they are naughty. I believe there's a hat monopoly somewhere."

"Oh," laughed the Junior Partner, "you must have left your philosophy and the placidity that goes with it, at the Golden Gate. You can wear what you please, but peo-

ple can smile too. There's no law against that. In one way you are doing the world a service by making it laugh. A great many of our struggling humorists might envy you your success. But, at the same time, I don't care to head a street procession of hoodlums, when I go out for a quiet walk. When one gets to be President it must be endured, I suppose, but we ought to enjoy the rights of a private citizen. The last time you were down Ogden avenue fifteen boys marched after you."

I am very stubborn, and kept my hat on.

In July when we went to Indiana I found myself one warm day in the town of Warsaw. I wore my historic hat. As the Hoosier poet and I were walking down street, a lad shouted out at the corner, "Say, mister, when's the show comin' off?" "He takes you for Cody," said my companion. You'll have to succumb to the pressure of public opinion in Indiana, or I'm mistaken."

I hoped and prayed that some hat thief would come along, or a bucket of coal fall on the hat, but neither thing happened; so at the first hat store I went in and bought a fifty cent crush felt. The selection was not inappropriate for I was a crushed man. My spirit was broken. After this no one accosted me. I became one of the herd, and felt very snappish, especially when I met the Junior Partner, and she asked in surprise, "Why, dear, where's your Panama?"

"Oh," said I, "it blew off into the Wabash."

It was not many months after my

Hilo visit, as I was going between Washington and New York, that I noticed a young woman eyeing me closely. One may be perfectly innocent of any crime against society, and yet feel very culpable if watched by a stranger. This person settled herself in her seat for a good, comfortable stare. "Now," thought I, "what's the matter with my tie. I knew that miserable thing would slip out when I couldn't arrange it."

Just as I was turning to look in the mirror at my elbow, the young woman came over, and in a sweet voice, a really very persuasive voice, said, "Excuse me, but are you Mr. Richard Le Gallienne?" "I am not," I said bravely. "You do so favor him," she continued, not in the least daunted, "I felt sure that I should know him from the pictures in the newspapers."

"Well you might", "they look like anybody from Julius Caesar to Josh Billings." She returned to her seat and took out a book, an autograph album if you please, and began to look it over. She was an autograph nabber; one of those relentless creatures that delight in some of the worst penmanship extant. The most of these collectors are boys and girls; some of the grown-up ones are lovers of literature who prize the autograph of the author they love; but some are horribles. My friend was one of the last. She was determined to get something out of me, so she dropped her fan as she passed my seat, and, of course, I picked it up for her. Then she smiled and made some remark about the weather. "Isn't it tedious travel-

ing?" she said, after I had invited her to sit in the seat opposite to me, for she was very attractive, "I do much of it—do you?"

"Yes," I said, "but I enjoy all the traveling I do, or I shouldn't travel." "Oh, you do, then I'm sure you must be an actor. And I knew you looked like some one I knew by sight, and I know now who it is—you are Sol Smith Russell!"

She brightened up and felt for her album.

"No", I said, "you are wrong again," beginning to fear, however, that I might be a Double. "Who are you please. I'm sure you must be somebody." "Yes," I claim that distinction," I answered, "but not in the sense you mean. I am only a plain, country doctor from a town of some 200 people, and I write a legible hand."

"Oh", said she much crestfallen, "I *did* make such a mistake."

Then she had nothing more to say to me.

But these "mistaken identities" are not so annoying as where a man's personality is valued according to his relationship to some greater person. I have suffered from this kind of valuation.

Socially Americans are, in many instances, very undemocratic.

They worship names and titles too much, and the newspapers indulge in such expressions as—"County Clerk Smith;" "Ex-governor lawyer Merrill;" "Customs-House Porter Jones."

"Mr. Rice, cousin of Hon. J. Cobb, is here;" or, "Mrs. Home, Senator Curson's third cousin arrived yesterday;" or, "David Bow,

a cousin of Henry W. Longfellow has just issued a book."

People do not seem to realize that such a relationship confers no honor upon the obscure relative, while it may offend the distinguished one. Notwithstanding this superficial view of things, taken by so many, a man in America, is really judged by what he is, and by what he can do. This is shown by the status of a man in a community. He is finally placed where he belongs, no matter what his connections may be. One of Thurlow Weed's nephews came out to California a few years ago, to check on his distinguished uncle's reputation. He was a lazy vagabond, and soon found himself herding sheep at \$25 a month. But when he arrived, he was heralded as Thurlow Weed's nephew, and after the nephew was found out, people said, "I don't believe he is Weed's nephew," just as if the kinsmen of great men were not like those of ordinary men—good, bad and indifferent.

I have run up against Henry Clay's, John Bright's, Garfield's nephew; Carlyle's, Lord Salisbury's, G. A. Sala's brother; Talmage's niece; Whittier's, Blaine's cousin, and I have come to the conclusion that the great are pre-eminent at the intellectual expense of the rest of the family. They appear to be born with a part of the brains that belonged to and should have been divided up among the other members. This is exemplified in the vegetable kingdom. You will find that a few large apples have cheated the many smaller ones on the tree, or that a potato or two

have grown large at the expense of twelve pigmies in the hill.

This has been my experience with most of the distant relatives of well known men. Of course, some of the former are worthy and capable, and bear their misfortune modestly; I am speaking of those that advertise their relationship. There are others, too, who being related to some distinguished person through father or mother, look upon the kinship not as an honor, but with loving consideration for the parents' sake. Some years ago, when a relative of mine was preparing a genealogy of the family, he wrote to me, asking my co-operation, and in his letter, spoke of the family's connection with the Hawthornes. He said that my father's family and that of Hawthorne had intermarried in Ipswich, and were considerably mixed up.

I was young at the time, and thought well of the matter, forgetting or not knowing, that in early times nearly everybody in Massachusetts was related to some of his neighbors.

I forget what relationship was said by the genealogist to exist, but it has been enough to cause me much annoyance.

I handed the family historian's letter to some friend, and thought no more about it. But shortly after when a volume of mine came out, there in the publisher's circular was the reflex credit, "A cousin of Julian Hawthorne"; "A member of the Hawthorne family."

This has been rehashed several times, and if I am to blame for it in any way, I wish to atone. If there is relationship, it is so distant, and

so undemonstrable by ordinary methods, that I disclaim it altogether. It confers no honor on Mr. Hawthorne, and is of no advantage to myself. Much as I admire Hawthorne's works, I should little care to have his blood without his gifts.

Only last week I received a letter from some very distant relative (named Smith), who writes—"I am so glad that we are related to Hawthorne. I see by the genealogy that you are a descendant of the original family in Ipswich. My great-great grandfather was your great-grandfather's uncle. My boy is just the picture of Julian Hawthorne". So much for that.

Another thing I wish to set clear and that is my relationship to Emerson's family. That this is known by some is not my fault. My mother was an Emerson, and for her sake I love to speak of those that may be her people; but I have made no study of the genealogy at all, and could not say what relationship she bore to any outside of her immediate family. From a loving impulse, I have often been prompted to do so, but each time I am checked by the knowledge I have gained by contact with the world.

It is enough to have a far away sense of kinship to so good a man as Ralph Waldo Emerson, and to have realized in my own mother's life much that I have found in his books.

For more technical evidence I do not care.

I therefore disclaim all relationship to any but my own family (some of my cousins I should be glad to disclaim), and beg of my friends to accept me for my own possessions.

It is the misfortune of great men that they are born with the usual genealogical correlations; a branching that invariably reaches the average. I suppose there is not a living person who is not related to some person of distinction, if it be only a United States Senator. These great men become so by overtopping the rest; and the rest remain as low as ever, while they suffer from the proximity of the relation. But I like to meet my real relatives at all times, especially the common lot. Since I am not benefitted by kinship with the great, neither am I hurt by the bond that unites me to the poor and unknown of the earth. I have spent happy hours hunting my namesakes in large cities; porters, carpenters, reporters, laborers, tracing back with them to the original "brothers".

And one of my chance discoveries I found to be the gentlest, kindest, most refined and loveable of men; a man of brilliant literary and oratorical abilities who flashed in my presence once or twice, then sank into a drunkard's grave. He was found dead in one of Chicago's streets.

PULSE OF THE IRRIGATION INDUSTRY.

PLENTIFUL WATER SUPPLY.

CARLSBAD, N. M., April 26, 1900.

The coming season promises to be the banner year for the Pecos Valley. The effect of the lying, meretricious advertising that for years past has kept the valley "in the hole" is gradually dying out and plain and truthful statements of conditions here, are rapidly bringing to light the fact that fertile soil and abundant water will win in the end as an agricultural proposition.

These vast lakes here, huge storage reservoirs, could almost inundate a state. There is on hand now enough water to supply the canals and ditches of this vast irrigating system for two years to come without drawing another gallon from the Pecos river or a drop from the clouds.

It must be said, however, that many of the crops irrigated, especially the forage crops, need occasional rains and as a rule them get them during the summer months. The average rainfall here is very nearly fifteen inches yearly. Many plants must receive moisture from above for their leaves.

The waters of the lakes, with their rich sediment, irrigate and stimulate the roots, but the sugar beets, the celery, the orchards, need now and then an occasional washing from the clouds. This is a fact in every irrigating district. It is so at "Chino", Cal.

The dense fog from the Pacific ocean that envelops the land during the spring, and the early summer months constitute the life of the sugar beet crop there, as there is little irrigation water available.

There is small question now, after all these years of experimenting and conjecture, that this Pecos Valley is about the most successful irrigating proposition now in the West. It has the water, and it has the soil and as Prof. Agaziz used to say in his lectures on "Natural

Phenomena," "Combine water and soil and bread stuffs appear."

This country has both. Soil and water. It simply needs the people to develop the fact that, as the Professor said, it can produce food for the multitude.

An advantage of the farming in this valley is that it does not take long to get a small tract of land into a condition where it will pay the farmer a living. Six months is enough. A year is ample. The sterile farms of the North require years—sometimes to bring into a paying basis. Nearly all these southern lands are the same. Of course as the years go by this soil, rich as it is, will require to be fertilized. The great adobe lands of the Sacramento and the San Joaquin districts did too. They now need it. The valley soil, however, is thus far "virgin." Corn, does fairly well here. Wheat, oats and barley do not thrive. The crops adapted to this dry atmosphere are alfalfa, fruit, celery, asparagus. All kinds of fruit trees do well and alfalfa is a never failing crop.

GEO. H. HUTCHINS.

CONGRESS GROWS GENEROUS.

Demand from all over the country for information as to water supply and for irrigation investigation and surveys have been so great that the modest appropriation made by last Congress to the Geological Survey for this purpose has been exhausted long before the end of the fiscal year, and such work has been brought to a standstill. But now, in one of its gentler moods, Congress after considerable persuasion on the part of the western legislators and after several attempts to throw it out, has made a deficiency appropriation of \$20,000 to be immediately available for carrying on this work till June 30, 1900.

"I am particularly gratified," said Mr. F. H. Newell, the Hydrographer of the

Geological Survey, and in charge of irrigation matters, "at this action of Congress, not so much in allowing the appropriation, though we need that badly, but in so declaring its temper in regard to this work."

Senator Bard introduced the amendment and along with Senator Carter and other western friends of irrigation in the Senate, urged its adoption. Senator Perkins, being on the committee having the bill in charge, was in a position to assist materially. In the House, Congressman Needham and Kahn worked hard. Anything pertaining to irrigation which is out of the ordinary, has a difficult time of it in getting through the House, where western representation is so comparatively slight.

"This work we are doing," continued Mr. Newell, "meets more than a western demand, and it is a good sign for the West that it does. All through the East there is a demand for water gauging and stream measurement by the government, for basing estimates in erecting manufacturing plants proposing to utilize water power. All this work which we have been doing in stream measurement, surveys of reservoir sites and underground water flows in the West has been stopped for lack of funds, but I have now telegraphed to continue with it and it will go on at least until the 1st of July."

IRRIGATION ON A LARGE SCALE.

One of the largest single irrigation systems in the world is conducted at Durango, Mexico, where the largest cotton plantation in the world is located. Chicago capital is interested in this company, of which the following description is given by E. C. Butler in the *Chicago Record*:

This concern, otherwise known as the Tlahualilo Agricultural company, was incorporated seven years ago under the laws of Mexico, but quite recently has passed under American and English control. The stocks are owned in the United States and the bonds, placed in England, have a regular quotation on the London stock ex-

change. Four of the five directors of the company are Americans—James Brown Potter, James M. Townsend and C. P. Mackie of New York and William D. Bull of Chicago. The English trustees are Lord Welby of Abington, a secretary of the British treasury, and Henry P. Sturgis of the Westminster bank of London.

Mr. Mackie, who is the vice-president and general manager, has arrived here from one of his annual trips to Durango and he gave me to-day some information concerning the enterprise. The company operates in the Laguna basin, located in an immense plateau 400 miles wide by 600 in length, hemmed in by mountains, and with a general level of 4,000 feet above the sea. It is known as the Bolson de Mapimi, and is one of the two great water-sheds of the Sierra Madre in northern Mexico. In the Bolson are some broad, shallow lakes, and a few rivers, the largest being the Nazas river, some 300 miles long. Some seventy years ago the Nazas left the Cayman lagoons to one side, and they finally degenerated into a mesquite wilderness, with a deposit of fine detritus of great depth.

Fifty years ago irrigation began. The lowest level of the basin was 100 feet below the Nazas river, and it was proposed to irrigate 175 square miles of the 220 composing the basin. A dam was built at a point where the river at flood was 1,500 feet wide. From this point was made a main canal 39 miles long, 72 feet wide at the base and six feet deep. This main canal terminated in a distributing tank and branched east and west, one branch 15 miles long and the other 13 miles, and each about 30 feet wide and 6 feet deep. A total of 546 miles of ditching was carried through, including 400 miles of distributing canals and ditches. The total excavation was some 8,000,000 cubic yards. The work occupied nearly two years and an army of 5,000 peons was employed. So the Bolson de Mapimi, lying in the dry steppes of Durango was redeemed.

The company is thus conducting to a successful issue one of the largest, if not

the largest, single irrigation system in the world. The plantation contains 60,000 cultivated acres and is being constantly extended. About half the plantation is planted in cotton, which is 20,000 acres more than the largest cotton plantation in the United States. It has produced as many as 9,000 bales of cotton in one year. Picking on the Tlahualilo tract is begun early in September, but it will continue till March, while in Texas and other northern cotton States the last bale was picked two months ago.

Mr. Mackie is of the opinion that within five years Mexico will be independent of the rest of the world for her cotton supply, and will even export to Central and South America. Cotton is indigenous to Mexico. At the time of the Spanish conquest it formed part of the royal tribute, and Emperor Montezuma II sent as a sort of peace offering to Cortez a gift of cotton goods of delicate fabric interwoven with feathers of humming birds. The product of cotton in Mexico at the time of the conquest was about 100,000,000 pounds per annum. The Spaniards ravaged the country, and then came the centuries of disquiet and revolution. The production in 1876, when Gen. Diaz came into power, was only about 50,000,000,000 pounds, while in 1898 the production was 70,000,000 pounds, more or less. The Mexicans are turning out prints and finer cloths, and in fact all kinds of cotton goods. The mills of Mexico are in a large part spinning and weaving mills.

IRRIGATION ALONG THE ATLANTIC AND GULF COASTS.

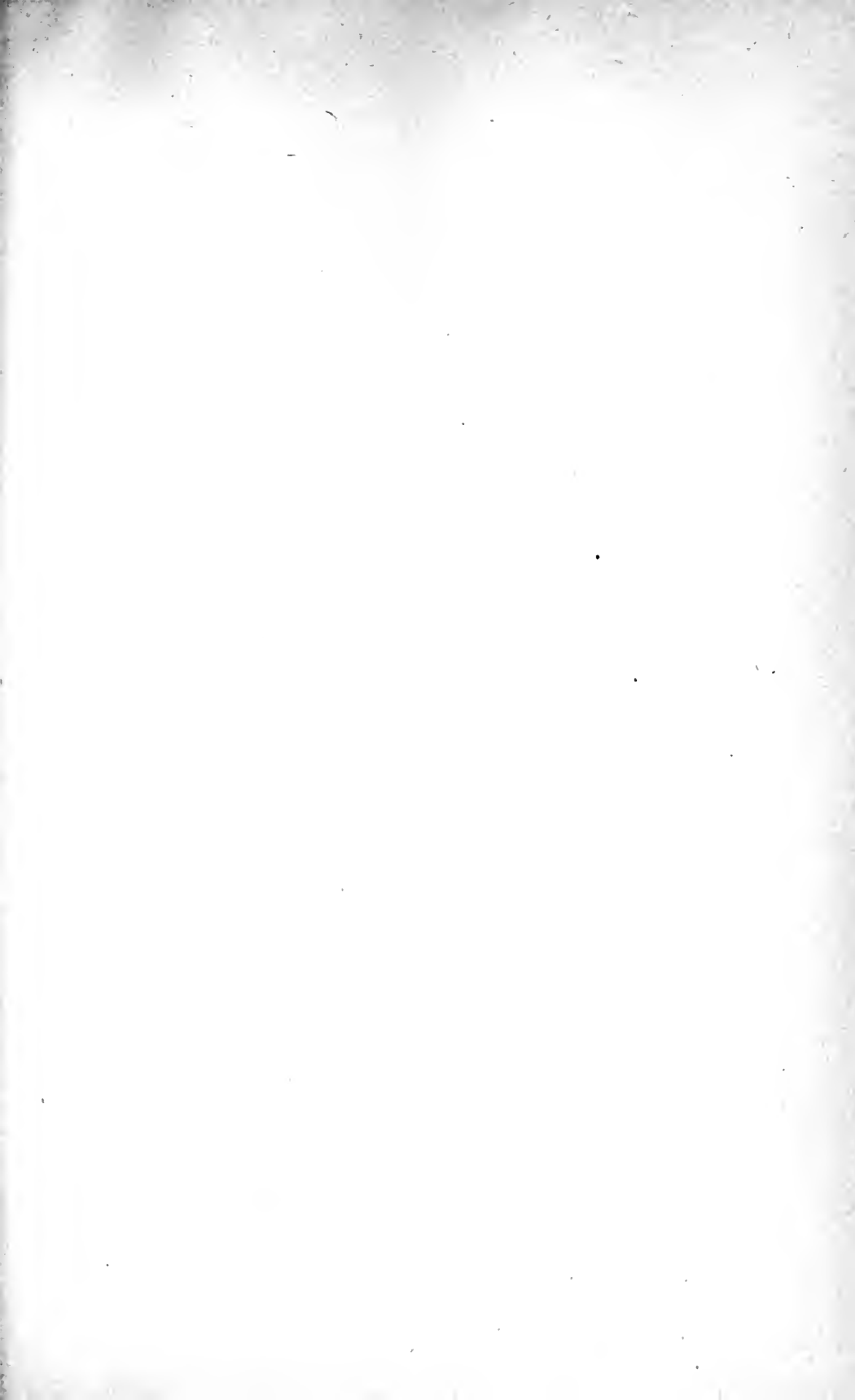
The rapid extension of irrigation in the West and the attention which it has attracted has caused the irrigation already practiced in the humid portions of the United States to be overlooked. The facts already gathered by the irrigation investigations of the Office of Experiment Stations of the U. S. Department of Agriculture show that there is a considerable area in the eastern part of the country now

being artificially watered. For market gardening and growing of high-priced products, irrigation has proven highly successful. Few people are aware that the rice planters of Louisiana irrigate over 100,000 acres. The canals to water the rice fields along the South Atlantic coast were in use more than a century before Brigham Young's followers cut the first ditches from City Creek in Utah. The area of land covered by reserves, or reservoirs, as western irrigators would call them, is greater than the acreage covered by such reservoirs in any arid State, and the volume of stored water is equally as large. Recently there has been a tendency to extend this use of water to other crops, notably on truck farms. If this shall prove profitable, the physical conditions are favorable for the irrigation of a large portion of land along both the South Atlantic and Gulf coasts. Canals to water these level bottom lands along the coast rivers can be dug for far less outlay than has to be expended on many of the canals in the arid West, where rocky canons and precipitous slopes must be traversed to reach the plains yet awaiting reclamation. Recent experiments in Louisiana show that the irrigation of forage crops is exceedingly profitable; hence it does not seem to be unreasonable to anticipate that we may have in this section of the South irrigation works rivaling in magnitude those of Piedmont and Lombardy.

WESTERN DEVELOPMENT BENEFITS THE EAST.

When eastern manufacturers and wholesale jobbers have their attention called to the matter, it is a very simple thing for them to see that with the opening of large areas of fertile western land, through a policy of national irrigation, new markets will be opened for their goods and products. And so they become at once favorable to the idea. This secures for the West an active and influential ally in every eastern State.

GUY E. MITCHELL.





THE IRRIGATION AGE.

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THE PROGRESS OF WESTERN AMERICA.

Irrigation Appropriation.

The irrigation appropriation of \$250,000 which is asked for the use of the Geological Survey, would enable that bureau to vigorously prosecute its needful work of getting at the facts concerning the water possibilities of the arid region, and making surveys to show definitely where water can be stored, in what quantities and how much there will be to store. These are all subjects of vital interest to arid America and which Congress owes it to the West to provide for liberally

"The great importance to the West of the work which the irrigation branch of the Geological Survey is doing," says Gny E. Mitchell, "is perhaps not as generally understood as it should be. For some years the Survey has been working along on small appropriations, making stream measurements and reservoir surveys, but if the West is to attain its full development through irrigation, this work should be pushed and reservoir sites should be determined, surveyed and set aside, subject to development by private capital or government enterprise. Persons familiar with reservoir engineering know that nature plays some queer pranks on individuals and that what appears an ideal place for water storage, may in fact be incapable of holding water, while a site which seems to even the careful observer to be anything but suitable for water storage, may

in reality, afford a situation for a reservoir of great proportions."

Increase of Our Export Trade.

Statistics from Washington show that exports to Asia and Oceanica in the fiscal year which ends with the month of June, will for the first time in our history exceed \$100,000,000. In no part of the world has our export trade grown with such amazing rapidity, with the single exception of Africa. In 1893 our total exports to all Asia and Oceanica amounted to only \$27,421,831, so that in the fiscal year now about to end they will be about four times as great as those of eight years earlier. Imports from that part of the world are also growing rapidly because of the large increase in the share of our sugar supply which now comes from the Islands of the Pacific. More than one half the sugar imported into the United States now comes from the East Indies and Hawaiian Islands. The growth in exports to Asia and Oceanica is chiefly in cotton, breadstuffs, provisions, and manufactures.

Favorable Eastern Sentiment.

It is pleasing to note that such a far eastern paper as the *Boston Transcript* recognizes the fact that irrigation appropriations for the West would be national investments, in the interests of and for the benefit of all the people of the United

States. Quite a part of the annual outlay of the nation, the *Transcript* says, is an investment rather than an expenditure. Public buildings are direct investments, obvious to everybody, because they save rental to the government. In the case of certain other appropriations, the investment aspect, while just as genuine is so indirect as to escape attention. An appropriation for the improvement of Boston Harbor would be an indirect investment. The cost of transportation is one of the great public charges, the rates of which bear directly upon the fortunes of everybody. A deep channel to Boston makes possible large ships and low freight rates.

It is the same story, continues the *Transcript*, with all the worthy river and harbor improvements; they are national investments. Irrigation expenses, in so far as they provide for permanent works, come under the same head. National expenditures of the investment sort should be encouraged, especially when the country is so prosperous that it can bear its burden well as against the time of greater stringency.

It takes but slight study to see that an irrigation appropriation applied to any one section would almost immediately help other sections. If the West were fully developed, the East would necessarily benefit thereby for western money would flow eastward to purchase those things which the East alone supplies and so through the prosperity of the irrigated West the manufacturing East would indirectly benefit by the opening of great additional markets—Nat. Ir. Ass'n.

"Learning
By
Doing."

To say that the Indian, negro and reformatory schools furnish better advantages than those offered to our ordinary school children is to make a strong assertion, and to say that the same advantages could not be obtained for \$10,000 a year, is still stronger. Yet this assertion has been made and well sustained by Albert Shaw in writing about the industrial school at Hampton, Va. A recent

issue of the *American Review of Reviews* contained an article by Mr. Shaw entitled, "Learning by Doing at Hampton," illustrated with forty half-tones from actual photographs taken at the school. It is in this interesting and instructive article that Mr. Shaw says: "Better than at almost any other place in this country, have they at Hampton grasped the conception of what we may call integral education. Some day the people of this country—including the wise and the prudent and some of the educational leaders—will more or less suddenly wake up to the realization of a very curious fact. This fact is that by all odds the finest, soundest, and most effective educational methods in use in the United States are to be found in certain schools for negroes and Indians, and in others for young criminals in reformatory prisons. If I paid \$10,000 a year for it I could not possibly give my own small boy anywhere in or about New York city the advantages of as good a school as the raggedest little negro child of Phœbus, Va., freely enjoys, whose education is under the care of the Hampton Institute." In this school the pupils are taught domestic science, farming, dress-making, carpentering, in fact almost every branch of common work and "learn by doing," so that the children grow up with the idea that it is just as important to be able to wash and iron as it is to read and write, and thus they are much more apt to be contented in their various occupations than if they were taught that "book-larnin" was the all important thing. Booker T. Washington, that great worker for the colored race, whose name is inseparably associated with the Tuskegee Institute, was educated at Hampton, and the Tuskegee Institute is founded on similar lines—is, in fact, a child of Hampton. The writer says "A large part of the secret of the future unlocking of the South's vast possibilities of wealth and culture and happiness lies in the thorough and contented acceptance of agriculture by the colored race. * * * * A large-

part of the mission of Hampton Institute is to teach the young negro that it is just as fine a thing to be a good farmer as it is to be president of the United States." This is what is needed in our schools and educational institutions all over the country—just this *practical* education which is carried on at Hampton. Our school children and young people, white as well as black, should be taught that the truly valuable education is that which will enable them to go out into the world, well prepared to earn their own livelihood by some good trade, not that smattering of book learning which unfits them for work because they have learned to dispise it. While we do not wish to appear unappreciative of higher education, we do believe that in many cases "a little knowledge is a dangerous thing," and any reform in our educational system which will make it more practical and give the students an opportunity to "learn by doing," as at Hampton, will tend to make them more contented and satisfied with honest occupations and do away with much of the unrest which sends them from the country to the city in their desire to escape from the "drudgery" of farm life.

Farmers' Institutes.

One of the recent bulletins issued by the United States Department of Agriculture gives the history and status of farmers' institutes in the United States and Canada. It was prepared by Prof. L. H. Bailey of Cornell University, and issued by the Department in response to a general demand for more information regarding the various means which have been adopted to bring agricultural education directly to the farmer.

The bulletin begins with a general historical survey which traces the origin of the farmers' institute back to 1869 or 1870, when, as an outgrowth of previous farmers' societies of various kinds, the institute was formed on the same general lines as at present. Iowa was probably the first state to hold such meetings, an account of one being published in 1871. Prof. Bailey

then gives statistics of the states and provinces, from which we learn that, with three exceptions, every state and province holds farmers' institutes. The institutes are promulgated and administered in a variety of ways; in some states and provinces the institutes are more or less under governmental control, in some they are under the auspices of the agricultural college or experiment station. The governmental control is of four general kinds—in charge of a state department of agriculture, in charge of an independent state officer, in charge of county organizations, in charge of rural societies which receive state or provincial bounties. Statistics which are given from the states in which the institutes have been most successfully conducted, show an attendance which proves how valuable these institutes are, and that the farmers are aware of and appreciative of the opportunities offered them. The largest average attendance is in Ohio, where 250 institutes are held annually, with an aggregate attendance of 90,000; New York has over 300 institutes yearly with a total attendance of about 75,000; California holds about 80 institutes annually, attended by 16,000, while in Wisconsin there are 120 institutes held annually with an average attendance of over 50,000 persons. Prof. Bailey estimates the annual expenditures for institute work in 1899 to have been about \$170,000, which is more than twice as much as that expended in 1891. During 1899 about 2000 institutes were held in the United States, which were attended by over half a million farmers.

Forestry and Irrigation.

There are two interests which should be closely united, since each depends upon the other for its complete success, and these are forestry and irrigation. Trees cannot grow without moisture; therefore to have trees in the arid portions of the West we must have irrigation in order to supply this necessary moisture. On the other hand, it has been demonstrated beyond a doubt that to destroy the

forests is to decrease the rainfall in that section and also diminish the water supply, since the rain which does fall runs off the hills in torrents into the valleys below, if there are no trees to check it and no roots and leaf mould to conserve the moisture.

This fact is now widely recognized in this country, as it has long been in European countries, where in some localities cutting down a tree is not allowed unless another be planted in its place. For years past the reckless waste of our forests has made foreigners stand aghast. And now that a great many of our great timber districts have been destroyed, we are beginning to realize how prodigal we have been and are striving to retrieve the mistake. The Division of Forestry of the United States Department of Agriculture is doing much by means of the publication of the results of their investigations, to teach the public the value of trees. Brunswick, Me., a place of about 7,000 inhabitants, has recently appropriated \$100 to improve a tract of land by planting white pine trees. The tract of land consists of about 1,000 acres owned by the city, and was once covered by a pine forest. For years it has been practically unproductive and the city proposes to follow an Old World institution and have a town forest. At Sewanee, Tenn., the University of the South has placed its 8,000-acre tract of hardwood timber near that town under the management of the Division of Forestry. All trees to be cut down will be marked by an official of the Division, while the logging contracts will be drawn up by the same party and will provide for the preservation of the young timber. It is expected that the forest can in this way be made to provide an annual revenue for the college.

More closely allied to irrigation subjects is the advice of W. L. Hall, assistant superintendent of tree planting of the Division of Forestry, who recommends the planting of belts of trees along every ditch and reservoir, not only to shade them, but to shelter them from the wind. Prevention of evaporation is a very important problem, since there is not only a waste of water but there is danger of the lands becoming alkaline.

Putting aside all question of the utility of tree-planting there still remains the ornamental aspect, which in itself should be strong enough to induce people to set out trees. What adds more to the beauty of a street or yard than a row of noble trees? What is more majestic than a great oak or maple tree? One looks upon its mighty trunk which has grown slowly year by year, and has a feeling almost of veneration for the great silent giant who has outlived generations of men, and within whose span of life whole histories are compressed.

The profound thinkers who are wrestling with the Country vs. City.

many economic questions of this great nation view with dismay the rush of young men to the city. As the cities become more and more congested the modest village homes and small farms are given up and we are in danger of becoming a nation of renters in our eager race after the almighty dollar. The man who is a failure in the country thinks that perhaps he can achieve success in the city where so many more opportunities are open to him, but he often finds that he is only one of a numerous throng of "failures" in the city; that he is, in fact, a "nobody" there—unnoticed and uncared for. David Starr Jordan, president of the Stanford University, gave this advice to farmers' sons: "You have your own life to make. In the country you are sure of your ground. You will get what you deserve. While your rewards may not be brilliant, your failure will not be ruinous. Do not go into the city unless you are sure that the city needs you. If you go there with nothing to give that the city cares for, you will find yourself cast aside.

Learn to do something well. It will make a man of you, and wherever he goes a man will find that he is needed.'

In his article entitled "The Rush to the Cities" Mr. Jordan says: "Steadiness of national character goes with firmness of foothold on the soil. * * * * * Because the life of the country is simpler and more honest, it is easier for the man of moderate ability to fit into it. I call it more honest, because the farm life deals with nature at first hand, while in the city life deals with the shifting relations of men." It is most apt to be the man of "moderate ability" who decides to try his fortune in the city, and the tenement home and a hand to mouth existence is very likely to be the sequel.

OF WIDE-SPREAD INTEREST.

IRRIGATION COMING RAPIDLY TO THE FRONT.

The wide-spread interest that is being awakened in the irrigation industry is evinced by the prominence given it in the different periodicals. Hitherto it has received attention only through agricultural publications and those of a kindred nature, and the fact that quite a lengthy article bearing on this subject was given in the *Christian Science Sentinel* is a flattering indication of how general the interest is in irrigation. The article in question was an editorial on "The Power of the West," and the editor says "there is a necessity for awakening the people of the East to the rapidly increasing magnitude of the great West." Continuing the writer says:

"It is high time such an awakening should take place. A more thoughtful study, by the people of the East, of the almost limitless possibilities of the vast region of country lying between the Mississippi River and the Pacific Ocean, will bring with it a revelation even more wonderful than that which followed the discovery of the American continent by Columbus: especially that part west of the Missouri River, which only of recent years has been, to any extent, developed.

"This region of country is a vast empire, embracing within itself every needed element of material prosperity. Its agricultural resources, brought to their highest development, would furnish a net product almost equal to the world's present demands. Its mineral wealth of gold, silver, lead, copper, coal, petroleum, natural gas, iron, etc., is only just becoming known. The discoveries and output thus far are but suggestions of the vast treasure-vaults yet undiscovered. Its horticultural possibilities are astonishing even the oldest experimenters. Its grazing—cattle and sheep raising—facilities are vast beyond the conception of those unfamiliar therewith. A large part of this great region is arid, and can only be reclaimed to cultivation by means of irrigation, and this is being done, thereby adding, with annually increasing rapidity, to the settlement and population of a region which, in the past, has been believed to be uninhabitable."

The editor then quotes as follows from the "Personal Recollections of Gen. Nelson A. Miles," regarding a certain section of California:

"Within the memory of most readers it was a hopeless desert, with an oasis here and there around which all there was of the Spanish civilization had clustered. American ingenuity, tempted by a climate which has, perhaps, no parallel in the world, found new sources of water. The highest resources of modern engineering science were

applied, and mechanical skill of the first order was brought to bear. Artesian wells were sunk where the existence of water beneath the surface had never before been suspected, and flowing wells, which surprise the eye and seem miraculous, water hundreds of the richest acres of the world. Tunnels have been bored into the mountains. Ditches were lined with cement to prevent the seepage which had wasted half the water in all old systems. Miles of piping have been laid. Mountain springs have been found and their waters carried long distances at vast expense. The results are now known to all the world as something marvelous in an age of marvels. The work has not yet come to an end, and the time may come when hardly an arable acre in all that wonderful region will be unwatered and idle.

“This is but an instance, though perhaps the foremost one, of the practical results of modern irrigation. Yet systems even still more colossal have been made, used, and have passed away, upon American soil. The most extensive of these remains are found in Arizona, a region then and now almost the heart of aridness, and yet one that was once occupied by choice by the unknown people of an unknown time, who lived and toiled in those valleys, which have long since reverted to the primeval desert.

“ . . . The question of irrigation in the United States has in recent years become a topic of absorbing interest. The public lands which are arable and lie in the humid and sub-humid regions are practically all now occupied, and the process of spreading out and occupying has had its first check. Yet the soil of the arid region is very rich. There is every inducement to settlement if there were only a certainty of even a half supply of water. So recently has the emergency confronted us that no action has as yet been taken by the general government beyond the appointment of a commission to investigate general facts and establish boundaries, whose final report has never been acted upon. The various states and territories have locally interested themselves. The instances of successful irrigation in southern California have been mentioned, and exist elsewhere in localities far apart over a wide area. But they may be said truly hardly to affect the general situation, which is one of great magnitude and vast importance. These beginnings have led to investigations and imitation, and the following are some of the facts that now appear:

“According to the census of 1890 Colorado had under irrigation 4,068,409 acres, or about 6,337 square miles; Arizona had 65,821 acres; New Mexico, 91,745 acres; Wyoming, 229,676 acres; Montana, 350,582 acres. California exceeds the largest of these figures, and there is a still smaller acreage in Idaho, Washington, and Oregon. It will be seen how small a proportion of the area of these regions is at this date under the dominion of the plow.”

In conclusion the editor says: “These interesting data furnish a rough hint of the future of the area under consideration, and dimly prophesy of the inevitable course of empire in that direction.

“But we cannot dwell upon this subject. It is well worth the serious study of people everywhere, and especially of New England, many of whose citizens, strange as it may seem, are much more familiar with England and the continent of Europe, than with the section of their own country here considered.”

DIVISION AND CONTROL OF WATER.

BY PROF. GEORGE L. SWENDSEN, AGRICULTURAL COLLEGE.

Read at State Farmers' Institute. Brigham City, Utah, February 25, 1899.

In all of the agricultural districts of Utah, a common complaint is, that the supply of water for irrigation purposes, is less than the needs of the irrigable lands, making a division of the available supply imperative in almost every case, a division, not according to the needs of the land, but usually according to the vested rights of the parties concerned. In the majority of cases such division is necessary in the natural stream supplying the canals. For instance, more than a dozen canals are taken out of Bear river in Rich county, each claiming a certain part of the stream or a certain volume of the water. The irrigation districts of Beaver county have more than twenty canals supplied from Beaver river. Numerous canals are supplied by the Jordan, claiming various portions of the water, some dating their claims as far back as 1850. Here in Brigham City you have to divide the water between the city and the farms. Many other similar cases might be mentioned, in all of which, at some time or another will arise the question of a proper division of the supply. And again, those using the water from a canal generally have rights and methods materially different from one another, and it is, I think, generally the rule that the division and subdivision of the water is not satisfactory to the parties concerned. Therefore I believe we can profitably consider some of the means and methods to be employed in the distribution system of canals, as well as that of the streams which furnish the supply.

In the first place, then, let us consider, for a short time, some of the methods employed in dividing the stream among the several canals supplied by it. Take first the case where a canal claims a certain portion of the water in the stream. In such a case the simplest, and probably the most common divisor, is a partition of some kind put in the stream, dividing the channel in the proportion. For instance, if one tenth of the water is to be diverted from the stream, fifty feet wide, the partition would be placed five feet out in the stream; on the assumption, of course, that the water is of the same depth across the channel and that it has a uniform velocity. In order that this method may give reasonably close results, either the location should be in a portion of the stream where the bed is level across the whole channel, and the velocity of the water about the same in the whole section, or a check should be put in the channel to bring the water to a state of low velocity, and a longitudinally level drop or apron over which the

water may flow, and at which the division may be made. If such precautions be taken this method of division may be made to satisfy the conditions of a great number of cases. With care the discrepancies need not be excessive.

In the case where a canal has the right to a certain volume of flow from a stream, the Colorado laws provide a quite successful scheme for the division. They are ordinarily called rating flumes. One kind is of the same width as the canal, and the bottom of it on the same grade as the canal. It supplies a short portion of the canal with a permanent bed and sides. The amount of water that will pass through this flume, at various depths, is determined by measurements with a water meter, and by that means a table of volumes, corresponding to various depths, may be made, or a constant may be determined by which to modify the depth to change it to volume of flow. A graduated gauge is put on one side of the flume, so that the watermaster or whoever has charge of the distribution can read the depth and thus know by comparison with his table the volume of flow through the canal. The rating flume is usually placed near the canal headgates. In his report to the Governor last December, the State Engineer of Utah described this method of division, and urged its use in our State.

As ordinarily constructed the divisors of water can rarely be exact, but frequently the convenience of an approximate division is a source of satisfaction. By an elaborate system of gates, weirs, etc., it is doubtless possible to attain more accurate results than with the above methods. However, in most of the cases these schemes will suffice, and at least be a great improvement on the various ways of guessing at just division.

But after the water has been divided among the several canals, probably the greatest problem yet remains to be solved, that of subdividing the water among the irrigators. Is there a single man before me today who has not at some time or other thought that he was not getting his share of the water and that his neighbor was being favored?

The subdivision into irrigating streams surely needs attention. One method that is growing in favor is that of having two sets of gates where the water leaves the canal, one controlled by the watermaster, and the other by those using the water. The watermaster's gate may be put in a certain position and locked, so that as long as the water is at the same level in the canal the amount going out of the canal cannot exceed a certain amount, and still by means of his gate the irrigator may shut it off entirely. With this method, when the depth of the water in the canal varies the flow through the gate will vary also.

The subdivision according to quantity may be made by means of the Foote water meter. A gate in the main canal forces a portion of

the water into the box on the side which is provided with an opening into the irrigator's ditch.

The side of this box, next to the canal, is of such a height as to keep a certain depth of water, usually four or six inches, above the opening into the irrigator's ditch. The surplus runs over the side of the box back into the canal. The pressure being maintained constant, the flow through a certain sized opening will always be the same.

This scheme is the invention of Engineer A. W. Foote of Idaho. It is a very satisfactory arrangement for measuring out a certain quantity of water.

In bulletin 27 of the Colorado Experiment station, Prof. L. G. Carpenter mentions some interesting devices for measuring out a certain quantity of water from a canal. One invented by an Australian consists of a cylinder floating vertically in the water. The water enters the top of the cylinder, which is kept a certain depth in the water by means of a bellows arrangement fastened to the bottom of the cylinder and to that of the canal; the bellows is made of leather in such a way that it will open and close as the water varies in depth, and this keeps a constant head on the top of the cylinder.

The water from the cylinder passes out through a pipe connected with it by a flexible joist.

The same bulletin mentions one of similar design, being used on the Marseilles canal, but it was discarded because it was not sensitive enough.

Now, while I think these schemes are an improvement on the methods depending on the judgment of the ditch-rider or watermaster, I am of the opinion that the problem is not fully solved. I have not seen anything offered to the irrigators in the way of a subdivision of the water, that is simple enough, cheap enough, and withal precise enough to merit general adoption.

In localities where the water supply is inadequate, the time system of distribution among individuals will accomplish considerable toward its economic use. Of course, in order that the method may be just, the amount of water in the ditch should be kept as nearly constant as can be. Then the aim should be to give each the quantity of water proportional with his right, and therefore the perfection of this system would be where a person gets the quantity he has a right to.

To illustrate what I mean: If one person uses the water soon after it leaves the canal and another with equal right after it has flowed three-fourths of a mile, evidently the last man should have the use of it longer than the first. The stream has irrigated trees and vegetation of various kinds in the three-fourths mile of flow; it has lost, by evaporation and percolation and the volume of flow is lessened. If one is to get as much as another, evidently the time cannot be the same.

A few points I shall mention to you in this connection will, I hope,

cause some discussion and agitation of the question. I cannot expect much else, on account of the purely local application of the points I shall mention to you.

In districts where water is scarce, discussion on methods of application usually have to do with economy in use of water, and in districts where water is plentiful, the limits and beneficial results of its application are the points at issue. In this, as in most questions, some very valuable lessons are learned by a study of extreme conditions.

The investigations of the California station during the unusually dry season experienced in that State last year, are very interesting and instructive, and I mention some of the points they noted, in hope that they may be at least suggestive.

In the first place, the successful growth of some of their trees with such a small amount of water led to an investigation of the conditions of these successes, as well as the failures. The results of this investigation are given in bulletin 121 of the California Experiment station, from which I shall take a number of points for discussion.

The deeper range of the roots in some trees than in others, whereby they may draw moisture from a larger bulk of the moist soil, is given as the main cause of the success in tiding over the drought. A case is given where the roots of a prune tree penetrated to a depth of more than eight feet, where they had practically an unlimited supply of moisture, and were independent of the surface conditions as far as moisture was concerned. It seems to me that the example is a simple one, and that the only conclusion the irrigator can draw is, that he should do all he can to encourage deep rooting. It is a well-known fact that roots follow moisture, and if the moisture is applied near to the trunk of the tree so that it will penetrate deep into the ground, the roots will follow it for their supply of moisture, and the result will be deep rooting to an extent compatible with the ability of the subsoil to furnish the necessary nutrition, whereas if a great area around the tree is irrigated to a slight depth, the same reasoning will bring the roots near the surface and the moisture will be subject to losses by evaporation.

In southern California the water is carried to the tree in pipes, usually of concrete, and by means of an opening near the tree, supply it with water. By this means they are able to irrigate thirty acres with three inches of water, or an equivalent of 500 acres per cubic foot per second. Whereas, in the same locality, where all the space between the trees is irrigated, a much less area can be irrigated, and the roots are spread out, and near the surface.

Now, irrigating near the plant may not always be practicable, but in the case of trees it seems to me that we might safely say that where the soil is a foot deep, we should apply the water so as to make the roots penetrate a foot, where the soil is five feet deep, apply the water

so as to make the roots go down five feet. In this way we will be getting the highest efficiency from our irrigation of trees.

I have thus spoken of the irrigation of trees on account of your local conditions here, and am aware that some of these points are impracticable in the shallow soils in this region, but in the vicinities where you have deeper soil and where water is so precious as it is here, they cannot fail to be of interest.

But first it seems to me we should meet this problem of a proper division, make a united effort for its solution, see to it that a just distribution of the water supply is made, and it will soon be followed by an effort at more economy in the application to the land.

THE HOUSE OF THE TREES.

BY ETHELWYN WETHERALD.

[Indianapolis High School *Daily Echo*, Tuesday,
May 2, '98.]

Ope your doors and take me in,
Spirit of the Wood;
Wash me clean of dust and din,
Clothe me in your mood.

Take me from the noisy light
To the sunless peace,
Where at midday standeth Night,
Sighing Toil's release.

All your dusky twilight stores
To my senses give;
Take me in and lock the doors,
Show me how to live.

Lift your leafy roof for me,
Part your yielding walls;
Let me wander lingeringly
Through your scented halls.

Ope your doors and take me in,
Spirit of the Wood;
Take me—make me next of kin
To your leafy brood.

HOW TO IRRIGATE.

BY JAS. G. KYLE, OF RIVERSIDE, CAL.

Read at the Farmers' Institute at Perris, Cal.

Local conditions determine so many points in the skillful distribution of water that it seems not altogether wise to ask a non-resident to talk to you on the subject.

The first point is how much water can you depend on having to use during May, June and July for deciduous fruit. If you can have thirty inches a day of twenty-four hours for two days out of every thirty days, I think you can organize your land and flumes so as to do justice to twenty acres. This is double the amount of land for the same amount of water customary at Riverside.

How to do it? First grade carefully as soon as possible after the first rain in autumn. After the next rain plow deeply across the line of irrigation, put in a good flume on the proper side, or still better on two sides, so that you may be able to cross-irrigate. If you start a young orchard you will not need all your water for several years; but you can always sell it to some neighbor who started his orchard during the time when hopes ran high and water ran low. I like the plan of having the holes dug before beginning to plant. Better let the water have a good start at filling the holes. Plant in water, and let each planter roll up his sleeves above the elbow and two men shovel in earth. The planter should spread the roots so as to give them a natural position. Plant across ten or fifteen rows, as you may have water, and it will keep ahead of you. Cover in your trees with dry earth, and straighten the inclined before the ground settles. In about two weeks you are ready for the first irrigation. Then run a good deep furrow on each side of the row. Start the water in only one furrow. When the water has got as far as two feet beyond the first tree block the furrow, and then open across to the other furrow from one to two feet above. Let the water run down the second furrow a little past the second tree. Block as before; and so down the line. You will in this way put water on three sides of your tree, and by reversing the starting furrows you will have every time you irrigate a basin system which is altogether the most economical of water. The second year run two furrows on each side of the tree, and repeat the blocking and shifting of water from one furrow to the

other near the trees. By the time the roots occupy most of the space you can let it run in the furrow straight down.

And now begins the most difficult part, which is to get the water through to the lower end and no farther. Most of our good people think this cannot be done. If they will offer a premium of \$25 to the man who does it successfully for one whole season the thing will be done. There is no more sense in a man's letting water run away from him than to let his horse run away from him or with him. The difficulty is in favor of the water. It needs no training; it only takes guiding. You would not think of putting a fine colt into the hands of an inexperienced rancher's man without mental resources. I have seen men who pretended to be irrigating have a story book with them and spend fully half their time under a tree reading. They would get up and walk along the flume and clean the moss from the holes, and regulate as they called it. At the same time the water at the lower end would be running to waste in some furrows, while it was not half way down in others. On my way home, a few days ago, I noticed a grove from which the water had just been turned off. It was a good grove, and usually well watered, but I counted sixteen furrows dry at the lower end, and most of these were, as usual, next to the trees. I must explain that this work was done by a man of very little experience. We still have rivers of waste water, but the man who received \$4,500 for his crop of ten acres the present season had the least waste water.

The trees should be numbered at the upper and lower end of the field, so as to correspond. As soon as the water is fairly under way the man in charge should inspect the flow by walking across near the lower end, and with a tablet and pencil make a record by numbers of the flow, and then go to the flume and shut down, or add water, according to its records below. There is a mystery in how one furrow will allow water to pass on so much faster than its neighbor. With an open soil and a heavy fall I would recommend not to run water farther than twenty rods, as it will wash if you run a stream large enough to go far. It will cut and wash away your loam, and not spread laterally. Put in another flume and start again slowly, so that the water will soon run clear. Water with slickens in it does not spread laterally near so rapidly as clear water. After it has run a few hours and the ground is wet, heavy and settled, a larger stream can be run with safety.

Furrow deep from the start, as the main idea of irrigation is to get the water down to where the roots naturally live. If you furrow shallow your top-soil will be wet and you will think well of yourself, but in a few months or a year your roots will come up, and will be dried by the hot sun of July and August, and your trees will show sorrow before the thirty days come around. If you could wet the

ground underneath from furrow to furrow, and still keep the top dry it would be perfect work. The furrows should be made with a narrow, sharp pointed shovel, and the blacksmith should be called in to help in keeping it so. You should plan not to allow your ground to get dry below before each irrigation, as when dry it does not take water so freely. You all know the instructions for oiling harness. You had better hire a good man to help you to get a good "ready," and absolutely put the water where you want it and nowhere else. Remember that a slow, small stream will spread faster laterally and go down deeper than a rapid stream. My plan is to get the water through as soon as I can without cutting. As soon as a furrow is through shut it down so that it will just keep a wet shine in the bottom of the furrow to the end.

If you think irrigating an easy job, which anybody can do, I fear you will not succeed on a basis of an inch to ten acres. Cross furrowing at the end of a field, the lower end, is a great help in old orchards. If this be not sufficient, then with a large hoe pull out these cross furrows as far into the dry middles as you may wish, leaving the end blocked. If there is a side-fall to the field work from the upper side. To compensate for this side-draft put on more water on the rows you draw from.

THAT CAT.

BY BEN KING.

The cat that comes to my window-sill
When the moon looks cold and the night
is still—

He comes in a frenzied state, alone,
With a tail that stands like a pine-tree
cone,

And says: "I have finished my evening lark
And I think I can hear a hound-dog bark,
My whiskers are froze 'nd stick to my
chin;

I do wish you'd git up and let me in"—
That cat gits in.

But if in the solitude of the night
He doesn't appear to be feeling right,
And rises and stretches and seeks the
door,

And some remote corner he would explore
And doesn't feel satisfied just because
There's no good spot for to sharpen his
claws,

And meows and canters uneasy about,
Beyond the least shadow of any doubt—
That cat gits out.

BEAR RIVER VALLEY DAM REDIVIVUS.

In the Riverside Enterprise editorial columns we find this:

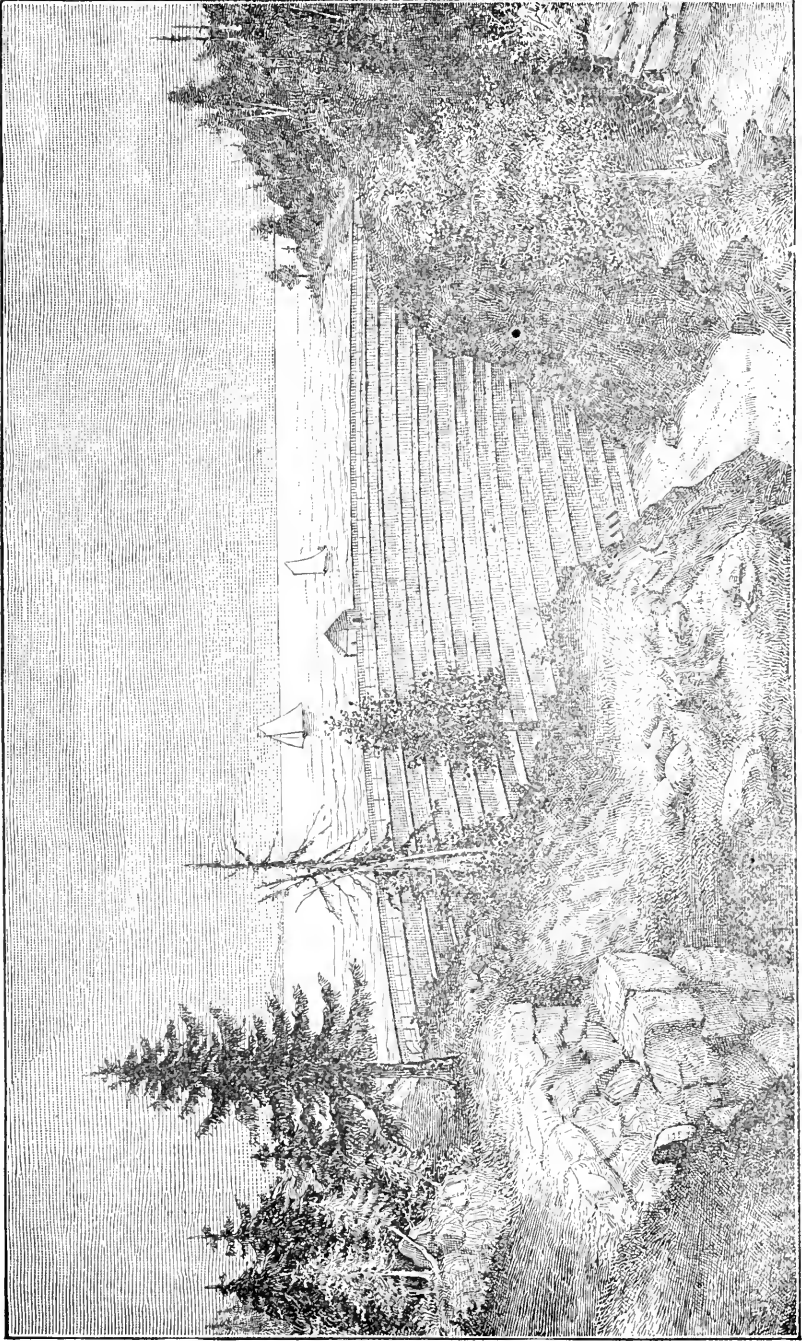
“The bursting of a dam near Denver recalls the agitation that was carried on here against the Bear Valley dam years ago. A flimsy looking structure it certainly was and is, and the only thing that could be said in its favor was that it stood. Some people suggested that perhaps an earthquake might throw it down, but such natural convulsions could not be foreseen or provided against, for the reason that an earthquake that would throw down one would, in all probability, be equally destructive to the other. It will be interesting to note whether when we have a recurrence of regular rainy seasons again, any further effort would be made to increase the storage capacity sufficiently to carry over an extra dry season. Provided the present dam had been strong enough it could have been raised enough feet to cover two or three dry seasons, with an economical use of water. Redlands, fortunately, is developing enough water to make her practically independent of Bear Valley.”

Bear Valley dam is unique, in that it was built on the theory that an arched monolithic structure of half the thickness and less than a fourth of the cost of the ordinary type, would not only stand, but be safe. Experience has demonstrated the truth of the theory, albeit it was condemned by every “expert” dam engineer in the world to whom the plans were submitted.

However, our friend proceeds on the wrong theory when he says that “provided the present dam had been strong enough it could have been raised feet enough,” etc.

There has never been any intention of building the present dam any higher, nor to build any dam *at that point* any higher than the present structure. This is because of the configuration of the canon. Accurate surveys have shown that a dam twice the height of the present one—120 feet as against 60 feet—can be built lower down the canon at a cost vastly less than would be necessary to build the present one to twice its height. It is difficult to explain this without a diagram, but it is true.

The new—and lower—dam at twice the height the present one will hold four times the amount of water the present dam holds. The present capacity of the reservoir is 10,000,000,000 gallons; and the new reservoir would hold 40,000,000,000 gallons, a capacity exceeded by only two or three artificial reservoirs in the world.



THE PROPOSED NEW BEAR VALLEY DAM, HEIGHT 120 FEET, CAPACITY OF RESERVOIR, 40,000,000,000 GALLONS.

That this new dam will be built seems to us a certainty. The affairs of the Bear Valley company must be straightened out—freed from all legal tangles and troubles—and then our people can—and probably will—form a joint stock company, make the water appurtenant to, and impossible of dissociation from, the land, and then buy it and finish the present incomplete system on the original plans. Pumped water can never compete with gravity water, in either cost or irrigation worth. The Bear Valley system will yet be completed and owned by the people who use the water therefrom, and all speculative private ownership will be absolutely eliminated.—The Citrograph.



MOODS.

BY LIZZIE CLARK HARDY.

A rain-swept earth and a wind-swept sky.
 And gray mists trailing low;
 A wailing wind and a troubled sea
 With a moan in its ebb and flow—
 And a soul at war with itself and God.
 A heart surcharged with woe.

* * *

A rosy light in the cloudless sky
 And a new-born earth below—
 A golden mist on a sapphire sea
 With an anthem in its flow—
 And a soul at peace with itself and God.
 A heart with love aglow.

FOREST RESERVES.

BY GOV. N. C. MURPHY, Governor of Arizona.

So much has been written and said; so much apparent alarm exists among the farmers of the valley at what is alleged to be a serious menace to their water supply; so many hasty conclusions have been formed, and unjust and unfounded accusations made, even to the extent of threatening personal and sectional strife, that it seems proper to present the questions involved to the citizens of both northern and central Arizona for cool and impartial consideration. The best interest of the whole territory requires careful and considerate investigation of such important questions before conclusions are formed and action taken which subsequently may prove to be mistaken and unwarranted by the facts; and at all times there should be observed a just recognition of individual and community rights.

In the first place, it is proper to state and emphasize that these subjects which are now being so earnestly discussed are in no respect political, and they have no proper place in party platforms. Political leaders or official place hunters who seek personal advantage by using party machinery regardless of principle should receive no consideration from the people, no matter to which party they may happen to belong. It is folly and destructive of public welfare to adopt any course which tends to array section against section or industry against industry for the purpose of the arbitrary ruin of either, especially if either occupies any considerable place in the progress and development of the commonwealth. The questions disputed are of public interest, especially in the localities most affected. Democrats, republicans, populists and all classes of citizenship and political faith should desire a fair, honorable and impartial adjustment of the problems presented. Neither political bias nor superficial and hasty judgment should be allowed to prejudice and inflame the public mind. Political conventions and party declarations of principles cannot affect the contention in the remotest degree except to complicate it injuriously, although public meetings, non-political in character, attended for the purpose of enlightenment and an intelligent interchange of opinions for the purpose of devising ways and means to correct abuses where they exist, are perfectly proper and beneficial, and if well conducted are educational and corrective in their effects.

I shall try to review the controversy over the grazing, forest preservation and water supply problems which has developed during the year, without bias or personal interest of any nature or degree

and in stating the arguments which have been presented by those most vitally interested in the subject, both here and at Washington, I shall do so without the slightest prejudice either for or against either side.

There are several collateral interests involved and each should be referred to, in so far as it is evident that it relates to the main questions.

First, there have been very serious differences between citizens of the territory engaged in grazing cattle and these grazing sheep on the public domain, and I believe these differences exist in a greater or less degree whenever the two industries are carried on in the public land states and territories.

In Arizona, and especially the southern part of the territory, according to my observation and all the evidence I have been able to obtain, the cattlemen so-called have good reason for their protests and just cause for complaint at the periodical and migratory manner in which sheep graze over and destroy their ranges during certain seasons of the year. While it is technically true that a sheep has as much right on the public domain as a steer, it is also true that the cattleman who has located a spring of water or a number of them for home ranch purposes and has appropriated for grazing his cattle a large area of the public domain contiguous to the watering places, has certain rights recognized by custom, at least, to the range appropriated by him and until the land is disposed of by the government by sale, his possessory right is not disputed. Therefore when sheep which are allowed to graze undisturbed during the summer in the forests and on the plateaus of northern Arizona are driven down and across and grazed upon the ranges of the cattlemen of the south in the fall and winter, destroying these ranges for cattle grazing, at least for the time being, the cattlemen who are thus imposed upon seem justified in adopting every possible means recognized by law to protect their property: and when the law does not specifically protect them it is hard to determine how far they are justified in going in their own defense. Acrimonious disputes have arisen year after year, lives have been lost as the result of armed conflicts and until some method is adopted for legally controlling these conflicting interests I feel that good order is being constantly menaced in certain localities of the territory. During the Twentieth Legislature a bill was introduced to regulate the salaries and fees of certain officers in fourth and fifth-class counties, and a section was added to the bill authorizing the board of supervisors of any county to license all kinds of business within the county and to regulate the amount of said license. It was an open secret that the object of the bill was to enable the board of supervisors to require such a heavy license to be paid by sheep grazers whenever deemed expedient as to be prohibitory, and it was not proposed to enforce the terms of the law as to other kinds of business.

Opposition developed to the bill because of its sweeping character and because of the opinion by many well informed citizens that if enacted it would be inoperative because of fatal legal defects. An attempt was made to modify it and still retain its material features as to sheep grazing, but because of active opposition and lack of time it failed of passage. I am heartily in accord with the cattlemen in their contention against the migratory grazing of sheep upon the southern ranges, but it seems to me equally unjust that the cattlemen should seek to destroy the sheep industry upon its natural grazing ground in the northern counties. My own solution of this vexatious problem is the leasing of the lands under territorial control which would not only provide a considerable income and reduce taxation, but would enable the proper authorities to establish boundaries and protect each class of industry within its leased limits. This, however, is incidental to the subjects of this paper and only bears indirectly upon the forest reserve and water question. The attempted legislation, however, was the beginning of an organized attempt by the cattlemen to protect themselves against the sheep. The same legislature, which was largely democratic, adopted a memorial, council memorial No. 2 (the council was two-thirds democratic), worded in the strongest and most explicit language, requesting that live stock be permitted to graze within the forest reserves without any restrictions whatever. The memorial was adopted without division, it not being considered in any sense a political question. About this time strong opposition commenced to develop to grazing within the forest reserves and it was asserted by scientists and others that grazing destroyed tree growth because sheep ate the young sprouting trees, underbrush and grass, and their presence meant gradual destruction to the forests. No discrimination was made at the time between cattle and sheep, although there were but very few cattle in that neighborhood. As a natural consequence cattlemen joined issues with the forestry preservation people and as the agitation continued, the settlers of the Salt River valley became alarmed at what they were led to believe was a serious menace to their water supply. Lines have now been drawn between the cattlemen of central Arizona, farmers and some of the friends of forestry preservation on one side and the sheepmen of northern Arizona on the other (the cattlemen of the northern counties in some instances would like to have the sheep excluded, providing cattle are not). Many arguments have been presented by both sides to the controversy and the most painstaking investigations have been made by the secretary of the interior and the commissioner of the general land office. The first superintendent of forest reserves, Mr. Benedict, recommended that live stock be permitted to graze within the reserves, and his successor, Mr. Buntain, made the same recommendation in stronger terms, but notwithstanding their reports, the depart-

ments issued an order excluding the sheep, but were induced to revoke this action for the time being or during the current year to enable a more thorough investigation to be had, because of legal reasons and a reluctance to arbitrarily, without compensation and a reasonable time for adjustment, destroy this part of the grazing industry.

Some of the arguments presented pro and con are as follows:

The irrigationists claim that the sheep eating off the grass and underbrush on the watershed which supplies the irrigated valleys, allows the moisture to run off in floods on the surface instead of gradually, as would be the case if held in suspension by the brush and grass, and therefore all these flood waters are lost for irrigating purposes.

To which the grazers reply, that there are no surface streams on the plateaus grazed and that the sooner the rain and snow sinks into the ground the longer it will remain in subterranean reservoirs and percolate out into the streams which supply the valleys below; also that if the contention were true that the moisture were held in suspension, the greater part of it would be lost by evaporation, and especially in the winter time, when by freezing by night and thawing in the day, three feet of snow has been known to gradually disappear and leave dust on the ground; also that but a small portion of the area grazed sheds into the irrigated valleys, and that much of it has no underbrush.

The farmers contend that since grazing has been permitted in the northern forests contiguous to the streams which supply the valleys the water supply has been gradually growing less.

To which the grazer replies that very few more sheep are being grazed now than there were eight years ago, and that the drouth of the last two years is abnormal and that the demand for water in the valley has grown greater and that much more of the supply is now diverted than formerly: that there are now sixteen ditches on the upper Verde dividing water where ten years ago there were but three.

The forestry preservation association contends that grazing destroys young trees, although the scientists of this association do not claim that sheep eat pine and cedar except when in a starving condition.

The grazers reply that the destruction of tree growth is reduced to a minimum in the greater part of the area grazed because there is practically no underbrush and young growth, and that the three great saw mills and several smaller ones destroy more tree growth in one year than double the number of sheep now grazed would in ten years.

The farmers, if it can be proved that their water supply is being diminished even in a very inconsiderable degree as a result of grazing, have proper cause for alarm and are justified in adopting every possible measure for protection. At the same time the grazing industry is very important to the northern tier of counties and contributes a

large proportion of the taxes. The great railroad running through those counties which formerly paid a large part of the taxes, now pays but a trifle, under a recent decision of the supreme court; therefore, unreasonable haste in destroying an important asset of these counties should be avoided except when actually necessary for the public good.

Arguments on both sides of the question are many and it is not yet entirely clear just what can be done properly to adjust the differences.

It may not be generally understood that the government is absolutely powerless to control the situation satisfactorily under the existing law. With the exception of the Black Mesa reserve, the reserves now in controversy are almost entirely within the land grant to the Atlantic & Pacific railway and the government only owns the even sections. The map is like a checker board, and while the government can reserve all the even sections, it has no jurisdiction over the odd sections. Nor can it exclude stock from them, nor prevent stock from being driven across the even sections to them, which makes these reserves practically inoperative. Some say those who own odd sections should be compelled to fence them. This would be difficult to do, and even then they could not be prevented from driving their stock to and from their own property, and if the government should attempt to guard all the even sections it would take an army of rangers. The department of the interior and the general land office, acting under the best legal advice obtainable, have realized their inability to control the situation, however much they would like to and they have at great expense tried in every way to protect the forests and the people's interests. These officers have been accused by vicious critics, and without the slightest reason, of showing favoritism to the sheepman and by inference corruption has been suggested. I am ashamed to think that any citizen of Arizona should so far forget himself. I have had opportunity to hear and know just how these department officials feel in regard to these questions. I know that their inclination has been all the time to exclude live stock from the forest reserves wherever their jurisdiction extended, especially where it could be shown that forest preservation of water supply was in any way endangered. I know that a very large and influential corporation of northern Arizona brought great pressure to bear upon the secretary of the interior to exclude one kind of stock and admit another. He replied that he was inclined to exclude both and that he certainly would not admit one without the other. I know that the commissioner of the general land office has been working hard to secure such legislation from congress as would enable the interior department to control these reserves. I know the department has offered to give lands in other localities equal in value to these lands,

providing the owers would exchange them. I know that the railroad attorneys and the representatives of the government are now trying to frame a bill whereby each can relinquish to the other lands within the grant so that the government can control this very reserve question. This is a difficult kind of legislation, and whether or not it would result in any better protection of the water shed I do not pretend to say. The people will find that the commissioners lately appointed to investigate the subject in controversy will make an exhaustive and impartial examination and will give every locality and interest equal consideration. The plan adopted is in my opinion the only way to reach correct conclusions and form a basis for effective action, and I believe the citizens of this valley should help the commission and prepare such data as they are able to obtain and investigate the subject thoroughly themselves through an appropriate committee, and not jump at conclusions nor accept hearsay testimony. Political conventiens and resolutions controlled by imaginary local interests and not based upon actually demonstrated facts cannot have the slightest effect upon the government's action in the premises. Many of our people are alarmed and acting upon their honest convictions. They are fair-minded men, however, and will not countenance manifest injustice. There is a selfish element, also, a hasty and superficial class, and worse than all, some curb-stone statesmen and strife breeders, who thrive on agitation. I believe the people should be conservative and deliberate, investigate the matter thoroughly and I am sure if it is found that grazing upon that portion of the northern forests which sheds into this valley affects the water supply of the farmers here, that all live stock will be promptly excluded from that region so far as the government has power, and I will do all I can to have such a result accomplished. I have been repeatedly misrepresented on these questions, and, as I have previously stated, I have not the slightest personal nor sectional interest. I wish to serve the people of the territory impartially and no amount of misrepresentation will cause me to swerve a hair's breadth from what I consider to be my duty.—*Arizona Republican.*

SHE WISHED TO SING.

BY WILLIAM LIGHTFOOT VISSCHER

There are just three persons of importance in this history though we may need a fourth before it is quite concluded. The fourth will depend upon how the girl is going to act, for the history will chase her for a time. That she is going to do some very spirited and independent things is certain. She is a spirited and independent sort of girl.

The other two persons to start with, are Henry Hamilton Mays and Dr. James Lewis.

Mays is a young man of twenty-seven, and handsome, as well as educated; clear-headed and ambitious. Moreover, he is of good blood. Almost anyone who gives some attention to pedigree would know that, and in the region where Mays has lately settled, to practice law, much attention is given to pedigree. The people, generally, are fond of horses and fine cattle. They are particular as to the pedigree of these, and they say: "If there is anything in the pedigree—good blood—of stock, why should not that hold good with men and women?"

The somewhat small city where Mays practices law is not far from the town in which he was "born and raised" and educated, except that the finishing of his education was done at a distant university from which he obtained his two degrees, master of arts and bachelor of laws. Thus the people of his city—the good people—were familiar with the Henrys and the Hamiltons and the Mays of Benton

county, and it was from these that Henry Hamilton Mays got his pedigree and his name.

Dr. Lewis was brought up in the city where Mays settled, but it was at the university that Lewis and Mays became acquainted and, also, devoted friends, though Lewis is five or six years older than Mays. They graduated in their respective professions one year apart, Lewis having advantage of the year.

Somehow a young physician does not like to start in to practice among the people who have known him from boyhood. He thinks, very naturally, that the persons who have seen him playing "knucks" in a vacant lot, or "skinning the cat" on every horizontal pole that would permit of such a performance, and that he could reach; who have seen him paddle, barefoot, in the gutters after a summer shower and "squash" mud between his toes while standing before an irate parent, and have seen him double and agonize after a gorge of green apples, and, in short, have watched him through all the idiocies of adolescence, are not going to suddenly accept him as their guide through a dangerous spell of illness, either of themselves or their loved ones, even if he came home with diplomas enough to paper the walls of his office. Hence Dr. Just-From-School generally goes forthwith, elsewhere to try his maiden pills and things, and if he has good sense enough, in his early, light cases, to use placeboes—make-believes—quite extensively, until he has become intimately familiar with prognosis, diagnosis and symptoms, and the judicious route

to remedies and specifics, he will get along all right and will not have, in the evening of life, such dreams as horrified hunch-backed King Richard in his tent that night before Bosworth Field.

So it is that Dr. Lewis is living in good style on a South Side boulevard of Chicago, owns the house he lives in and the next one to it, has an office in a down-town sky-scraper. with brief hours there, per day—perhaps—and is altogether much sought for by the swell sick, and for consultations, clinics and scant-record operations.

Notwithstanding Lawyer Mays' general level-headedness, he is in love with Kate Tinsley, so much that there is no use of wasting adjectives and similies in trying to describe his condition. It cannot be done, anyhow. Novelwriters and poets have been struggling in attempts to do that ever since Adam and Eve had their honeymoon in the garden, and while the alleged descriptions, portrayals and all that sort of thing go on *ad infinitum*, *ad nauseum*, the sweet pain continues in all its freshness, blissfulness and aggravation, perennial, unfailing and more and more indescribable, the trite and hackneyed, mawkish and long-drawn, stilted and straiued, over-done and under-done attempts at it to the contrary notwithstanding.

But Henry Mays loves Kate Tinsley "for all there is in it," and that is a great deal.

Kate is the independent and spirited girl mentioned at the outset of this veracious statement of contemporaneous fact. She is, moreover, wondrously lovely in form

and feature. Besides, she is witty and has a neat little fortune. She is also twenty-two years young and very much her own mistress, notwithstanding the nervous efforts of a tall maiden aunt, her alleged guardian, to lead the young woman in the primrose paths of conventional propriety. Not that Kate has any tendency to do scandalous things, but that she is *outré* in the better sense of the term. Not eccentric, but just the reverse, exceedingly natural, and uncontrolled by fashion, fads and finesse.

Kate is out this lovely autumn evening, with Henry Mays, at a plaza concert, and in her exuberance of spirit is worrying that somewhat precise young man by, now and then, singing in concert with the band when that tuneful aggregation pipes through an aria with which she is familiar.

Mr. Mays so far loses his equilibrium as to suggest that it is hardly the proper thing to thus attract the attention of persons in their immediate vicinity, some of whom smile at the gaiety of the girl, though one long-haired crank palpably evinces his displeasure and irritably removes himself to a distant elsewhere.

Mr. Mays suggests, at last, quite prematurely, that they return to her home, and Miss Tinsley, with a suddenness that somewhat jolts the young man, accedes to the proposition, and on their way she sulks. He endeavors to palliate matters, and is painfully unsuccessful. She declares that she is much pleased to reach a place where she can sing to her heart's content, which

is a privilege she enjoys at home, entirely undisturbed.

Mr. Mays will be delighted to hear her sing to the accompaniment of her own piano and by her own deft hands, but discovers upon their arrival that her singing impulse has subsided for the time, and though the hour is yet early there is a more or less strained atmosphere in their immediate environment, and his visit for the evening closes with unusual prematurity.

This morning Miss Tinsley has a call from a very dear friend of her childhood and young maidenhood. The caller's name was, in their school days, plain Sarah Duncan. Now, however, she is "La Belle Sarene," the bright particular star of "The Imperial Grand Opera Company," which is just closing a week in the city of Kate Tinsley's home, and excepting the one evening of the plaza visit, Kate has been closely attendant upon the performances of that illustrious corps. The Sarene, two or three years the senior of Kate, was the prodigy, in a vocal way, of this small city, and by the patronage of a wealthy woman, and from the proceeds of a swell testimonial benefit, little Sarah Duncan had gone the gamut, on the ascending scale, of a musical education. at the proper places in Europe and had thus attained exalted position in "the profession," and with it all the new name, this latter, of course, with a view to more picturesqueness on the bills.

The Sarene had ever been a worshipper of Kate's voice, that was exceedingly sweet and well-

trained, and now she is saying, for the many hundredth time, what a pity it is that such a voice should lose its sweetness on the common, every day air.

The sequel, which may as well be arrived at without circumlocution or unnecessary verbiage, is that Miss Tinsley is to accompany the divine Sarene upon one of her all-conquering tours, and herself become a famous canatrice, with probably a high-sounding *nom de stage*, or in the language of the modern manager, "A high priced attraction."

Besides, Miss Kate Tinsley has Mr. Henry Hamilton Mays largely in her thoughts, and she will prove to him, some more, that she will sing where and whensoever it suits the fancy of her own self.

Miss Tinsley is "not at home," when Mr. Mays calls this evening, and somewhat discomfited, but not at all discouraged, and not even greatly disappointed, for Mr. Mays is familiarly acquainted with the sometimes whimsically petulant caprices of his sweetheart, he goes back to the solitude of his apartments, and then to the more breezy atmosphere of his club. Meantime Miss Tinsley packs a huge trunk, scorning assistance, and decidedly informs her devoted but long-suffering maiden aunt that she intends making some distant and indefinite visits.

Further to avoid prolixity and expatiation, it may be briefly stated that in Kate Tinsley's familiarity with the music and librettos of grand opera, comparatively short study and rehearsal have prepared her, now, for the occasional and

petite roles that she is singing with the Imperialists, as a beginning, under the patronage of La Sarene, and which continuing through some weeks have brought the Imperial company to a Chicago season, and Miss Tinsley, under the stage name of Hilda Vernon, to a hotel room with a violent attack of influenza that imperiously assumes all the versatile and malicious phases of that erratic malady.

There is consternation in the Imperial Grand Opera Company, in which Kate has become a general favorite, and Sarene is watchful, sympathetic and sisterly, despite the demands of her profession.

La Sarene and Dr. Lewis have been friends from the childhood of the one and the ladhood of the other, and this eminent and imminent physician—for he is always much in evidence when Sarene sings in Chicago—becomes the medical attendant of Kate. In a burst of confidence Sarene informs Dr. Lewis who his patient is, and though the doctor had not before met the young lady, he had known of her family all his life, and has learned, superlatively, and even extravagantly, of her through his correspondence with Henry Mays, who has written more of Kate Tinsley to the suffering physician than of any other ten subjects that they have made any pretense of discussing.

Thus Dr. Lewis is now enabled to alleviate the sufferings of his distant friend through a "treatment by mail," more than any individual has ever before been relieved by such service, for Lawyer Mays has written disconsolately to Dr. Lewis

of his sudden and inexplicable loss of a sweetheart, and of a resulting attack of sympathetic heart disease that is very painful.

The telegraph now becomes the medium of communication between these friends, and today "Henry Hamilton Mays" is a name that indicates a southern arrival at the same hotel in which the raging octopus, la grippe, has gathered Kate within the ungentle embrace of all the myriad tentacles that it can bring into use upon one somewhat small young lady's body—and soul.

Lawyer Mays is inclined to be profane to Dr. Lewis because this arbitrary functionary will not allow this lawyer-love to see the young lady for the present, or even permit the communication to her of the fact that Henry Mays is in Chicago, or even on earth.

Today, however, a week later, the embargo is removed, for in the meantime the young lady is close to entire recovery. Besides, a scheme has been developed. It is all the doctor's ingenuity. A love-lorn lawyer, nor thus afflicted disciple of any other profession, or calling, never had plain, common sense, much less ingenuity, in matters pertaining to a crossed-love case.

The doctor has told the young lady that she is very much in danger of acute tuberculosis—in lay parlance, quick consumption—if she doesn't hurry to the warmth and care of her southern home, as soon as convalescence and a Pullman car can collaborate to that end.

Now Kate is at home, and Henry Mays was her devoted attendant and *cavalier servente*. Happily, the

young lady has escaped tuberculosis—of which, in fact, she has at no time, been in danger. Henry Mays says she can sing whenever and wherever she is disposed to do so, and he is very much in authority, since that fourth important personage to this history comes upon the scene. He is from the door of the vestry-room of St. Mark's Church, and he is the Reverend Charles Chamberlain, rector hereof.

He said: "Wilt thou?" and other things, to Henry Hamilton Mays and Kathryn Tinsley.

Paradoxical as it may seem, they acceded to his propositions and yet they have not wilted.

THE OLD OAKEN BUCKET REVISED.

(Read at the session of the Highland Horticultural club, devoted to pumping-plant problems.)

How many the poems, the proverbs and fancies,

All right in the east but all wrong in the west,

Where multiplex problems of power and pumping

Embezzle our slumber and rob us of rest;
Mechanical problems, diversified problems,
Perennial problems that rob us of rest.

How often the wealth of the waters beneath us

Is painted and penciled in eloquent strain;

How much of our time and our money is wasted

In blunders bewitched and experiments vain;

In ludicrous blunders, extravagant blunders,

Implausible blunders, experiments vain.

How perfectly plain that our neighbor's a novice

At sinking a well and selecting a plant;
He ought to have listened while we were expounding

Our dogmas entitled "you can" and "you can't;"

Those logical dogmas, those iron-bound dogmas,

Those moss-covered dogmas, "you can" and "you can't."

How chipper and cheering the newspaper sages

Who say that a drouth is a friend in disguise;

How quickly they join the refrain of the farmer

When natural showers descend from the skies;

When copious showers, when old-fashioned showers,

When quadruplex showers descend from the skies.

O, Jupiter Pluvius! Mystical fellow!

You're Duke of the Weather and Water is King—

Then why not return from your seven-year furlough

And back to the foothills your Sovereign bring?

And back to the foothills, the welcoming foothills,

The orange-clad foothills, your Sovereign bring.

—WM. M. BRISTOL.

NOTES AND REFLECTIONS.

These are the days when, "Hot Enough for You?" as Sydney the Great observed, one would like to take off his flesh and sit in his bones. "Yes," added some ingenious sufferer, "take out the marrow and let the air draw through." This would certainly be the quintessence of coolness, although attended by minor inconveniences. It seems incredible that the hottest portions of the globe are inhabited, yet such is the fact. In Thibet, in the deadly Soudan, and the burning regions of Equatorial Africa are to be found not only native tribes, but representatives of northern civilizations dwelling year by year and, what is still stranger, in comparative comfort. In India the English bear the heat with wonderful complacency, the highest temperatures apparently affecting them little. Indeed, as a general proposition it may be said that man is the only animal capable of adapting himself to every possible climate. Dr. Kane, lying upon the snow in a canvas tent, slept comfortably in a temperature of 65° below zero, and in portions of Persia and Arabia life is supportable at 126° above.

It is to be noted, however, that in hot countries the inhabitants guard against excessive heat either by ignoring habiliments or by adopting rational safeguards: rice-cloth garments, white canvas shoes, pith hats and sun umbrellas. The mischief of it is in temperate climates that one never knows what degree of heat or cold a day may bring forth. After a careful study of the subject I should say

that, in Chicago at least, the proper paraphernalia of the summer season would be an ulster, a linen duster, a fur cap, a cork helmet, a palm leaf fan, a Mackintosh, and a pair of skates.

Shillshallying.

The war in the Philippines drags its slow length along, almost every day bringing its melancholy list of casualties, and the practical subjugation of native tribes appearing as remote as ever. It is idle to disguise officially reported facts, and the most ardent supporter of the present administration must feel chagrined at the outcome of so many months of futile effort. Prominent among the fatal encounters are those of small and isolated groups of American soldiers, who seem to labor under the delusion that the native troops are to be disdained. The lessons of the past should dispossess their minds of purblind theories regarding the enemy's craft and prowess, and the early experience of the British in South Africa may be studied to advantage. Why not end the miserable business by sending 100,000, or 200,000 if necessary, determined troops to the island, that the possessions which, by every right of conquest and treaty cession, are now American may be forcibly and systematically embodied in our territory. Such a course would certainly be more humane in the end and show the world that, having entered upon an era of territorial aggrandisement, the United States is perfectly capable of dealing with its new problems with vigor and intelligence.

Insane? Is it not about time to hear from our esoteric brother George Francis Train? The world seems dull without some sign of his existence, however paltry. We miss his fervid monologues and fierce denunciations. Since the World's Fair he seems to have lapsed into peaceful oblivion and the reverberation of his thunders is all that remains to us to recall his memory. Hush! If one madman can be silent, let well enough alone. Others will afflict us soon enough. "Let us have peace!"

Yet there is a very touching side to this man's character—his love of children. To have seen him seated bare-headed in Madison Square on a midsummer's day surrounded by troops of happy little ones, is something to remember. The world's fate trembles in the balance, the universe itself is merging in chaos, and it is his alone to save—do not the journals strewn at his feet call upon him to deliver mankind? But to the children peanuts and popcorn are the only vital issues. Earth may be rent asunder; it matters little so that their genial benefactor remain, for they have no home save in his generous heart. The scene forms a curious psychological study—perhaps the sweetest and tenderest feature of Gotham life.

**The Real
Uitlander.**

A work recently issued, "The War in South Africa," by J. A. Hobson, (Macmillan) throws new light upon the remote causes of the conflict. In a word the writer con-

tends that an anti-Jewish crusade is the fundamental motive of the struggle. The writer asserts that Boer distrust of the "Uitlanders" lies in the fact that a large number them—15,000 in Johannesburg alone—are Jews, chiefly Russians and Germans, who have become naturalized British subjects by a short residence in England.

All the great mining, financial, liquor and gambling interests are in their hands, and their methods and management have been such as would inevitably alienate the sympathies of the sturdy and Puritanical founder of the republic. It appears, therefore, that the hostility of the Boers is only another manifestation of the widespread anti-Semitic agitation which for centuries has convulsed the Christian world, and in recent years has led to drastic measures of deportation in Russia and indirect ostracism elsewhere, especially in France.

This state of affairs, this race antagonism, according to the writer largely explains the attitude of Continental nations towards the struggling republics. Among the ruling classes there is nothing but sympathy for them; whereas in England, anti-Semitism never having been pronounced, the shortcomings and ulterior designs of the "Uitlanders" are regarded with leniency, not to say with mercenary favor. No one approves of fanaticism; yet there seems to be a chapter in Boer history, now written, which demands careful study and should modify our impressions of the difficulties under which these Dutch patriots have labored.

Every now and then bursts forth upon a trembling literary world a spasm of the superlative. Some sybil propounds the question "Who are the world's best five, ten, fifteen, twenty, and so on, best authors?" *Tot homines tot sententiae*, one would rationally reply. Yet this does not satisfy the inquisitors. They demand a categorical answer—as illogical as the formulated subject of debate in the colored society. "Which is mightier the pen or the sword?" Affirmative Messrs.—,—; negative Messrs.—,—. This is all very harrowing to those who have staked their happiness upon fame. To find the reward of genius—for they, of course, all share the gift—to be only oblivion! Pehhaps the slyest commentary on the exclusive literary mania was that of Mark Twain, who, upon being requested to name the twelve books he liked best, addressed to the correspondent a list of his own most remunerative works.

Ideal
Royalty.

The unhappy de-thronement and broker-hearted decline of Dom Pedro II has left to the world but one interesting monarch, King Oscar of Sweden and Norway. We are never tired of reading of him—of his remarkable literary and musical gifts, his artistic talents, his ideal domestic life, and the charm of his

unaffected manners. No wonder he is endeared to his people and that all classes regard his kingly character and conjugal devotion with national pride. His scholarly tastes never seem to render him remote from popular feeling, and the anecdotes illustrative of his simplicity of demeanor and goodness of heart towards the humblest subject are innumerable. Had Dom Pedro been reared in the freedom of the Reformation, in place of servile deference to Jesuitism, he too might have lived to wear a crown of happy years like Oscar.

Once was the Swedish monarch sorely tried—when his parental heart was rent sorely by the morganatic marriage of Prince Oscar to his mother's maid of honor. He had stoutly opposed the union, which necessarily involved his favorite son's abdication of all rights to the throne. With chivalrous devotion, however, the king finally yielded to the entreaties of Queen Sophie, and the nuptials were duly celebrated. How perfectly the hopes of that true love alliance have been fulfilled is attested by twelve years of the happiest wedded life. The Count and Countess Wisborg, as they are known, are nobly devoted to charitable work; their home life is enlivened by the presence of several beautiful children, and a wholesome rebuke administered to royal customs and the cruelty of constitutional and political bonds and their too frequent misery.

THE DIVERSIFIED FARM.

FACTS ABOUT COWS.

By J. LAWSON SMITH.

The Spokane (Wash.) *Daily Chronicle* recently published the following excellent article relative to cows and milking, written by J. Lawson Smith, of the Hazelwood Ranch:

Cows are raised for either of two purposes—to produce beef or to give milk. The different kinds of cows probably came originally from wild stock which has been changed and developed by various kinds of care, of feeding, of surroundings and by cross-breeding. These changes took place long ago, and so though we have today a great many sorts of cows which are known to experts, they may be divided roughly into the two main classes—beef cows and dairy cows.

The beef cows are heavy, large, square framed animals, which turn nearly all the food they eat into meat. They weigh from 1000 pounds to 2000 pounds, and some even run over that weight. The principal kinds of beef cattle are the Shorthorns, a red and white variety; the Herefords, which have a white face; the Polled Angus, a short haired, black, hornless animal, and the Galloways, a long haired, hornless, black sort. The Shorthorns and Herefords come from England and the Polled Angus and Galloways from Scotland.

Some kinds of beef cows are better fitted for looking out for themselves than others, and so we find special breeds in the parts of the world like Montana, where large herds are kept and are obliged to get along as best they can during most of the year. It pays to keep good, well-bred animals, as they will fatten better than what we call the scrub cattle. The highest price ever paid for a cow was given

several years ago in New York, when \$40,000 was paid for one cow. Unfortunately for the buyer the cow only lived a year after this fancy price was paid for her.

The dairy cows are smaller animals than the beef cows. They often look thin and almost scrawny, as the food they eat goes principally to produce milk and not meat. They are usually more nervous, more excitable and crosser than the beef cows.

The principal breeds of dairy cows are as follows: The Jerseys, the Guernseys, the Alderneys. All these breeds are a sort of fawn color, or fawn-color-and-black, or some modification of these colors. The Channel islands, between France and England, are where these cows originally came from. The Holstein, a black-and-white cow, came from Holland, and the Ayrshire, a red-and-white dairy cow, came from Scotland.

As the dairy cow is nervous and excitable, it is necessary that she be treated well, if she is expected to do well and give rich milk and plenty of it. It has been proven time and again that if a cow is chased by dogs and worried by boys she will not give as much milk as if she were in some quiet pasture. It is a curious fact that milk from a cow that has been worried will sour quicker than that from one which has not. So dairy cows ought to have quiet quarters where they are not likely to be disturbed.

Cows must also be milked regularly. A cow that is milked so will give more and better milk than one which is only milked when the owner feels like doing it or gets time to attend to it.

It is necessary that the barns should be warm, clean and comfortable. You can not expect a cow to be healthy, nor her

milk to be wholesome, if she is kept in dirty close quarters. The cow should always have a supply of clean, fresh water, from which she can drink. It has been proven by scientific investigation that cows which drink from stagnant pools or from dirty ditches, or polluted wells, may take in disease germs which afterwards go into the milk, and so produce sickness in the people who are thoughtless enough to drink such milk. It is also very important that the cow herself is a healthy animal. One should be careful to get milk from cows which are strong, healthy and carefully treated animals. The food is a very important point. To the beef cow we feed corn, oats and hay; to the dairy cow we feed bran, roots, oats and hay. A very good ration for a dairy cow is twenty pounds of carrots, ten pounds of bran and shorts, and some oats or alfalfa hay. This is in the season when she can not get at pasture. When she can be turned out to eat grass she need only have a little bran and a little hay. A cow eats hay with pleasure to herself and profit to her owner every day in the year. It is very important that nothing like slops or swill or refuse from breweries or such food be given cows. If turnips are fed to a cow one hour before she is milked, the milk will taste of turnips, so quickly does milk become contaminated. It is easy to see that slops are decayed and rotten vegetable matter will also make milk both unwholesome and unpleasant to the taste. For a like reason cows should not be allowed to feed on weeds, as they are often obliged to do where no regular pasture is provided for them and they are allowed to roam around and shift for themselves, drinking from ditches and eating anything that looks green.

It pays to keep good cows and to treat them well. The ordinary scrub cow will give from 125 to 150 pounds of butter a year. A well-bred, carefully handled cow will give 300 pounds of butter a year, and he is known which gave 1000 pounds of

butter in a year. Nor is breeding every thing. An ordinary herd which gave 150 pounds of butter per head was turned over to an expert and by giving these same animals the proper food he got them up to the point where they produced 300 pounds per head during the year. If you want to get good results from any cow you must house her well, keep her warm, keep her clean, feed her clean, wholesome food, and give her plenty of pure, fresh water to drink.

SUGAR BEET CULTURE.

By GEO. H. HUTCHINS.

The Pecos Valley Beet Sugar Company has decided to plant all of their lands in alfalfa and are urging the farmers to do the same. A large acreage is being put into alfalfa. This step is taken in order to put the lands of this valley in better condition for the culture of beets. It is a well known fact that alfalfa in this valley is the fertilizer. The manager thought it prudent to advise this in order to have the land in first-class condition for the cultivation of beets in 1901. In the meantime steps will be taken to get a colony of good beet growers, mostly Germans, to raise the beets for the factory. They are convinced that this course is the proper one to give the factory a full supply of beets. We are as confident as ever that both the soil and the climatic conditions in this valley are exceedingly favorable for beet culture, but realize that proper fertilization and good beet growers are necessary here as well as in any district where beets are being raised. It has been thoroughly demonstrated that the ploughing under of a good growth of alfalfa is the best policy, and the one that is needed particularly in this valley. The Company feel assured that the policy adopted by them will insure a large crop for 1901, one that will give sufficient beets to work the factory up to its full capacity. The plant itself has been put in absolutely first-class condition. With the recent improvements made in the same, though not a large plant, it is as

quite a model one as any of the new factories recently constructed; and by the fact that one year will be omitted, by no means do the Company desire to have the impression go out that they have suspended business. The financial standing of the Company is in first-class condition. All who are familiar with the standing of the owners of the factory are aware that they are not only fully able to carry through the enterprise but one ten times its magnitude.

THE CANKER WORM.

The so called "measuring worms" that are now stripping the leaves from apple and elm in many parts of Ohio are canker worms. Had they been taken in hand at their first appearance they might have been destroyed by spraying the trees with a mixture of from 4 to 6 ounces of Paris green with 4 to 6 pounds of slaked lime in 50 gallons of water, the lime being reduced to a milk of lime and strained through a fine wire scive, so as not to obstruct the nozzle of the spray pump; but when the canker worm has attained nearly its full growth it is not so easily killed and Paris green is not effective. At this stage, however, it may be destroyed by spraying with Swift's Arsenate of lead, Bowker's Arsenic lead or Bowker's Disparene, using three ounces of the preparation to fifty gallons of water. These mixtures will not injure the foliage; when fully prepared they have a milky white appearance, and being nearly as thin as water they spray readily, and they adhere for several weeks, thereby avoiding the necessity for more than a single application. They may be obtained of Swift & Co., or Bowker Chemical Co., both of Boston, Mass. These are merely proprietary forms of the standard chemical compound, arsenate of lead.

Recent experiments carried out by the Entomological Department of the Ohio Agricultural Experiment Station have shown that within three days after application of these mixtures to trees seriously

overrun by canker worms, fully ninety per cent of the worms were killed.

If treatment is neglected the worms will increase in numbers and by another season will probably kill the trees.

A complete illustrated description of the canker worm, with its life history, is given in Bulletin 68 of the Ohio Experiment Station.

ON ADVERTISING.

The business may be old, the article may be well established, but there is no reason why the person who reads an advertisement for the first time should heed it. To him the article is new; the business is unknown; the advertiser a stranger.

By repeating the advertisement time after time, changing the points to make it interesting reading and using different display to attract attention, you ought in time to be able to convince a reasonable number of these people that your goods and prices are right.

The first few advertisements may convince some people. After that each advertisement will convince more people, for it carries the influence of its predecessors.

—*The Citrograph.*

MOVED THEIR OFFICES.

The Lidgerwood Manufacturing Company, manufacturers of the Lidgerwood standard hoisting engines, and Cableways, have removed their Cleveland office, Messrs. Kaltenbach & Griess sales agents, from 26 South Water street to the Williamson Building.

WANTED—Place as foreman or superintendent on ranch or canal. Fifteen years' experience. Best possible recommendation. Address "Irrigation" care of the Age. 3t-6-1900.

PULSE OF THE IRRIGATION INDUSTRY.

THE CANALS OF EGYPT.

GUY E. MITCHELL.

The great system of canals which affords fertility to Egypt has been developed at an expense of fearful suffering and labor on the part of its constructors. Many of the largest of the canals have been built by unpaid labor, or what is known as the *corvee*. When Mehemet Ali, at the beginning of the century began the canals which today cut up the country, *corvees* of more than 300,000 men were seen, drafted from every part of Egypt, digging the Mahmoudieh canal. At that time the labor demanded annually by this despotic power corresponded to the employment of 450,000 laborers for four months. The poor *jellahs* who were thus driven to onerous labors, usually received thereby no benefit to their own lands. The methods employed in excavating were the most primitive. The only tools used were the *fass*, a kind of large hoe and the *couffin*, a basket woven from the stems of palms. The *corvee* was usually divided into diggers and carriers and children frequently constituted the latter. The *corvee* was directed by none too gentle overseers. In the digging of Egypt's canals, the lash has played an important part.

UNDER NATIONAL CONTROL.

In all the great irrigation systems of ancient times, history records that a central head made responsible to it each individual irrigator or section, and so the rules and laws under which agriculture was performed were framed in such a manner as to insure the greatest good to the largest number; thus a marvelously perfect agricultural development arose under such systems, and serious conflict of rights was unknown.

EASTERN CO-OPERATION.

The manufacturers of the country, especially the East, now that their attention has been called to the subject, are becoming heartily in favor of the plan of federal aid to irrigation, because of the promise that the development and population of these now arid lands means the establishment of a great home market for their goods. Their friendliness and aid will be found not inconsiderable.

IRRIGATION SURVEYS.

A reliable and systematic survey of the water resources of the arid region which is subject to reclamation through the preservation of the waters that now run to waste, is highly important. Congress should authorize and appropriate liberally for the carrying forward of such work.

AN ACCESSORY INDUSTRY.

In Colorado the new art of irrigation sprang up as an accessory industry to mining for gold and silver. The great desire of many mining sections for irrigation works is that products may be raised for the man who does the mining and the mule which hauls the ore, and the cost of their living cheapened.

A BUSY RIVER.

The *Scientific American* remarks upon the multiple duties of the Santa Ana river in California. This stream, which flows out of the San Bernardino mountains, is now used to transmit power to Los Angeles some eighty-two miles distant. Nine thousand horse power is consumed in propelling machinery, moving street cars and in heating and illuminating the buildings

in Los Angeles, besides furnishing power for several nearby villages. After being used to generate power, the mountain stream is gathered into a conduit and led farther down to irrigate the hundreds of orchards and groves in the San Bernardino valley.

NATIONAL IRRIGATION.

Throughout the entire arid region the plan to construct storage reservoirs, to be under government control, to be used for the storage of flood-waters for irrigation is almost universally endorsed. There is no more important question now before western Senators and Representatives than the reclamation of the arid west through this means, nor no project to which they could devote themselves with more profit and upon which they could combine every force with more certain and general support from their varied constituencies. Will these constituencies demand such action on the part of every representative sent to the national Congress? The question after all always rests with the man who casts the vote, if he will but keep the fact in mind.

IRRIGATION PARAGRAPHS.

The stampede to enter Oklahoma public lands, upon their opening to settlement, is a matter of recent history. The government has between 70,000,000 and 100,000,000 acres of arid public lands which can be reclaimed through irrigation and made more productive than the lands of Oklahoma; and the government could sell its land to settlers just as fast as it reclaimed it.—From the National Irri. Assn.

Such important works as storage reservoirs should be built as internal improvements and permanently maintained by the State or Federal government. This would give absolute assurance of safety to communities farming the lands below them. Without such a guarantee of stability, the inherent fear of the settler in reservoir systems cannot be overcome, for the irrigator is always at the mercy of the reservoir.

It is well said, why should the arid West not have its share of the great sums of money which are being expended by the national government for internal improvements? What good reason can be advanced why the western states and territories should continue to contribute to building such improvements for the East and the South unless the West is given a fair proportion of expenditures for such purposes? Eastern States whether seaboard or interior, get their proportion of river and harbor appropriations, but the arid states of the West get nothing, even while they contribute their share to these expenses.

Crops evaporate 300 times their own weight of growth annually. To allow the growth of weeds in an irrigated field means an immense loss of the precious fluid so necessary to plant life. While the man causing the waste gets all the water he needs, still he deprives the irrigation works of a portion of its capacity thereby cutting off some one or causing an increase in expense and perhaps a resulting loss to himself in the end.

WITH OUR EXCHANGES.

PROF. KING'S NEW BOOK.

We cannot have too much good literature on any subject and it is therefore with pleasure we review the neat little volume on "Irrigation and Drainage," by Prof. F. H. King, of the University of Wisconsin. Prof. King has wisely departed from the example of many writers on irrigation and has presented in a broad way the fundamental principles underlying the methods of irrigation and drainage, without taking up the legal or sociological side and without entering into a discussion of engineering problems and possibilities which, while very valuable to those intimately connected with these professions are of but slight interest to the ordinary reader, who desires to get a general idea of irrigation—its history and present standing. To such Prof. King's book is a valuable aid. Sixty-five pages are devoted to an interesting introduction of the subject proper, and the remaining 435 pages are divided into two parts, the first dealing with "Irrigation Culture," tracing the history of irrigation from its infancy, thousands of years ago, to the present time, and dealing with the conditions which make it imperative, the measurement of water, the character of the water used, methods of application, etc. The second part of the book, "Farm Drainage," discusses the principles of drainage and the practical details of underdraining.

The book is well bound, nicely printed on a good quality of paper, well illustrated, and in short is a practical and entertaining volume which we unhesitatingly recommend to any one desirous of obtaining a clear idea of irrigation and drainage. It is published by The Macmillan Co., 66 Fifth Avenue, New York City. Price \$1.50.

SCRIBNER'S.

Scribner's Magazine for June opens with an article appropriate to the season of national conventions. It is entitled "How a President Is Elected," and gives a view behind the scenes of the way in which the machinery of a Presidential election is put in motion. It begins with a meeting of the National Committee which decides on the place where the convention is to be held, and terminates with the last night of the campaign when the successful chairman telephones from headquarters, "I congratulate you, Mr. President." The author, A. Maurice Low, is a Washington correspondent who has had every facility to see the workings of a campaign. A brilliant series of pictures fully illustrate the narrative. Another article of national interest is "Are the Philippines Worth Having?" by George F. Becker, a United States geologist who recently spent more than a year in the islands. This article is a very clear exposition of the mineral, industrial, and agricultural possibilities of the islands, with an account of their climate and the characteristics of the people. It contains more valuable condensed information about the islands than has heretofore appeared, and is fully illustrated from recent photographs.

THE FORUM.

Among the thirteen articles in the June *Forum*, there are at least seven which will be widely quoted and discussed: Consul-General Ho Yow's vigorous criticism of "The Attitude of the United States Towards the Chinese;" "Do We Owe Independence to the Filipinos?" by the Hon. Charles Denby; Sir Charles W. Dilke's paper on "U. K., U. S., and the Ship Canal;" "The Present Position of the

Irish Question," by the man best qualified to speak, J. E. Redmond, M. P.; Edward Emory Hill's essay on "Teaching in High Schools as a Life Occupation for Man;" Professor Hall's arraignment of "College Philosophy;" and the Hon. John Charlton's paper on "American and Canadian Trade Relations." Hon. Charles Denby has a vigorous answer to those who urge the granting of independence to the Filipinos. "Do we owe independence to the Filipinos?" he asks, and then proceeds to show from despatches and from the history of the Philippine campaign that no reasonable ground exists for supposing that Aguinaldo ever looked on the United States as an ally, and that therefore in conquering the islands from Spain Americans are in nowise pledged to obtain the consent of the Filipinos before asserting sovereignty over them. He reinforces the argument by historical parallels, and has made an exceedingly effective argument for expansion.

M'CLURE'S MAGAZINE.

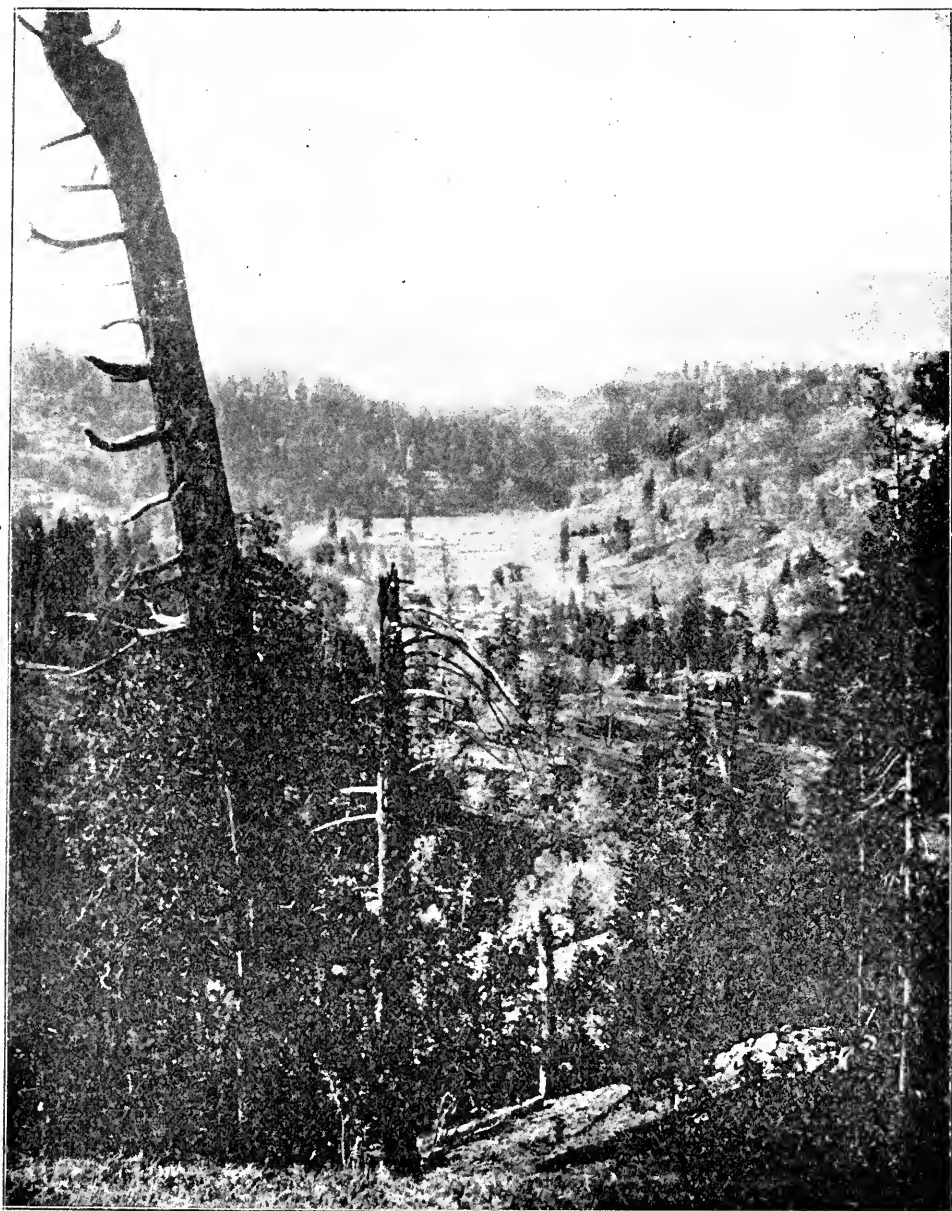
The June number of McClure's is particularly strong and varied in its contents, both as regards fiction and special articles. President Kruger of the South African republic is portrayed in an acute character-study by F. Edmund Garrett, who has had the advantage of personal contact with the remarkable Boer leader, and is thoroughly familiar with his past career and with the political history of the Boers. Excellent portraits of Kruger and his wife are included. J. Lincoln Steff-

ens, of the New York *Commercial Advertiser*, relates some striking "incidents of conflict" between Governor Roosevelt and the party leaders, and considers whether his first term as governor has turned out to be a successful experiment. In addition to this there are several good short stories and a thrilling naval story of the Japanese-Chinese war by Adachi Kinonosuke, a Japanese writer.

THE LADIES' HOME JOURNAL.

Rudyard Kipling, Dr. S. Weir Mitchell, Ian Maclaren, Cyrus Townsend Brady, Julia Magruder and Mrs. Burton Kingsland are among the contributors to the June Ladies' Home Journal. Some of its notable features are: "The Passion Play This Year," "The Richest Woman in America" (Hetty Green), "How Some Familiar Things Came to Be," and "The Masterpiece of Mary, Queen of Scots," picturing an apron worked by that unfortunate sovereign while in prison awaiting the executioner. Dr. S. Weir Mitchell's article, "When the College is Hurtful to a Girl," is sure of a wide reading; so are Ian Maclaren's views on "The Minister and His Vacation." Mr. Kipling's "Just So" story humorously accounts for the kangaroo's long hind legs, and is the best of his series. The fiction features of the June Journal are the opening chapters of Julia Magruder's new serial, "The Voice in the Choir," and "The Autobiography of a Girl." By The Curtis Publishing Company, Philadelphia. One dollar a year; ten cents a copy.





RESERVOIR SITE AT HOUSTON, SOUTHERN CALIFORNIA.

THE IRRIGATION AGE.

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CHICAGO, JULY, 1900.

NO. 10.

THE PROGRESS OF WESTERN AMERICA.

Politics in Irrigation.

The question of the reclamation of the arid lands by the government has become so vital that many of the state political platforms in the arid region have declared in favor of such a policy, while at Philadelphia the national platform of the republicans contained the following plank. "We recommend adequate national legislation to reclaim the arid lands of the United States, reserving control of the distribution of water for irrigation to the respective states and territories."

While it may argue well for a cause that it is considered of sufficient national importance to declare for it in the platform of a great political party, the question itself is not one which should be dragged into politics. The national irrigation movement is one which can be and is being combined upon all parties. It is a question as vitally interesting to the western democrat as to his republican or populist neighbor, and no matter what differences of opinion may be held upon other issues, all can agree upon the proposition that the reclamation of the arid lands of the west is a subject for consideration and solution by congress. It is to be hoped that the movement looking to the building of storage reservoirs by the government and the conquest of Arid America will stand upon a strictly non-partisan basis.

Power of the Press.

We run a great risk in venturing to use such a hoary chestnut, worn threadbare by country newspaper editorials, as "keeping everlastingly at it brings success," but nothing seems to so completely express our opinion regarding the irrigation question. There must be vigorous agitation on the part of those interested in irrigation development, and it must be not only vigorous but continuous. Spasmodic efforts will accomplish but little. What is needed is concerted and organized action by western papers and people to bring the necessity of national aid for irrigation to the attention of congress. In this connection Guy E. Mitchell, secretary of the National Irrigation Association, says:

"The situation in congress is such that if a united demand is made by the West for irrigation appropriations it cannot be refused. There is no question of this fact. The trouble has been in the past that the West has not been thoroughly united upon this proposition. The West holds the power in congress if it will stand unitedly and exercise it. And if western newspapers—the city papers, the country papers, the dailies and the weeklies—will print arguments and demands that congress shall consider this great question of irrigation as a national question, not print one article on the subject, but keep continually driving at the idea

that the question is the one most vital thing to the entire West, the one question which if acknowledged by congress will change millions of acres of waste and barren places into smiling fertility and wealth, then it will not take western senators and congressmen long to see that this is a question upon which they must unite to a man, and with a united western delegation the battle is won. This is the power which the western press possesses."

**Irrigation's
Future.**

The Rise and Future of Irrigation in the United States, is the title of an interesting article from the pen of Prof. Elwood Mead, in the Agricultural Yearbook, just issued.

The earliest pathway of civilization on the American continent, says Prof. Mead, led along the banks of the streams. In various parts of the Southwest, notably in the Salt River Valley of Arizona, in northern New Mexico, and along the southern borders of Colorado and Utah are well-defined remains of irrigation works which have outlived by many centuries the civilization to which they belonged. In at least one instance the bank of an ancient canal has been utilized as a part of modern works.

Riding up the valley of the Rio Grande, in the first half of the sixteenth century, Spanish explorers found in the midst of arid surroundings beds of beautiful roses, "not unlike those in the garden of Castile," as they noted in their diaries. They also found Pueblo Indians irrigating the thirsty soil, as their forefathers had done for centuries before them and as their descendants are still doing to-day. In this valley and along the tributary streams, and at other places in the desert wastes of the Southwest, Spanish settlements sprung up and maintained themselves by means of these life-giving waters. The ditches at Los Cruces, N. M., have an unbroken record of three hundred years of service, the history of which was written in the banks of the canals and in the fields irrigated. This is due to the sediment with which the waters of the Rio Grande are

laden. Year after year this has slowly added layer on layer to the sides and bottoms of these ditches, until from being channels cut below the surface of the soil they are now raised two or three feet above. It is here that one yet can find agriculture almost as primitive as that of the days of Pharaoh, where grain is reaped with the sickle and thrashed by the tramping of goats.

**American
Trade
with China.**

Tien Tsin, Newchwang and Chefoo, which are mentioned as the points of greatest activity and danger, aside from Peking the capital, in the present trouble in China, are especially important in relation to American trade in that country. They are in the northern part of the country and it is in them that American goods seem to be in the greatest favor. The growth of our trade in that section is described somewhat in detail by a recent publication of the treasury bureau of statistics, which describes Tien Tsin as the most important city of northern China. The commissioner of customs, Mr. Alfred Hhippsley, writing in 1898 of the 1897 trade, calls attention to the importance of American trade at that port, and adds that it is the only trade which increased in 1898 over that of 1897, saying that American drills, American sheetings and American kerosene had especially increased in imports during the year, while the cotton goods from other countries were showing a decrease.

Consul Reade, of the United States, says that Tien Tsin ranks in commerce next to Shanghai and Canton, and in a report to the state department says: "Tien Tsin, by its geographical position, is the point of accumulation and distribution of all merchandise destined for the United States or intended for consumption in the northern provinces of China. Direct shipments from the United States to Tien Tsin are impracticable, it being in all cases more advantageous to ship to Shanghai or Hongkong and then transship to

the steamers of light draft that ply between those ports and Tien Tsin."

Chefoo is considered an extremely important treaty port by reason of the constant and growing demand for American goods at that point. Its importance to American interests is pictured by Consul Fowler in a report to the state department in which he says: "It is satisfactory to see that during the six months under review the following American goods show a gain over the same period of 1896: drills, 13,214 pieces; sheetings, 111,040 pieces; kerosene oil, 942,050 gallons.

Newchwang, while a comparatively small city of about 60,000 population, is of especial importance to the United States as a treaty port. American cottons, oils, and American Manufactures generally are in great demand in the province of Shingking, and goods reach the interior by the Muren river, which is navigable nearly to the northern border of the province.

Some of the California newspapers are advocating the division of the state into two states. The sentiment seems strongest among the papers of Southern California, the *Santa Ana Standard* being a particularly strong partisan. The fact that Santa Ana is spoken of as the capital of the southern state, should the division be made, may have something to do with it. Upon this subject the *Ontaria (Cal.) Record* says editorially: "Nature has made a division between the northern and southern ends of this state, and man would do well to make his dividing lines conform to those laid down by nature. The people of Siskiyou county have more interests in common with the people of Maine than they have with those of San Diego, and there is no reason for having the tremendous area that is within California's present border confined to a single state.

Southern California, with its orange groves, its mines, its oil wells and its thousands of other industries, is large

enough, rich enough and brainy enough to be given statehood, and its people can be better served by having their interests looked after by the state of Southern California than they ever can hope to be served under present conditions."

Irrigation and Labor.

In connection with the question of government irrigation of arid lands, which is now beginning to attract so much attention throughout the West, a report was made about ten years ago by a committee on arid lands of the California State Board of Trade, which is of special interest just now. In this report, the committee draws attention to the fact that most of that part of the United States west of the one hundredth meridian either requires, or would be benefited by, irrigation. Without it, crops are not certain. Thus, irrigation not only becomes a question of national interest, but a question of national necessity. The vast territory in the United States requiring irrigation covers over one-third of the inhabitable part of our country, and if the national government can wisely expend millions of dollars in keeping the water off from a portion of the inhabited part of the country, can it not, with equal wisdom, expend wisely money to put water upon that portion of land which most needs it?

As showing the large area of the United States where irrigation would be advantageous, and where it is most necessary, the following figures are given:

Area of	Acres.	Square miles.
California.....	100,992,640	157,801
Oregon.....	60,975,360	92,274
Utah.....	54,380,800	84,970
Washington.....	44,769,160	69,994
New Mexico.....	77,568,640	121,201
Nevada.....	71,737,600	112,090
Arizona.....	72,906,240	150,932
Colorado.....	66,880,000	104,500
Wyoming.....	62,645,120	97,883
Idaho.....	55,228,160	86,290
Montana.....	92,016,640	143,776

To this may be added the northern and western part of Texas, with an area of about one hundred thousand square miles.

The population of our country is in-

creasing at a remarkable ratio. As the population increases, the opportunity for young and ambitious men who live in the older States of the Union to gain an honest livelihood, is every year becoming less. Labor is necessarily becoming cheaper. If no more unoccupied lands are made fit for use, landholding will soon be the privilege of the rich, and tenantry the only hope of the poor.

Another point that should be regarded in this connection is the increased stability lent to a government where many of the citizens are land-owners. The irrigation of these arid lands would do much to promote the welfare of the entire nation, by taking from the unemployed classes and adding to the class of land-owners.

The following paragraph, from the report of the committee, might have been written today:

“Before the republic should seek to acquire new territory, it should wisely utilize the territory it now has, and it is most respectfully submitted that a national system of irrigation, directed by wise and uniform laws, controlling the

rights of water and its uses, will be of infinite advantage to the whole American people, and especially so if carried out under the wise supervision of the national government and engineered by its scientific and experienced men. When this is accomplished, there will be ample room in the unsettled portion of the United States to find homes for the millions of people who are to come after us.”

There is another feature to be considered in connection with this question. This is the large opening for labor which the construction of great irrigation works would make. The problem of the unemployed in this country is constantly becoming a more serious one. It is, just now, temporarily obscured by the war, but will certainly come to the front again, as soon as the war is over. The construction of these irrigation works would be more than a temporary remedy for the evil. It would, first, furnish employment to a large number of men, and then create conditions which would enable them to get homes on the land, and become permanently self-sustaining.

ONE HUNDRED THOUSAND APPROPRIATED BY CONGRESS.

FRIENDS OF IRRIGATION MADE A STRONG FIGHT IN CONGRESS.

BY GUY E. MITCHELL.

Always alert in the interests of the arid West, Senator Carter made an able defense of the item in the sundry civil bill of \$250,000 for irrigation surveys and investigation by the geological survey, during the closing days of Congress. Last year's appropriation for this work was \$50,000 and when it was proposed to increase this amount this year, first to \$100,000 and then to \$250,000, it of course raised a storm of objections from senators who fail to comprehend the vital importance of irrigation to the great arid region. After strong urging by western senators, the \$250,000 was voted by the senate, but unfortunately this was cut down by the house to the original increase proposed of \$100,000, which amount will be extended by the survey, during the coming year, on this much needed work. The action of the house, however, shows the necessity for the West to stand together, and present one solid front and be bold and aggressive in its demands if it is desired to get rightful recognition from eastern congressmen on these questions of supreme import to the arid region.

"The question is," said Senator Carter, in the course of his remarks, "does this appropriation go the acquisition of information on some subject of consequence to the people? Let us see.

A THOUSAND MILLION ACRES.

"There are seventeen states and territories in the arid and semi-arid region of the United States. Those seventeen states and territories today have a population of about three million and a half. In those states and territories there are 992,617,600 acres of land. Of that acreage but 30 per cent. has passed into private ownership; the government of the United States is the owner of 70 per cent. The extent to which these lands can be reclaimed is dependent upon the water supply. The manner of reclamation is dependent upon a knowledge of the volume of water available. No intelligent system of development can be prosecuted until we know the water available for irrigation purposes. The facts are of supreme importance to the people living now and to live hereafter on two-fifths of the American continent.

SIXTY-FIVE MILLION DOLLARS.

"Mr. President, while we are voting here \$65,000,000 for various

purposes, all of them national, all of them proper, raising certain appropriations to considerable limits, making additions for river and harbor appropriations in the aggregate of over \$12,000,000 in the bill, and senators from the arid regions acquiesce in the appropriations because they are national and beneficial, does it seem the right comprehension of a great situation to challenge an item in the bill intended to secure needed and absolutely necessary information in order to deal with problems involving the very life of the country itself? We have reached the point in that arid region where we cannot now, without the investment of very large capital, invite any large increase of immigrants to settle upon our soil.

“Hundreds of people are passing each and every day upon loaded trains over as fertile land as ever the sun shone upon, going over the Rocky Mountains and off to the humid regions of the Pacific coast. Why? Because in the state of Montana where we have 146,000 square miles, people have taken out nearly all of the water and reclaimed nearly all of the land that individual effort is capable of reclaiming.

NEED OF OFFICIAL SURVEYS.

“There are instances in California where large enterprises went in and constructed heavy canals and subsequently found that the water supply was wholly inadequate to supply the canal. This has been discouraging to investment in this line. What we need with reference to this matter is specific, authoritative, substantial information, vouched for by the public records of the United States.

“It is said, let individuals do it. According to that suggestion the farmer living out on the Yellowstone is to build a gauge for the benefit of humanity, and is to determine the flow of water that runs down that stream in twelve months. Why not, on the same principle, let sailors survey the coasts and establish light-houses for their own guidance? To suggest that is to declare that nothing shall be done at all.

“Are the new struggling states, wherein the government of the United States owns 70 per cent. of the soil, and is the great land-owner of the country, to be charged with the expense of acquiring information which is of equal value to Missouri, Iowa, Nebraska, and all the states below? I think not. It is a government enterprise, looking to the development of government property, looking to the creation of conditions which will develop a superb population where waste places now exist.”

EASTERN OPPOSITION.

Senator Turner, of Washington, who strongly favored the increase struck a responsive chord, when he asserted that some eastern senators were prone to antagonize measures because apparently they were intended to benefit the West.

“I consider the amendment,” he said, “as exceedingly important.

to the arid region. But I notice that nothing is ever offered in this body in the interests of that section that some senator from the eastern seaboard, whose section has been amply provided for, does not discover that the work could better be done by somebody else than the particular person to whom it is proposed to be entrusted, or he discovers that we are going into a reckless appropriation which ought to be suddenly stopped at a point where the interests of the West require consideration."

THE SOUTH LENDS A HAND.

The gauging of streams in the South Atlantic and other southern states by the government may not seem a matter of very great importance or interest to the people of the arid region of the West, nevertheless it is likely to be a means of helping them materially. For years the West has had to make its fight for irrigation surveys alone, with but little assistance from senators or congressmen east of the humid line; it was a matter in which they had little interest, though some of them might recognize the justice of such appropriations. But during recent years the people of the South, whose manufacturing enterprises have been springing up like mushrooms in the night, have come to a realization of the importance and necessity of the work of the geological survey, especially in its measurements and gauging of streams available for power to be used in manufacturing plants.

And so now, when the question arose of allowing an increased appropriation to the geological survey for irrigation surveying and investigation in the semi-arid and arid West and for stream gauging in all the states, those who always take occasion to oppose such appropriations, suddenly found lined up against them southern senators who expressed their determination to co-operate with western representations in behalf of this needed government work. The vigorous words of Senator Butler, of North Carolina, in the United States senate in favor of this appropriation show that the manufacturing sections of the South highly appreciate the value of this work and that henceforth they will sympathetically join hands with the arid region to procure necessary national legislation along these lines.

AGRICULTURAL POSSIBILITIES OF THE TRANSVAAL.

VIEWS OF THE AUSTRALIAN.

The war in South Africa has made us all more or less familiar with the transvaal—the existing conditions, the names of its cities, its mineral resources, etc., of which the recent troubles but little was known. From the illustrated lectures the country appears to be rather desolate and offering but little encouragement to agricultural efforts. It was, therefore, quite a surprise to read the account of an Australian who is settled in the Transvaal, and find that the generally-accepted idea of the country is a mistaken one. Under the title of “The Agricultural and Pastoral Capabilities of the Transvaal” the writer says, in the *Australian Pastoralists’ Review*:

“The Transvaal as a country of untold mineral wealth is known to us all, but of its pastoral and agricultural capabilities but little has been written. Speaking geographically, the surface of the Transvaal is one continuous stretch of plateaus, the lowest of which is several thousand feet above sea level, and the following three divisions are usually made, viz:

“1. The high veld, comprising a district south of a line stretching from Lydenburg in the east to Middleburg, along the Witwatersrand to Litchenburg in the west. As the name implies, this division is the highest plateau in the Transvaal, and although situated further north than a semi-tropical country like Natal, its altitude makes the climate one of the most perfect and equable in the world.

“2. The bush veld includes all the country north of 25 deg. south latitude, in extent nearly half the Transvaal. The climate is in most parts sub-tropical, and in the summer months low fever is very prevalent.

“3. The middle veld embraces the country between the two other divisions. It is intersected with deep valleys, is very picturesque, and generally wooded and watered.

“The extent of pastoral and agricultural development at the present time is ridiculously small. For this we must blame the people, not the country. The Transvaal Boer will never kill himself with hard work, though some allowance may be made for the primitive ideas of the people, for the Boer’s notion of farming is to produce enough to satisfy his own immediate wants. Probably some excuse for his want of energy in the past may be found in the fact that, up till the advent of the gold fields, there was practically no local

market for his products. But today a town like Johannesburg, with its 125,000 whites and 250,000 blacks, calls in vain for the products of the soil; and yet the Boer still leaves his acres untilled, and refuses to keep pace with civilization. Situated as the city is in the heart of an admittedly fine agricultural country, the source of its food supply is unique. Flour for particularly the whole population of the Transvaal has to be imported, a small quantity from the Orange Free State, the rest from America and Australia. Until the Australian article became known, almost the whole of the butter consumed was tinned Danish, but now, with the exception of a small quantity from Cape Colony, the Australian frozen butter commands the market. Fresh milk in Johannesburg is an expensive luxury, and in most country towns is seldom sold, consequently there are large imports of the condensed article from Switzerland and Denmark. For an article of everyday diet, like eggs, the town derives its main supply from the island of Madeira, a lucrative trade in this being established some few years ago by Russian Jew egg venders. Hams and bacon are all imported. Vegetables, poultry and fruit are also imported in very large quantities from Cape Colony and Natal. The foregoing is very conclusive proof of the utter failure of the Transvaal Boer as a farmer. Generally speaking, he supplies the Johannesburg market with nothing, save store cattle, green fodder and mealies (maize). Even mealies, which is the staple food of the black races, and is also largely used for horse feed, has often to be imported in large quantities from America, although it can be grown in any part of the Transvaal.

“It may well be asked, then, what are the capabilities of the Transvaal as a pastoral and agricultural country? A sheep country the writer considers it never could be. In the Standerton district, in the southeast, sheep thrive fairly well, but in the greater portion of the high veld, and in almost the whole of the middle veld there are no grasses they will thrive on, and in most parts no shelter, in the shape of trees or shrub, from the sun's rays and the severe tropical thunderstorms. The bush veld, though largely covered with a good sweet grass, is climatically unsuited for sheep. As a cattle country, though, the Transvaal is well known. The high veld is undoubtedly well adapted for the rearing of cattle, which thrive on the coarser grasses that sheep will not touch. Still, a mob of fat cattle is a most unusual sight in the Transvaal, and it is chiefly owing to this reason that the Boers do not grow their cattle for consumption, but for transport, either for carting to market what little produce they grow, or for forwarding goods and material to mines or storekeepers.

“The agricultural possibilities of the country are immense. Practically, the whole of the high veld and the greater portion of the middle veld are capable of growing every description of cereal and vegetable product. Nothing impresses this more on one than a visit

to some of the few farms owned and worked by progressive English and colonial farmers. In the vicinity of Johannesburg—a district by no means so fertile as many other parts—several farms afford a splendid example of what can be done with the soil. You can see acres of vegetables, orchards of thriving fruit trees, patches of lucerne, and fields of wheat or mealies growing side by side in profusion. You go into the home paddock, as it were, and find sleek cows and fine horses, and near the house itself a big poultry yard full of fine birds. One needs only to turn to the reverse side of the picture—to the farm owned by the Boer—to learn why the Uitlander so often calls him a lazy good-for-nothing mortal. The writer of this has visited numerous Boer farms in the Transvaal at various times, and though occasionally he has met a semi-progressive farmer who has perhaps gone in for irrigation on a small scale, yet he can, without prejudice, state that, in his opinion, the poorest of poor Australian selectors does three or four times as much honest work in the day as the ordinary Boer. If it were possible to transfer the selector from his few acres to the Boer's farm and *vice versa*, where the Boer now lives a life of a nonproducer, the selector would have acres of tilled land and a mob of fat cattle, but the Boer placed on an Australian bush selection would starve in a week. A trip was taken by the writer in May of last year, through one of the most fertile parts of the Transvaal, the Lydenburg district, in the east. The journey was mostly done by coach, two days to the destination and two back. The country was very undulating, with long wide valleys. Not a sign of animal life was to be seen, save here and there a few cattle grazing near a farmhouse; not a sign of agriculture save a few patches mealies in low-lying spots. And yet water was flowing everywhere, the country side abounds in springs, the climatical conditions permit of the growth of any cereal, and the veld provides natural pasture for countless herds. The coach road at many points leads right past the doors of Boer homesteads, and no matter at what hour of the day the coach drew up at a farm, the head of the family, along with two or three big hulking sons, would stroll out of the house half asleep, where they had been passing many hours of daylight instead of being out on their land doing an honest day's work.

“In another part of the high veld, the Heidelberg district, south of the Rand gold fields, the writer, as secretary to a gold-mining syndicate, has leased two freehold farms—originally purchased from Boer farmers as gold-bearing—to a Boer at a rental of £20 each per annum. The extent of each farm is 2,500 acres, and one may judge of the extremely arduous labor of the Boer tenant when the writer states that he has more than once been applied to for a reduction of rent, the tenant professing his inability to make ends meet. His working of the farms consists in allowing several teams of bullocks

to graze, which he uses for transport services. There is only one conclusion to be arrived at after a criticism of Boer farming in the Transvaal, and that is, what a different country it would have been had it been peopled by English or colonial farmers. In Australia one sees and hears of thousands of struggling selectors working from morning till night, having often to fell huge gum trees before they possess a vacant spot to cultivate, whereas the thousands of Boers have no trees to fell, no bush fires to battle against, no drought to cope with, but own a land open and inviting that calls in vain for their labor. Yet the selector surmounts all these difficulties, and sends his products to supply the wants of the Boers' towns, whilst the Boer produces nothing and lives the life of a pauper.

"This article would not be complete without a reference to the capabilities of the bush veld and to the tobacco industry. The Zoutspanberg district, which includes the greater portion of the bush veld, and extends from the northern boundary down to the Murchison range, has a great future before it as a tea and coffee country. Several schemes have been mooted to start the industry on a large scale, although at the present time there are a few plantations already in existence. The firm of Lipton Limited is generally supposed to have the option over a large tract of country, with a view to planting. Tobacco is probably the best known of the Transvaal products of the soil. The home of tobacco-growing is on and about the Magaliesberg mountains, a range running due west from Pretoria. There are many other parts suitable for the growth of the tobacco plant, and the industry is a rapidly growing one, some of the more progressive farmers now going in for it. The Transvaal tobacco is smoked throughout the length and breadth of South Africa."

In connection with this article there was published an extract from a letter from a British soldier, who wrote as follows of the country through which he had passed:

"The farms we visited yesterday (near Donkerport) are the best I have seen. There's abundance of clear running water on them all. * * * There is fair grass, although one doesn't see much grass at any time. There is a great deal of small shrubs of different kinds, all of which are excellent feeding for stock, and along the river valley there are a good many trees, most of them acacias, and all thriving. The Rinderpest killed most of their cattle two years ago, so there are not many cattle about now, the few there are are purely bred. A good deal of dairying in the old primitive style is carried on. Odd farms have separators, but most of them do their work in the same old way. They charge about 1s. 6d. a bl. for butter, 1s. for a 4-lb. loaf of bread. Poultry seems to be very numerous, and are fairly reasonable considering the times."

WATER SUPPLY AND IRRIGATION IN PORTO RICO.

BY GUY E. MITCHELL.

Although the island of Porto Rico has a less area than the diminutive eastern state of Connecticut, yet its different sections are subject to as great a variation in rainfall as are the extremes of the United States, ranging from practical aridity to very heavy precipitation. As much as 140 inches of annual rainfall is reported in some parts of the island, while at places on the south coast three years have passed without rain. And it is on the south coast that opportunity is offered for irrigation; but the area available is very small. Some of the methods in use, however, are quite interesting.

"The soil on this land," said Mr. Herbert M. Wilson, the engineer of the geological survey, who has recently visited Porto Rico, "is in every case the best kind for irrigation. It is fairly deep and underlain with a porous limestone or coral which affords good drainage and probably insures safety from the danger of producing alkali. Much of it is already under cultivation.

"The perennial flow of the streams of this section is unusually abundant for a land requiring irrigation. Moreover, the flood discharges of these streams occur at frequent intervals during the year, but are especially well distributed throughout the summer.

"Are there any opportunities for the storage of water?"

"These frequent floods afford an abundant surplus for storage and the shapes of the smaller parting valleys and the lower canyons through which the rivers emerge from the mountains may be found opportunities for the construction of storage reservoirs at relatively small cost.

"The Spaniards, who in the past have been the principal landholders are thoroughly familiar with the requirements and processes of irrigation as practiced in Spain. Quick to appreciate the advantages of the artificial application of water, they have already constructed numerous ditches of moderate sizes, and much of the more valuable sugar land is cultivated exclusively by the aid of irrigation.

"Such work as I noticed," continued Mr. Wilson, "correspond in general type to those seen in Mexico, but because of the greater influence of European ideas in this island, the construction is of a more substantial character, and more nearly approaches that prevalent in Spain and Italy. The diversion works are in every instance of the crudest kind, simple wing dams of rocks and boulders thrown out into the beds of the streams to direct a portion of the waters into the heads

of the ditches. These are necessarily carried away by each flood requiring to be immediately replaced. On the other hand, the head-works, falls, regulating gates, and other dividers are constructed in the most substantial manner of massive masonry.

“In strong contrast to this type of construction are the minor distributaries observed in some of the cane fields. These were built by owners who had great grinding and boiling machinery for the treatment of their cane, and were imbued to a certain extent with American methods. They out-Americanized our Western irrigators. Their distributaries consist of a series of temporary trestles and shallow wooden troughs or gutters made of lumber brought from America. These tap the hillside ditches at such points as seem desirable, and are roughly placed so as to carry the water to such portions of the field as immediately require it. After irrigation in such localities the trestles and troughs are removed and utilized in irrigating other portions of the same fields. This practice is resorted to in order to reach the numerous little detached rolling hills 10 to 20 feet in maximum height, into which the surface of the sugar lands is broken. In other localities, where practicable, these lands are irrigated by direct diversion from the main ditches of laterals dug in the earth and ramifying to every portion of the field to which gravity will conduct the water.

“What effect might Porto Rican production or irrigation development in the Island, Mr. Wilson, have upon the American market?

“Oh, none whatever. The island is small and while methods will be improved, the total production cannot be greatly increased. The increased sugar production of the Island would not be a spot even on the Louisiana crop, to say nothing of the immense consumption of this country. Porto Rico's irrigation features are interesting but they cannot in any way affect the United States.”

AGRICULTURE AMONG THE CHINESE.

The outrages perpetrated in China and the speculations as to the outcome of the present troubles have caused the public to be profoundly interested in that country. Perhaps the following article on Chinese agriculture, may be timely and appreciated. It was written by Rev. Wm. N. Brewster, an American missionary to China, and first appeared in the *Field and Fireside*.

No better proof is needed that the Chinese as farmers are industrious, careful and intelligent than the fact that in South China nearly all of the soil in the valleys has produced at least two, generally three, and not infrequently four crops a year for thousands of years without reducing its fertility in the least.

It goes without saying that in order to do this practically everything that is taken off of the field is put back upon them. While they know nothing scientifically of the chemical composition of the soils, yet necessity has forced them to study out practically many methods which are scientifically correct.

That method which is most useful, most distinctive of China, most essential to the very existence of the Chinese as a nation under present conditions, most offensive to the foreigner's olfactories, and most omnipresent, is due to the fact that nearly all of the products of her soil are consumed by the teeming millions of her population. Cattle are comparatively few, pigs more numerous, but few in proportion to the population, chickens do not count much in the consumption, so that these three or four annual crops are eaten by the people who raise them. If this method were not used the country would become incapable of supporting the population in five years. This fact tends to reconcile the philanthropic foreign visitor or resident to the open vats and open buckets that he must pass or be passed by a hundred times a day as he travels about. But the manure of domestic animals is made the most of, and in the peculiarly Chinese way.

I said to the man that brought me his pony for a short journey the other day, "Why do you not keep your pony in a clean place? A white horse with a filthy coat is very objectionable to a foreigner."

"If I clean up the stable every day the manure will not be so valuable," was the characteristic reply.

When the bubonic plague was raging last summer I was exhorting the village people to clean up about their houses to prevent them taking this fatal disease. A place for feeding the family pig was as filthy as possible. I said, "You ought to clean that place every day. You can fatten your pig just as well, and avoid the stench in the

house, and possibly the plague may come from that pile of black filth." And this practical economist replied: "That black dirt makes very good manure." The fact that one member of the family taken sick, much less dying, would cost many times more than the fertilizer was worth in several years was too remote a possibility to affect this time-honored practice of feeding the family pig inside the house and cleaning up the sty only so often as it would be profitable for agricultural purposes. Vats of cement or stone are everywhere, and into these vats are thrown straw, vegetable tops, leaves and whatever refuse there is that is not wanted for fuel or for other commercial purposes. Water is then poured in, and when the refuse is entirely rotted this water is carried in buckets and sprinkled on the growing rice and vegetables.

The Chinaman fertilizes not merely once a year when putting in his crop, but until it is nearly ripe. This, in the case of green vegetables, is more profitable to the producer than to the consumer, for disease germs are lodged in the leaves that doubtless have much to do with the constant prevalence of cholera in the East.

As I write this upon a canal-boat the fields on either side and banks are constant illustrations of my subject. On the banks are piles of earth drying, which have been scooped up from the sediment at the bottom of this canal. This, when hardened in the sun, is pulverized and put on the fields. It is most fortunate that this sediment is valuable, being well worth the labor of dredging it up by hand with a scoop attached to a long bamboo pole worked by a man in a flat-boat. If it were of no value these canals, so necessary to agriculture and commerce, would fill up. This government would not concern itself to keep them open, and there is little public spirit in China to depend upon for such works.

In many fields on either side of the canal are round piles of earth in clods, about two or three feet high and twice as broad, from the back of which issues a thin column of smoke. The entire surface of much of the rice-land is thus being smoked and burnt by straw in the middle of each pile. This is a laborious but very effective method of strengthening the soil. It is probable that one reason that Chinese fields are so free from weeds is the fact that the soil is treated in this way. The burning kills the seeds.

The value of ashes as a fertilizer is well understood, and the housewife carefully saves them, selling for a good price or using them upon the family fields. Even the sweepings of the houses are saved by these thrifty economists; and a wife is expected to get enough money for the house dust to keep herself supplied with brooms. Even the value of bones is understood, and they bring a high price. They are pulverized in a stone mortar, with hand or foot power, and used for certain soils and crops.

This gathering up of all the filth and using it to produce more

food serves a double purpose. Not only is the productiveness of the soil preserved, but a degree of cleanliness is maintained that makes life possible. With the utter ignorance and indifference of the Chinese to cleanliness for the sake of comfort and health, if it were not profitable for them to clean up their houses and streets they would become so filthy that pestilence would sweep the population off the earth. In proportion to the density of the population the value of all fertilizer increases, so that the very crowding of the people tends to improve their cleanliness. The city of Hinghua is said by all visitors to be an unusually clean one. It is not because the Hinghua people are naturally haters of dirt, but the population is unusually dense even for China, and it pays the people to clean up the streets and houses and carry the dirt off to their fields. The farmers are even willing to pay for the privilege by buying all the refuse of the city at a good price.

One would think that this scrupulous care in using everything would make it unnecessary and even unprofitable to import any fertilizer; but into this one small territory of Hinghua, seventy-five miles long by forty wide, is annually imported from the Shantung province, a thousand miles north, not less than one thousand two hundred tons of bean-pulp, which sells at from fifty to sixty dollars (Mexican) a ton.

This bean-pulp is simply beans from which the oil has been pressed out. It is imported in round, flat cakes of about the size and shape of an American farmer's grindstone. It is pulverized and dissolved in water by soaking for a fortnight, and then mixed with more water and put onto the fields. This bean-pulp is absolutely necessary, it is claimed, to raising sugar-cane. In planting, each joint is dipped into the pulverized bean-pulp.

Peanut-pulp is also used very extensively. Peanut oil is used by the Chinese as Americans use lard. The oil is pressed out, and the pulp in disks one foot across by an inch or two thick is used for much the same purposes as the bean, but it is less effective and is mostly a local product.

The expense of all this, it is plain to all, must be very great. The Chinese farmer can tell you exactly what will be the difference in his crop from using a certain fertilizer, and how much is necessary to bring the best results.

He calculates upon spending for this purpose alone at the rate of \$12 (Mexican) a crop an acre, or ordinarily \$36 a year for his three crops. But the figures do not tell it all. Where ten cents a day is considered fair wages, this \$36 represents the wages of one farm laborer for a year; or counting one crop a year, it would represent to the American farmer, for fertilizing three acres, a sum equal to the wages of his "farm-hand" for twelve months. That is far more than the land produces.

Nevertheless, farming is the chief and favorite occupation of the Chinese; it is the most certain of profits, though the margin is narrow, and in it their best qualities of industry, skill and economy are displayed.

RHYME AND STORY.

SPANISH-AMERICAN SKETCHES.

II. *Guadalupe.*

BY "VIATOR."

I never knew her age, Guadalupe, or Lupe, as she was commonly called, but, though her presence has long since become only a memory, the recollection of her witching popularity is yet more vivid than the impression of many an actual face and figure, forming one of the grateful visions which occasionally permeate the subtle region of our day-dreams, lingering in imagination and ever reawakening the quiet delight inspired by retrospective happiness.

Our corps was stationed along the lower Rio Grande during the closing years of the late Rebellion, and apart from official duties, the usual routine of which became a wearying monotony, there was little to while away the time save strolling about the scattered town, near the outskirts of which our regiment lay encamped. My own excursions frequently took me further away, and notwithstanding the danger of wandering far in those tempestuous days—for from time to time the bloodthirstiness of the natives was terribly brought home to us, and we had lately hanged four of the desperadoes upon one gibbet—it had become my habit to ramble through the adjacent chaparral in the long October afternoons, when the air was

full of Indian summer indolence, and existence alone seemed sufficient luxury after trying campaign in Virginia.

It was upon one of these occasions that a sudden turn in the grassy wood-road led me to a verdant clearing, bordered by delicate shrubbery, now vocal with the wayward ecstasy of the mocking-bird's song, and canopied by a sky whose azure I thought must rival the hue of an Italian heaven. A herd of goats fed tranquilly within the enclosure, or dozed in the pure sunshine, apparently untended, although they showed no inclination to stray. Beyond the open space I could discern a path winding amid the copses, and over the fringes of acacia pencilled against the eastern horizon loomed soft masses of clouds tinged with faint rose-color, towering into the balmy pellucid atmosphere—the guiding "pillar" of Exodus, fit throne of saints and cherubs such as Raphael and Correggio loved to portray. Yielding to the influences around me, I lay down upon a bank of bright turf, dotted with wood sorrel and the purple blossoms of the sensitive plant, and was soon lost in half-conscious reverie, in which all accidents of life were fused in the placid sense of being, while yet mortal, utterly at rest.

My meditations were rudely dispelled by feeling my hat suddenly withdrawn from my forehead, while a blaze of warm sunlight

streaming upon my face thoroughly aroused me. The outrage could scarcely proceed from other than a human being, though the predatory instincts and marvellous digestion of goats might have occasioned the surprise. The hat had wholly disappeared; so much was certain. I could not but reflect upon the futility of years spent in acquiring the dignity becoming my age and pursuits, the period of pedagogical state when, wielding my ferule as an awful sceptre, I saw my trembling subjects cower in dismay. Who dared in this unseemly levity lay bare my pathetic scalp, revealing even to this Texan sunshine the scattered locks that struggled to protect a professor's cranium? It was indeed very odd; it was no less so when my ears were regaled with one of the merriest peals of laughter to which it has ever been my joy to listen.

Soon a bunch of grass tumbled from the thicket, striking me in the face as I peered unawares about the bushes. Over that same barrier, I remembered, might have been hurled a fatal lasso, as more than one poor fellow who had traversed these solitudes had bitterly learned. At all events, I had endured less peaceful bombardments than this, and balls of tender herb-age were surely more welcome than Whitworth shells. The mystery, moreover, while it piqued my curiosity, was not without allurements, and, betraying no surprise, I resumed my siesta and awaited developments.

"Gringo, Gringuito!" soon came from the neighboring copse in tones of playful mockery. I shaded

my eyes with my handkerchief and feigned sleep. The ruse answered well, for in a few moments I perceived by a slight rustle of the twigs that my tormentor was in motion, and divining that the handkerchief would be the next object of desire, I held the corner of it fast and invited assault. Finally came a swift attempt at capture, but my hold was firm, and, as I turned to seek the mysterious culprit, I saw standing over me, a lithe, laughing girl, apparently somewhat subdued by defeat, yet revealing a world of mischief in her roguish eyes and in the dimples of her sunburnt cheeks.

I affected grave pleasure, and silently gazed upon the child—for child she seemed, though her stature indicated young womanhood—intent upon awing her into respectful submission, at least so far as to remove the hat from her glossy curls, upon which it rested jauntily, being poised at an angle I should never have dreamed of adopting, so detrimental to all moral equilibrium was its glaring impertinence.

I was at once struck with the singular beauty of the girl's face, the lines of which exhibited the highbred contour visible everywhere among the Spanish Americans; the delicate egg-shaped oval of cheek and chin, the exquisite mouth, and perfectly modeled brow, betraying a refined sensibility, frequently at variance, to be sure, with the character possessed by the class among which these outward attractions are apparent. Her dress was recklessly forlorn, indeed the commonest of girl

gowns, straggling about her naked feet, being supplemented by a black merino shawl spotted and rent, one end of which was carelessly flung over her left shoulder, after the fashion of her people. Yet in her clear olive complexion, her handsome dark eyes, whose drooping lashes were of the finest texture, her gleaming teeth, and in the glance of captivating naiv   with which she met my solemn scrutiny, there lay a witchery beyond resistance, and as I watched her oread grace and saw the confiding innocence of her youthful delight, I forgot the unkempt shepherdess in the gentle, maidenly creature whose buoyancy was like an embodied ray of the rich sunlight around us.

“Do you want your hat, Senor?”

“Oh, not in the least,” I replied with nonchalance. “Perhaps the warmth of the sun upon my head may prove an efficient hair-restorer.” (I knew the pitiless railery with which her race regarded physical shortcomings, although nowhere in the world is to be found a more heterogeneous assemblage of human ills than may be discovered among them.)

My answer evidently disconcerted her. She wanted to play, and I was serious: Changing her behavior she approached without speaking, and demurely dropped the hat beside me.

It was now my turn to be merry. Observing that one of her flock was disappearing at the farther end of the enclosure, I challenged her to race after the wanderer. She bounded away, calling prettily upon Santa Barbara to aid her,

springing over the turf with free, elastic step, and easily outrunning me, an exploit I could not regret, being glad enough to watch her splendid grace of motion as she sped forward.

Her delinquent charge having been at length coralled with the herd, she produced a tin cup from her pocket, and asked if I would like a drink of goat’s milk.

Now this was dangerous. There has come to me from an authentic source a tradition that, at the very outset of my career, when my attenuated dimensions might readily have been embraced by a quart-pot, my existence was guaranteed, as it were, through the beneficent ministrations of goat’s milk. Thereafter, being sorely ground upon fortune’s wheel—yea, having so far become the shuttlecock of fate that the feathers were well nigh knocked out of me—I have at times questioned the propriety of that fond yet deluded rescue from oblivion, cherishing an abhorrence of the vile fluid which had mediated to prolong my woes. Here, however, I beheld the preserver of my infant anatomy in an auspicious form, and hastened to accept the girl’s rustic hospitality.

She had some trouble in procuring the desired beverage. Goats, even in their soberest mood, are not wont to be tractable, their thoughts being less reduced to system than those of most animals, so that the direction they are about to take can scarcely be predicted with more certainty than that of a metropolitan herdic in search of prey. My hostess was nevertheless equal to her task, and we were

quickly seated together under an embowering acacia regaling ourselves with the warm and somewhat strong as well as strengthening draught.

The color had mounted to her cheeks with exercise; her jet black hair, loosened by the wind, fell in shining masses over her shoulders, while her features, animated by the novelty of the scene and now beaming with girlish pleasure, were even comelier than before.

"Do you want to listen to a story?," I asked. "Only you must first tell me your name; I never talk to little girls much unless I know their names. But if it is Jeronima, or Eulalia, or Tiburcia, or Idelfonsa, or Eustaquia, or Leocadia, or Dionisia, or Hipolita, or Policarpa—"

"Hold! for the sake of the Virgin," she cried, stopping her ears, "You'll frighten every bird from the chaparral with your hideous clamor."

"Or Murcielaga," I continued; whereupon she sealed further utterance with an indignant palm, but instantly withdrew her hand, sending her bright laughter far over the thicket.

"My name is Guadalupe, Senor, but I am called Lupe at home, and by my companions in the village."

The appellation had a ferocious sound, contrasting strangely with the gentle disposition of its possessor.

"Then, if you promise to be very good and quiet, and neither move nor smile, nor, above all, ask any questions, I will tell you a story, Lupe, and you must know that stories are always true, at least mine

are, because it is impossible to prove that they are not so."

The story itself is of little consequence. Enough, that being aware of the charm which hyperbole has for the Spanish imagination I endowed my characters with the supernatural qualities, and conducted them through the appalling situations, calculated to induce nightmare in the mind of the girl, together with sufficient fairy element to captivate her innocent fancy, the tale being interwoven with startling incongruities and an absolute disregard of logical sequence, designed to stimulate the very queries she had solemnly promised to withhold.

To repress the exuberance of feeling awakened by the narrative was quite beyond me. Lupe rolled upon the grass and screamed with excitement as adventure followed adventure, and only the intense seriousness I assumed, prevented her, I am sure, from momentarily interrupting me.

Meanwhile, I had ample opportunity to mark the character of the girl in the varied play of emotions that now illuminated, now subdued her fair, mobile countenance, in which were mirrored the subtle impulses of her hidden life, lending to her beauty the airy, evanescent charm that might haunt an Undine, or wake the rollicking mirth of a Marchioness.

As I ended, there was a bewildered expression upon her face. Perhaps she was endeavoring to trace the connection between the Prince's slaughter of the enemy in defence of his bride, and the remote spectacle of the cameleo-

pard and the cockatoo lunching upon herrings and cheese in the jungles of Africa. I flatly refused to enlighten her, and her dilemma was comical to witness. My sole desire had been to entertain, while improving the occasion to observe the engaging traits of the child's nature as revealed through her sympathies.

Our little holliday drew to a close. The sun was low in the horizon, and, with something of regret in her tone, Lupe called my attention to the hour and rose to gather her flock. "If you will come to my house, Senor, you shall have *frijoles* and *tortillas* for supper," she kindly said as we moved towards the town.

I did not quite accept the proposal, my presence in camp being required at evening sick-call, but agreed to accompany her home, reluctant, in truth, to leave my new companion, whose society was a welcome relief after the severe privations of army life, the natural result of which is a tendency to relapse into barbarism. Moreover, she had enlisted my friendliness in an unusual degree. Her wholesome laughter was a tonic to lonely thoughts, nor could memory of solitude abide in her enchanting presence.

Sedately she moved beside me now, however, and, though at times she enlivened the way with quaint reflections upon childish themes, her manner was evidently modified by the extreme probability, as she confessed to me, of chastisement upon reaching home, for she was late in returning. Perceiving her trepidation, I hastened to reassure

her, pledging myself to intercede in her behalf. Never had I found her people other than courteous and obliging, having tested their warm-heartedness frequently during our sojourn among them.

At sunset we arrived at the spacious corral, in which were huddled half a dozen adobe huts, Lupe's home being of the number. My tardy protégée was greeted with the musical imprecations which form an important ingredient of Spanish conversation, and I perceived a forbidding dame issuing from her hovel armed with an uncanny strap, intended for Lupe, no doubt. The girl ran to me, and, throwing her arms around my waist, claimed my protection. Advancing toward the swarthy executioner I explained her daughter's delay, at the same time averting her wrath by an off-hand contract for eggs, poultry, and tortillas, to be delivered in camp. I had never offered these poor people money outright, as I might have done among more civilized nations. Something in the stately resignation, with which they bore their lot, precluded ordinary alms, and it seemed to me an iddignity to suggest them. I knew, however, that the terrified child was free from punishment.

At Lupe's urgent request I visited her aunt close by, a bed-ridden woman of whom she spoke so proudly and affectionately, that I felt interested in the sufferer. I found her lying in a wretched adobe hut, the earthen floor of which was littered with saddles, lassoes, and kitchen furniture, the surroundings indicating the mest

touching phase of poverty. The interview revealed the true Lupe at once, and I watched with deep admiration the caressing tenderness, the deferential submission, and eger solicitude with which the girl tended her aged relative. I had not been mistaken in my estimate of the girl's character, and my grateful surprise was quickened when, upon my departure a little later, my young friend followed me to the gate of the corral and in parting took my hand and simply laid it against her soft cheek in token of unaffected regard. And so ended my first acquaintance with Lupe.

WHEN THE DOCTOR COMES.

CHARLES D. CENTER, M. D.

Gran'pap's sick, an' all on us are feelin' purty blue,
 Fer he's a gettin' purty old, an' weak an' feeble too.
 We're all a'mighty fond on him; th' day w'en we can't see
 Th' ol' man sittin' by the fire—th' Bible on his knee,
 Is goin' to make us orfle sad. I'ap sets an' twirls 'is thum's,
 Awatin' fer th' gate tu click w'en the Doctor comes.
 Bill sees 'im drawin' up the lane, so Pap he ups an' goes
 Tu tie th' horse, an' blanket him; th' Doctor 'll be mos' froze.
 Th' Doctor's voice is jest ez strong 'n cheerful ez can be,
 He sez ez how he thinks th' snow 'll last all thro' Feb'ary.

But Pap's voice 's harsh, an' sorter gruff, an' he acks so kinder glum.
 But he's cheerfuller 'n he was before, fer th' Doctor's come.

'En w'en he comes inter th' house Mam takes his coat an' hat,
 An' puts a cheer up by th' fire th' same place where he sat
 Th' las' time he was here. An' w'en he's warm he walks
 Right inter th' spare bed room, an' he an' Granpap talks.
 An' he feels 'is pulse, an' th' rest ov us are keepin' purty mum.
 But we're jest doggon orfle glad that th' Doctor's come.

But he stays in thur so tur'ble long th' figgits gits hold on Mam;
 An' mebbly me too, fer she boxes me an' tells me not tu slam
 Th' door. But Gran'mam she jest sits, an' a tear runs down 'er face,
 An' she sez, kinder soft an' slow, "O Lord, show us thy grace."
 An' that makes a nut come in my throat an' I feel orfle bum!
 But thiugs is goin' tu go all right fer th' Doctor's come.

'En he comes out, an' looks around, an' Mam she kinder braces.
 An' asks how Gran'pap 'll git along. An' then th' Doctor's is
 Jest th' hau'somest ye ever seen! An' he sez, "There, there, don't fret.
 I shouldn't wonder but Gran'pap 'll bury us all yet."
 An' theu another tear rolls down an' drops on Gran'mam's thum'.
 But she looks orfle happy now th' Doctor's come.

A DOCTOR'S PARADISE.**BY GEORGE F. BUTLER, M. D.**

The recurrence of the vacation season forcibly reminds the medical profession of the timely and permanent benefit to be derived

anxieties and responsibilities of metropolitan duties especially demand temporary relief from care, as furnished by the opportunity of annual retirement.

Remembering my own delightful



Approach to Star Lake.

from a judicious "outing." Few men, in any walk of life, are subjected to so continuous a mental strain as the practicing physician, and few if any, require more the absolute rest to be obtained in country relaxation. The wearing

experience a year ago in the great pineries of Northern Wisconsin, and the recuperative energy gained from a sojourn in the "Thousand Lakes" region, I cannot too strongly urge my colleagues to "go and do likewise." The route along the

Chicago, Milwaukee & St. Paul Railway abounds in summer resorts of rare attractiveness, and towns where private accommodations are at hand at a trifling outlay. From these points one may choose among

the entire outfit and running expenses being within reach of a moderate purse.

No section of the country east of the Mississippi is more favored in natural charm than these remote



Wood Road Near Darrow Villa, Minocqua, Wis.

many fascinating trips, any one of which affords ample resources for healthful out-door exercise and pleasure. Should greater privacy be desired, the country offers innumerable sports by wood and lake where one may camp undisturbed,

wilds. Here, surrounded by the forest solitude, breathing the balsamic exhalation of the pines, bathing in the translucent waters of turquoise lakes—set like gems amid the encompassing woodlands—one feels the invigorating im-

pulse drawn from communion with nature, to whose subtle influences heart and brain joyously respond. There is an elasticity in the air which stimulates the faculties and rouses them to keenest enjoyment, while the sense of restfulness is like a lethean draught to the system worn with toil. To lie at ease beneath the woodland bowers and listen to the songs of birds or the soothing flush of ripples upon the lakelet's shore, is a dreamy luxury

noon's trial.

A single week passed in this exhilarating atmosphere is of incalculable value for its perfect sleep and appetite and the embodied vigor borne away to the renewal of metropolitan care and labor. Before leaving town I had suffered considerably from insomnia, resulting from unusual anxiety and the responsibility of difficult cases entrusted to my charge. I knew well that matters could not continue



Star Lake, Wis., Showing the Famous Cabin on the Island.

of life seldom to be enjoyed. There is no balm for jaded energies of mind and body like the elixir of this happy existence.

And for one who has longed to follow in the footsteps of good old Isaac Walton, the country proffers the most captivating opportunities for sport. No need to fabricate fish stories more, or purchase a catch at the village market, when, as I found at Minocqua, Vilas Co., from fifty to eighty black bass, or a twenty-five pound muskellunge not infrequently rewarded an after-

thus unfavorably without serious results, and believe it was well for me that my decision regarding a vacation was promptly taken. The night before arriving at my destination I had partaken of food reluctantly; my appetite and digestion were now all I could wish. In the desire to revel solely in country recreation, I had made up my mind to forego newspapers, and even correspondence, a resolve which proved highly beneficial in relieving my mind of all unnecessary occupation. My wife and child shared

in the improved health incident to our stay in so beguiling a locality, our united weight upon our return to town being formidable. We had acted more wisely than we knew.

There are hundreds of physicians whose contracted duties need annual relief through an outing such as I enjoyed. A little reflection will show them the immense advantages of the change; in matters of ways and means there is slight cause for alarm (I think we even economized somewhat), and only the requisite decision remains to

render the vacation an accomplished fact. The experience, once tried, is sure to be repeated, and, for my own part, I seriously contemplated the purchase of a piece of ground in the vicinity of one of these myriad lakes, and a yearly establishment amid surroundings which have brought to me so much health and enjoyment. I find, at least, that the prospect of revisiting the delightful scenes adds new zest to my work and awakens the liveliest anticipations of restful content.



BACK IN THE WOODS.

THE DIVERSIFIED FARM.

DRY IN SOUTH DAKOTA.

Recent news from South Dakota would indicate that the serious drought experienced there has not caused the settlers to lose courage. The *Huronite* says:

"It is dry in South Dakota. There is no use denying it. A long unprecedented drought has affected the entire north-west, and South Dakota has not escaped. But see how she stands up under it! What other country could do it? A drought like this in Egypt would mean famine and appeals for help to keep people from starvation. But in South Dakota the people go right along eating three square meals a day and four on Sundays. They don't give up or cry out, but with the blow in the bottle American grit go right along just as though the water was a foot deep and the crops three feet high. It's the only country in the world that can stand floods and droughts and get rich with either or flourish without them. South Dakota will come out all right. The year is not ended and the clouds haven't all passed by. One of these days a bunch of thunder heads will come up in the east, the lightning will flash and the thunder roll, and the rain pour down in torrents, soaking things to a finish and then these fields that today look so brown will take on a new life, the prairie will send forth its grasses and the harvest will come on all right. the hay crop will be up to the average, the cattle will continue to fatten, the flocks will increase and we shall forget all about the drought of May and June. One drought can't hurt us permanently, one failure can't put us out of the ring. We are here to stay and prosper. It would seem better if we could call on the rains to fall and the

winds to cease just as we desire, but a wiser hand than ours has a finger on the button and knows better than we do what we want and what is for our good. This is His world and we are His people, and it becomes us to go right along working, hoping, praying and trusting. Not one sparrow falls without His knowledge, and this drought in the end will have some good in it. Let us wait and trust the harvest in His hands."

VALUE OF DRAINAGE.

"We recollect," says the *Genesee Farmer*, "walking through a magnificent field of corn on the thoroughly underdrained farm of our friend, John Johnson. One of the underdrains was choked up and there the crop was a failure. Corn delights in a loose, dry warm soil. If it is surcharged with water, all the sunshine of our hottest summers cannot make it warm, and all the manure that can be put on it will not make the corn yield a maximum crop. In passing along the various railroads, we have often felt sad to see thousands of acres of land planted to corn, which, by a little underdraining, would have produced magnificent crops of this grandest cereals, but which presented a miserable spectacle of yellow, sickly, stunted, half-starved plants struggling for very life. We have ever been willing to apologize for the shortcomings of American farmers. We know the difficulties under which many of them labor. We do not believe them to be, as a whole, intelligent and enterprising. But these sickly cornfields are well calculated to create a very different impression. We have frequently to repeat the German proverb, To know is not to be able. These farmers know how to raise good corn, but

they are not always able to put into practice improved methods of cultivation. There is scarcely a plant which does not thrive much better in a loose, deep soil than in a shallow, compact one, but in no case is this fact susceptible of more ready verification than in the corn plant.

“Water is held in the soil between the minute particles of earth. If these particles be pressed together compactly there is no space between them for water. Compact subsoils are but little permeable to water, compared with the same when broken up, pulverized and mellowed. The one is porous and drinks in moisture like a sponge, the other absorbs it, but in small quantities, and readily parts with the same on the application of heat. The one takes it from the air, which passes freely through it, the other, impervious to the air, or any slightly powerful influences, remains unchanged. Undrained soils, as we have shown, become compact after heavy rains by the evaporation of the water with which they are saturated; drained soils, on the contrary, become more porous from the filtration of the same amount of moisture into the drains below. Draining prevents injury from drought by giving a better growth to plants in the early summer. Seed sown on any soil containing stagnant water send no roots below that water line, but may for a while grow from roots near the surface. But let drought come, the water line sinks rapidly; the roots, having no depth to seek moisture below, they are parched and burned, and without rain the crop is irreparably injured. On a drained and deepened soil the roots go down without obstruction, and are thus prepared to withstand the effects of the long continued dry weather so often experienced. That they will do so a thousand facts in the experience of a farmer will prove to him that observes them.”

SETTING FRUIT TREES.

The season is again at hand for planting trees, shrubs, vines and plants, and no

time should be lost in preparing all the requisities so as to be in readiness for planting at the first opportunity. Many persons fail to understand the importance of having the soil in thorough tilth at planting time. The lifetime of a tree or plant depends materially on a scientific system of planting, and the first five years after planting determines the existence and profitableness of the orchard or vineyard.

Select the location for a new orchard with care. See that the soil conditions suited to the nature and requirements of each variety are present. Give the apple the loamy soil and the peach, pear, cherry and plum the thinner or poorer soil. The dwarf pear require a good garden loam. Plow the ground deep, harrow and level and mark off for the trees accurately. Dig the holes, or if planting largely, four furrows may be turned apart with the plow, leaving an open furrow for the line of trees. Have the trees trenched, each variety separately, near where they are to be planted. Take ten or twelve from the trench at a time, giving protection to the roots by covering with damp burlap or old carpet. Cut back the mutilated roots to sound, healthy wood. Use a sharp knife, cutting from the under side. Set apple trees one to two inches deeper than they stood in the nursery row, leaning ten to fifteen degrees to the southwest. Have the top soil thoroughly fined or pulverized. Fill in by sprinkling on and through the roots, packing in with the fingers. When the roots are well covered, the dirt should be well firmed with the feet so as to leave no air space about or near the roots. If the soil is too dry to supply proper moisture, then water. One to three gallons may be poured in the hole after the roots are covered, and after the water has settled out of sight, continue the filling and firming.

Peach, plum and pear should be planted three to four inches deeper in the orchard than they stood in the nursery, as this will bring the budded junction under ground, and in time the bud stock will cast roots and give support and vitality. After

the planting of apple and peach is concluded, go over and cut back the growth of the apple one-third to one-half, cutting the peach back, all side branches, to one and two buds of the center stalk. Head back the center stalk to two and three feet. Pear, plum and cherry should not be cut back except to take out broken limbs.

HOW TO GROW SUGAR BEETS.

The Denver Field and Farm publishes the following short and succinct article telling how to grow sugar beets under irrigation:

Sugar beet ground must be new ground or if old it should lie fallow a year and be worked all summer to kill the weeds, which will save half the trouble of cultivation the following year when beets are growing on it. Beets grown among weeds are worthless for the factory. Beets should be planted in rows three feet apart. When large enough to transplant they should be thinned where too thick and put in where too far apart, so that they will stand six to eight inches apart in the row.

For this part of the work the factory company provides an overseer to direct the work who has practical experience, as it is a particular job and if done wrong the plants will die. In three days after

transplanting, the ground must be irrigated. Be careful that the water does not reach the stems of the plants or they will sunburn and die. Then irrigate at least every two weeks. Cultivate after each irrigation, shoving the loose dirt well up under the leaves, so that the tops of the beets will not be exposed, for all that stand above ground are worthless at the mill. The seeding in New Mexico should be done the first week in April. The beets are ripe about the middle of September.

As soon as the leaves change color during the last four weeks turn on the water and let it trickle slowly through the furrows day and night. Plow the land away from the beets on one side of the row and pull the beets out. All beets that are cut by the plow or broken off should be sent to the mill immediately. The remainder may be stored in the field. For this purpose clear off a place three feet wide on the bottom and pile the beets three or four feet high in triangular form and cover with smutted straw, or rye straw, which is better. Put as many beets in a pile only as may be hauled to the mill at one time. Arrange the tops outward. Place a light covering of dirt over the straw, leaving only a thin protection at the top so the beets will not heat.

PULSE OF THE IRRIGATION INDUSTRY.

A NEW METHOD.

The Covina (Cal.) *Argus* gives an account of a new sub-irrigation system that is to be used by F. M. Chapman, of Palmetto ranch, in his fifteen acre grove. "In distinction to all other systems the pipes have no openings or perforations," says the *Argus*, "but at regular distances between the trees are placed receivers or miniature reservoirs constructed of a 20-inch cement pipe with a top, turned on end, into which water is conducted by means of a 2-inch pipe, and when this is filled it passed out through a pipe in the other side, into the next receiver, and so on until it reaches the end of the row. Mr. Chapman believes that in this system the clogging of the pipes by roots, to which has been due the failure of all former system, has been overcome. If this system proves successful it will revolutionize irrigation in Southern California.

This system is said to be entirely original with Mr. Chapman and a patent is pending.

A LARGER APPROPRIATION NEXT YEAR.

Encouraging news comes from Washington to those who have been fighting the battle for national irrigation of the arid lands owned by the government. Both houses of Congress have agreed to an item in the Sunday Civil service bill appropriating \$100,000 for irrigation surveys during the coming year. It is true that the amount is not large. The amount of \$50,000 had been allowed by the House, which sum was increased to \$250,000 in the Senate, and amount appropriated was a compromise between the two figures. This is twice as

much as was allowed last year, and the encouraging statement is made by the Washington correspondent of *The Times* that throughout the controversy "no man appeared and objected to the appropriation in toto." The correspondent adds:

"There is every indication that a much larger appropriation can be secured next session if the western folks who are vitally interested in the matter will make themselves felt in the proper way in Washington. Eastern opposition to western irrigation is gradually wearing away through the influence of the National Irrigation Association, which has its membership largely in the East."

The statement in regard to the membership of the National Irrigation Association is in line with one made a few days ago in these columns, when it was mentioned as a regrettable fact that eastern business men are actually taking more interest in this movement than are citizens of the Southwest, who are so vitally interested. This is not as it should be. With "a strong pull, a long pull and a pull all together," national irrigation may within a few years become an accomplished fact, when not only will Uncle Sam once more be able to give all his boys a good farm, but a great stimulus will also be given to our commerce and manufacturers.—*Los Angeles Times*.

SAFEGUARDS.

Congress will one day wake up to the fact that the empire in the West needs but little attention from the government—less than the rivers and harbors get—to be transformed from desert wastes into prosperous small farms and to contain a dense population—an upbuild

ing of rural homes on the public domain to form as Secretary of Agriculture Wilson says, "sure safeguards of the Republic."

AN INDIA FAMINE AT HOME.

"Indians Starving to Death" is the heading of a Phoenix special to the Chicago Tribune, the text of which is as follows. "Six thousand Indians are starving to death on the Gila Reservation, according to S. M. McGowan, superintendent of the Indian Industrial school of Phoenix. His statement paints a most deplorable picture of conditions existing among tribes that have never been contaminated by white blood.

Superintendent McGowan said that he found twenty helpless adults in one miserable shack, that would, under ordinary circumstances, scarcely accommodate three persons. Congress has appropriated \$30,000, but no method of distributing the money was stipulated, hence it is tied up, while the wards of the government are starving to death."

This statement of the pitiable condition of the friendly and industrious Pimas is old news to western readers, and the case is one of the most shameful and outrageous instances of neglect and betrayal on the part of the United States of an ally, worthy and true.

That 6,000 Pima Indians, always the consistent and active friends of the white man, should be reduced from a condition of wealth and great prosperity to actual starvation through the neglect of the federal government, while the adjacent Apaches, always the white man's foes and causing more trouble, pillage and loss of life than any western tribe, should be to-day sleek and well-fed at the hands of the same government, seems a rewarding of enemies and killing of friends.

For hundreds of years the Pima's lived in plenty, irrigating their fields from the waters of the Gila until the white man came and diverted its waters onto other

areas. At the time of the Gadsden purchase, Lieutenant Michler of the Boundary Commission said of these Indians in his official report, dated way back in 1856.

"Besides being great warriors they are good husbandmen and farmers and work laboriously in the field. They are owners of fine horses and mules, fat oxen and milch cows, pigs and poultry and are a wealthy class of Indians. The Pimas consider themselves regular descendants of the Aztecs. As we journeyed along the valley we found lands fenced and irrigated and rich fields of wheat ripening for the harvest a view differing from anything we had seen since leaving the Atlantic States. They grow cotton, sugar, peas, wheat and corn. As I sat upon a rock," continues Lieut. Miehler, "admiring the scene, an old gray-headed Pima took pleasure in pointing out the extent of their domain. They were anxious to know if their rights and titles to their lands would be respected by our government, upon learning that their country had become part of the United States."

The old man's anxiety was but too well founded, and could he contrast now the wealth and prosperity of his tribe before the westward sweep of civilization with its present destitution and decay, he would have cause to rise in vengeance and demand that this great government adopt a course of common decency.

There are many people in the Eastern States who have cried out against the injustice meted out to the poor Indian. Their sympathy usually has been misplaced and wasted upon a savage treacherous and relentless foe of the whiteman. But here now is a worthy cause—none worthier ever lived; to wright a wrong; to give to a good people that of which they have been wrongfully despoiled through the criminal carelessness of the governments. And the solution of the problem is so easy, so simple. The waters of the Gila are ample to supply the needs of the starving Pimas and many others, only

they largely run to waste during flood times. The government reports and surveys show that the building of a great dam on the Gila would store up enough water to irrigate thousands of acres of as fertile land as the sun shines upon.

Cannot some of our friends who have anon professed such interest in the poor redman come to his assistance now and see that he may be accorded simple justice? The cause is worthy; the means are at hand; the interest alone is lacking.

IRRIGATION AND PLANTING.

Chino Champion: It is an animated scene out on parts of the ranch now where the sugar company is grading and irrigating land and planting beets. Southwest of town about fifty teams are now engaged in this work, and it is really transforming the appearance of the country there.

The fields are first graded and leveled, so that all parts may be reached with the water. It is then furrowed and the water turned on from the main ditches which reach out to all these tracts. After the ground is thoroughly soaked it is allowed to stand two or three days until it gets solid enough to put a team on, when it is cultivated and planted.

Up to date there have been about 400 acres irrigated and about 375 acres planted on the Chino ranch. The scattered acreage at outside places reaches 1000.

The beets planted here are making a splendid start and are growing nicely, and are giving promise of a good crop.

One feature of the irrigation now is that the refuse lime from the factory settling reservoir is being mixed with the water and in that way carried out and distrib-

uted over the land. Experts have given as their opinion that lime will be of great value to this soil, and will give the young beets a vigorous thrifty growth at the start, and carry them through the ills that young beets are sometimes subject to, especially when they start weakly or under adverse conditions.

The work done by the company is really the advance step towards the most intense culture of the soil and putting the sugar beet industry here upon a firmer basis than it has ever so far been upon. For the work being done is not for this season alone, but for the years to come as well.

CONQUER THE DESERT.

There is no more vital question to the West today than irrigation development. What the West is today she has become in a large measure through irrigation and what she will develop into in the future will be largely due to the same cause. The union of land with the waste waters which now flow uselessly to the sea during flood seasons will mean the incarnation of an inland empire and the upbuilding of rural homes to conquer and occupy the desert.

THOUSANDS FOR IRRIGATION

Congress again showed its interest in and friendless for irrigation in the West, by raising last year's appropriation of \$35,000 to \$100,000 for continuing the irrigation investigation of the Department of Agriculture during the coming year. The work is proving of great value to the arid region.

WITH OUR EXCHANGES.

SCRIBNER'S.

Richard Harding Davis's "The Relief of Ladysmith" in the July *Scribner's* is probably the most brilliant piece of war correspondence since his famous story of the fight at Las Guasimas. The first of the papers on "The Slave-trade in America" by John R. Spears, appears in this number. A remarkable series of illustrations by Walter Appleton Clark accompanies the text.

THE DELINEATOR.

There is a sensible article in the July *Delineator* that will be read with pleasure by troubled mothers. It relates to Amusements for Sick Children. It is the first of a series of articles along that line by Lina Beard, the famous sister of the famous cartoonist and author, Dan Beard. Miss Beard's volume, "The American Girl's Handy Book," has made her known in thousands of American homes. In each issue of the *Delineator* there are more colored plates, more novelties in styles, more articles of value and interest to women than in any other publication devoted to fashions and home affairs, no matter what the price may be.

SATURDAY EVENING POST.

Years ago Bret Harte wrote a series of stories which he called "condensed novels"—humorous tales, in which he burlesqued the style, mannerisms and peculiarities of the authors of the day.

Mr. Harte has just completed, for *The Saturday Evening Post*, a new series of these inimitably funny literary caricatures. Admirers of Conan Doyle should read the adventures of Hemlock Jones in his quest of The Stolen Cigar-Case; and those who are fond of Mr. Kipling will find pleasure in Stories Three; tales of Moo Kow, the Cow; Puskat, the warmth-loving one; the

adventures of Bleareyed, Otherwise and Mulledwiney. In Rudolph, the Resembler, the astute reader will find a new version of Anthony Hope's most popular story, and will understand how much more complicated it might have been had there been three kings instead of only two.

The first of these "condensed novels"—appeared in *The Saturday Evening Post* of June 30.

Among the advertising literature received this month was a nicely gotten up catalogue and price list of the Marlin Fire Arms Co., of New Haven, Conn. The catalogue is profusely illustrated and contains full information relative to the rifles, muskets, shot-guns, shells, etc., manufactured by this company. What first attracts the eye is the cover, which is exceedingly pretty. In writing for catalogue, mention the AGE.

From the Witte Iron Works Co., of Kansas City, Mo., Manufacturers of the Witte gas and gasoline engines, we have received a unique folder advertising their goods. It is printed on a heavy mottled green paper and besides the discussion of the merits of the Witte engines, has a good illustration of their manufacturing plant. In writing for this folder, mention the AGE.

The Lidgerwood Mfg. Co., 96 Liberty Street, New York, has issued for free distribution a new book on "The Lidgerwood Cableway," which will be studied with interest by every engineer and contractor having to do with the hoisting and conveying of materials of all kinds in the most economical and expeditious manner.

The book has about 200 pages, profusely illustrated with half-tones and pen sketches of the cableways as employed in the con-

struction of dry docks, dams, piers, walls, fortifications, etc., also for open pit mining, quarrying, logging, discharging vessels and transferring cargo between ships at sea.

A splendid view of a battery of Lidgerwood Cableways as used on the Chicago drainage canal forms the frontis piece to the book, and is followed by an example of the use of the traveling cableway in constructing the dry dock of the Newport News Ship Building & Dry Dock Co. Considerable space is given to the Lidgerwood Cableway on U. S. Government fortifications, notably at Gerrish Island, Me., where the cableway is used as a high-speed, long-reach, traveling crane; also at Fort Morgan, Mobile, Ala., Fort Pickens, Fla., Willets Point, N. Y., Fishers Island, N. Y., and Tybee Island, Ga.

On some of this work a new type of Radial Traveling Cableway was employed, wherein the lead tower is arranged to travel about the other thus covering a wide area for excavating and delivering concrete and other material directly to any part of the work.

A chapter is devoted to "The Lidgerwood Cableway on the High Seas," which presents various views and a complete description of the Miller Conveyor for coaling vessels at sea, recently tested and ac-

cepted by the U. S. Navy Department, and which has already received much attention from the technical and daily press. Views are also published of the traveling dock cableway with overhanging boom for discharging coal from vessels as well as for reloading barges and boats.

Placer mining by means of the cableway with self-filling drag bucket, describes very thoroughly and attractively a plant furnished by the Company to the German Bar Mining Co., at Virginia City, Mont., which employs a Lidgerwood Cableway of the radial type. The patented drag bucket is of novel construction and is claimed to be absolutely the highest development in its line.

Following chapters are devoted to the cableway for digging sand and gravel, for building bridges and piers, for handling pipe, quarrying, open pit mining, coal stripping, etc., showing several important plants. The Lidgerwood transfer for discharging vessels and for use in coaling sheds, gas houses, and large manufacturing plants is shown with special attention to the Miller-Covell double swing fall rope carrier. The volume is a very creditable piece of work throughout and furnishes valuable information as to the capabilities of the cableway as built by the Lidgerwood Mfg. Company.

ODDS AND ENDS.

WHAT'S THE USE?

By GEO. F. BUTLER, M. D.

I sit alone within my quiet room
And gaze, O Skull! into your soulless eyes,
And mark the ghastly look on thy lean
visage,
While thoughts, like waves that roll from
shore to shore,
Sweep o'er my brain, and murmur to me
things
Far, far beyond my feeble mind to grasp—
Until, impelled by some mysterious force,
I fain would call thy spirit back again
From the strange confines of its bound-
less home.
Would thou couldst speak to me who toil
on earth
Unceasingly, groping for light to climb
The torturous path to honor, fame and
wealth:
Would thou couldst utter to my wonder
ing soul
The truth I seek, yet nevermore may find,
But what's the use?
Yes, dread memento of man's living state.
No less than grewsome herald of his
death,
'Tis in the subtle sphere of thy omni-
science
To solve the mystery that shrouds my
days,
And flood my life with knowledge that
shall shine
Like morning splendors 'round my pil-
grimage.
Thine 'tis to rend the veil that hides from
me
The pathway I should follow—now I tread
With trembling feet the labyrinthine
ways
Amid whose darkness fate has made me
creep,
With only here and there a fitful gleam
Of light enough to warn, but not to
guide—

Thinking that every turn must be the last
That bars me from my heart's ambition:
The blessed goal of all my tenderest hope.
For I was fashioned in no passive mould,
But dowered with human passions from
my birth—
Fires that burned within me, thoughts
that seethed
Deep down in hidden crypts of my lone
spirit,
And urge to maddening impulse and dark
deeds
My quivering fancy shudders to recall.
Oft have I wandered forth into the night,
Communing with the lightnings and the
storm—
When rock and crag, like demons, seemed
to shriek
My name, and the shrill cataract laughed
at me,
As, like Orestes from the furies, swift
I speed, not knowing whither, only mad,
Mad with the frenzy of a pitiless doom.
If life be sweet, as in our dreams it is,
Why was this bitter mingled with the
sweet?
Why in the paltry span of three-score-ten
Must be confined all mortal happiness?
If bitter, why so long? Why unto men
Was erst decreed so dire a mockery
Of bliss to bear—Pandora's precious gifts
So wantonly disturbed, the good and ill
Shaken pell-mell, as in a lottery urn—
The only certain prize uncertainty.
Tell me, O Skull! thou oracle, that still
Must be by lingering knowledge tenanted,
Tell me these things and calm my feverish
zeal—
But what's the use?

Flower and seed their purposes fulfill,
Ripen and die, obeying nature's law:
Yet man his mission oftentimes leaves un-
wrought,
Perishes ere his time, and leaves his task
Uncrowned by fair fruition. Every leaf

And blade of grass is counted ere its birth,
Rounding its humble life to free perfection—

Man knows not when a blight may intervene

To chill the aspirations of the soul,
And from his loving heart pours forth in vain

Perchance the tenderest emotions; honor-eth truth

Only to be deceived; and leave behind him

Only a mournful memory. Tell me, thou
Whose visions compass this sad destiny,
Tell me, O Skull, how on bright wings of hope

I can attain the regions eternal
Where peace doth reign, and happier thoughts abide!

But what's the use?

And tell me this, companion weird and mute,

Why the sweet cherub eyes of innocence
In death are closed, and sinful lives are spared

To soil the world with their impurity.
Why, unto those who righteously pursue

The path of wisdom, is the way obscured,
And from the book of life its loveliest page
By vandal fortune rent. Tell me if thou,
the past reviewing, dost regret the deeds

That marked thy earthly sojourn, or lament

The loss of that for which thy spirit yearned

Through years of fruitless longing—if the guerdon

Which fond imagination loves to frame
Be worth the martyrdom. If all be false,
Tell me, O Skull! as thou wert under oath,

The truth, whole truth, and nothing but the truth,

If these our dreams are only mockery,
Then what's the use?

Thus musing, suddenly a voice I heard,
Conjured from secret chambers, as it were
The lapping of dark waves in ocean cavern:

A voice that filled my inmost soul with awe,

So supernatural was its monotone.
I looked around me and a shuddering sense

Of an unearthly presence sealed my speech.
And as I mused, with death-like prophecies

Of some impending terror—lo, the Skull
Grinned in the placid moonlight as it fell
O'er ghastly contours, and, where once had beamed

Eyes of clear lustre, warmed with living thought,

Loomed the grim sockets as the spectre spake--

"Great nature worketh wisely: not in vain

Did she create in joy from her deep bosom
Air, water, flame, and myriad fruits of earth,

But that her loving largesse might provide

Meet habitation for the sons of men.
Of wealth thou pulist, and ephemeral fame--

That dies ere thou canst recognize its face:
Know that the sweetest boon vouchsafed to man

Is service unto others: whosoever
Shall give to drink, even to a little child,
A cup of water only—so the Master
Ordains the law of human charity.

Earth is thy blest abode, and love thy mission;

'Tis idle to repine and waste thy brain
In futile quest of knowledge which from thee,

While the poor robe of clay remains thy vesture,

Is wisely veiled. There's not a single hour

That is not freighted with the power of good,

And brings to thee blest opportunity
To make thy journey richer far than gold
Or vulgar baubles madly coveted.

Life is made precious only by good deeds
Thy wealth thou needst must leave beside the tomb.

Thy kindness and the love of fellow-men
Make thee his God's almoner, and forevermore

Shall dwell on earth, a fragrant memory.
Yet purblind as thou art, O mortal man,

Thy soul is shriveled in the fires of doubt,
And from thy soul comes the despairing cry:

Oh, what's the use?"

The voice grew fainter, and, as in a dream,
I pondered long the solemn oracle.

Still, as the moonlight calmly o'er me
streamed,

Soothing my mind with pensive melan-
choly,

I could but hear the echo of that sigh,
Borne on the wings of subtle fantasy:

“But what's the use?”

IRON IN EGGS.

There is scarcely any branch in which medicine has not advanced in the last 20 years, but in no one branch has more improvement been shown than in the compounding and putting together the drugs. No more is the unwilling patient made to swallow large doses of nauseating medicine, for sugar-coated pills, capsules and wafers have come into use, and patients can now take the most vile-tasting medicines without any discomfort. Now comes along a Frenchman with a more ingenious plan which opens up pharmacy unbounded possibilities of going still further ahead.

On account of the difficulty of assimilating iron as a medicine, a French druggist has sought to introduce it in a digestible

way by what he terms ferruginous eggs.

Hens can digest iron easily while rendering it back through the albumen of their eggs in a form that is easily digested by the weaker stomachs of mankind. A salt of iron is given to the hens with grains of wheat. A dozen of these medicated grains of wheat a day makes the hens, after three or four days, lay eggs which are very rich in iron already digested.

The Frenchman is experimenting further with other drugs, and it is not without the bounds of possibility that we shall shortly be able to take all our medicine in the form of eggs.—New Orleans Times-Democrat.

UNREASONABLE.

“I don't want to hurt your feelings,” said the man who was evidently in a hurry, “but your contention doesn't seem reasonable. You say there is no telling the trouble we are going to have with the Philippines.”

“Yes, sir,” answered the excitable friend.

“Then, what's the use of taking up time trying?”—*Washington Star*.

Rather Plain.

The pastor of a certain church on leaving his study, which is in the rear of the church, one day saw a little girl friend of his talking to a stranger. "What was that man saying to you Madge?" he asked as he came up to her. "Oh," said she, "he was asking if Dr. C— was the preacher of this church. I told him you were the present encumbrance!"

THE LATEST IMPROVED HYDRAULIC RAM.

The use of a ram instead of a windmill for elevating water in country places is made thoroughly practical by the successful device known as the Rife Hydraulic Engine, advertisement of which appears elsewhere in this issue. It possesses improvements of proven merit, is not dependent on wind or weather for its operation; is simple and strong. The manufacturers claim to elevate water thirty feet for every foot of fall in the drive head. The machine is built in capacities as high as one hundred and seventy-five thousand gallons per day, and an efficiency of 82 per cent. is claimed. To obtain complete information of this wonderful mechanism our readers are invited to write for descriptive and illustrated circulars to Rife Hydraulic Engine Co., New York City.



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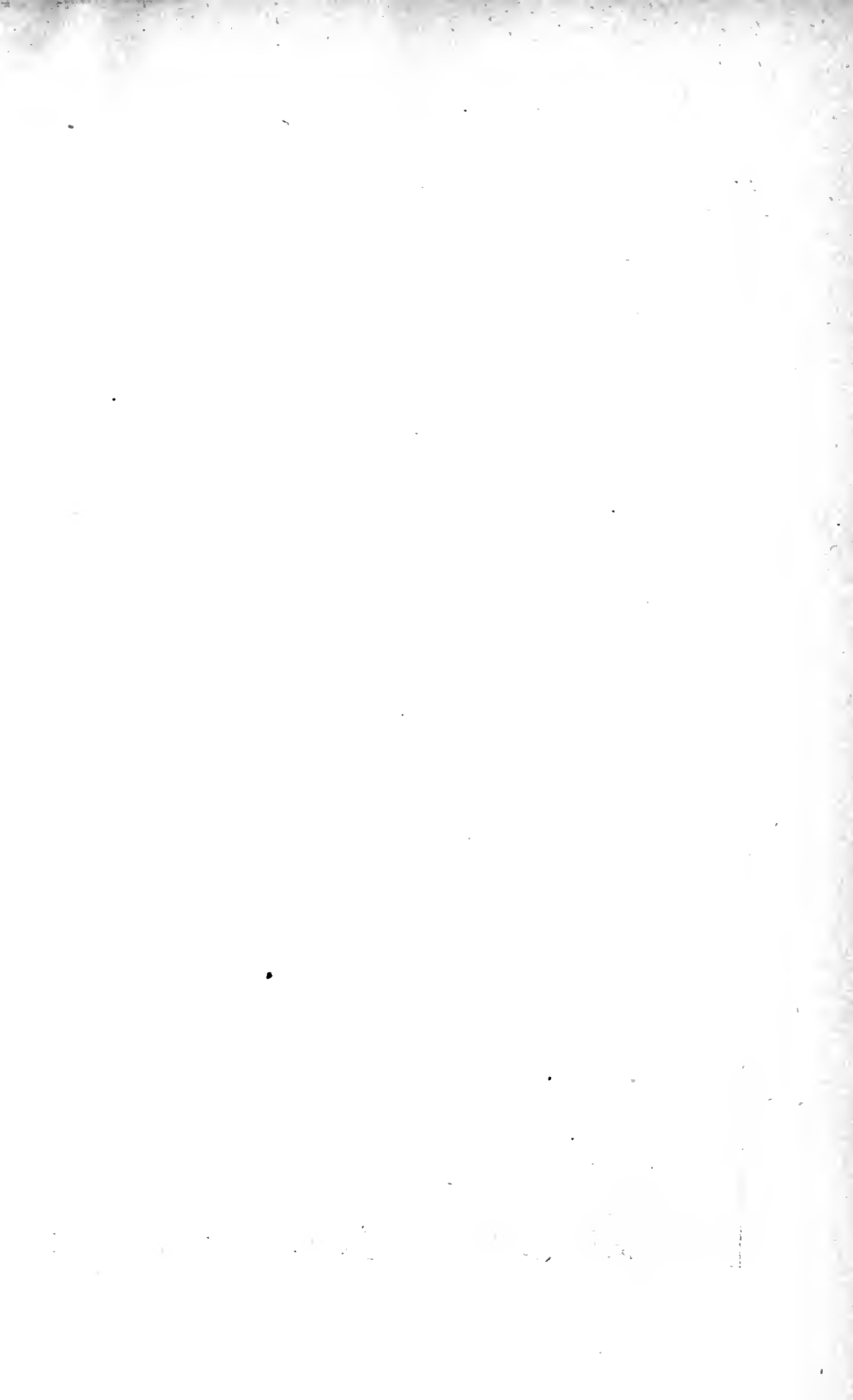
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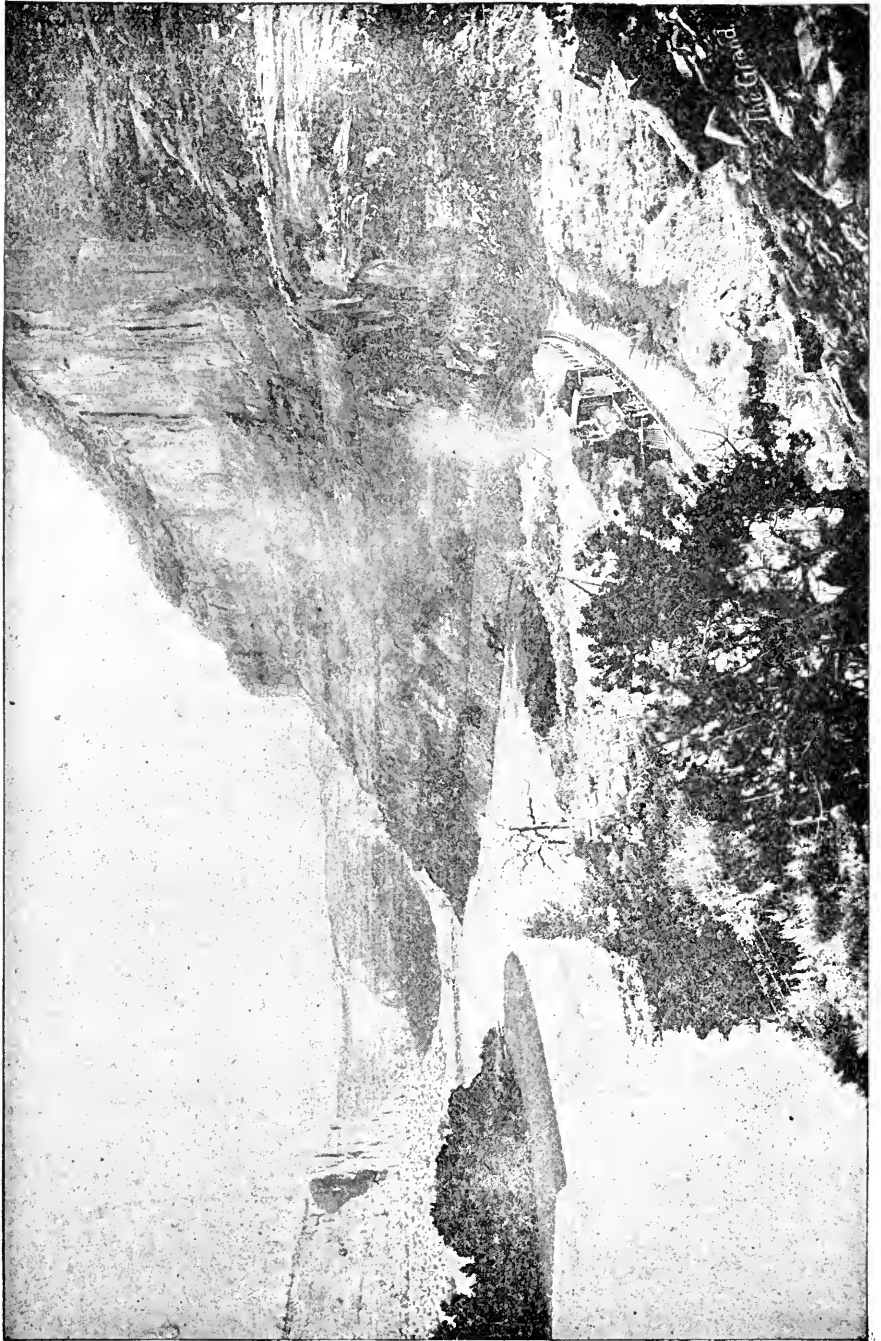
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THE IRRIGATION AGE.

VOL. XV.

CHICAGO, AUGUST, 1900.

NO. 11.

THE PROGRESS OF WESTERN AMERICA.

**Federal
Irrigation
Coming.**

Looking over the field at the close of the century it is seen that the United States stands practically alone among irrigation countries in having left all the work of reclamation to the united efforts of private capital, and in the prodigality of the surrender of public control of streams. In one respect the policy pursued has been successful. It has resulted in an enormous investment (not less than \$1000,000,000, and some estimates make it twice that sum) and the creation of taxable and productive wealth of many times the amount invested. We have now about reached the limit of this sort of growth. There will be few large private investments in canals hereafter until we have better and more liberal irrigation laws. Entrance on the coming century is confronted by larger problems: the storage of flood waters, the interstate division of streams, and the inauguration of an adequate system of public control, which will insure to the humblest handler of a shovel his share of the snows falling on mountains above his farm, no matter how far removed he may be.

**National
Control
of Water.**

The entire question of western irrigation leads up to one inevitable conclusion: This is that irrigation, over and above all other industries, is a matter demanding public supervision and control. Every drop of water entering the head gate, and every drop escaping at the end of the canal, is a matter of public concern. The public

must determine, through constitutions and statutes, the nature of water ownership. The public must establish means for the measurement of streams and for ascertaining how much water may be taken for each acre of land under the principle of beneficial use. The public must see that justice is done in the distribution of water among those who have properly established their rightful claim to it. We have thoroughly tried the method of leaving all this to private initiative and management, and along with magnificent material progress, we have reaped a large crop of deplorable financial results. While much must be left to the action of States and communities, there is still a wide field for national effort.

The National Government alone can make the best and broadest study of the various economic questions related to the development of agriculture on arid lands. This includes not only the measurement of streams and survey of reservoir sites, but also a consideration of practical methods of applying water to the soil and of social and industrial institutions adapted to the environment of the arid region. The nation alone can deal with the conflicting rights in interstate and international streams and with the construction of great reservoirs at their head waters, with a view to benefiting the several States lying along their course. The National Government is already active along all these lines, and the field for the expansion of its efforts is wide and inviting

Chicago Feeds the World.

On July 19th, S. F. Swift & Co., shipped five carloads of barreled pork and beef to Port Arthur for the use of the Russian army in China, and the same day Libby, McNeill & Libby sent five carloads of canned roasts, soups and beef to Tokio and Nagasaki, for the use of the Japanese army in China. It is expected that this is but a forerunner of other orders tenfold in size. There is but one place in the world that can supply even a moderate army, and that place is Chicago. That Chicago is equal to the task before it, and more, is shown by the official statistician of the stock yards company who says that the daily outputs of meat products would feed for one day 32,000,000 people, and some days 48,000,000 people, allowing a half pound of meat a day to each person. Half of continental Europe depend largely upon Chicago for meat products in time of peace, and in times of war no country could get along without the modern canned meats and dressed beef supplied by Chicago packers.

The War in China.

The war in China is daily growing in importance, spreading in every direction. Armies from nearly every European power are landing in Chinese territory, and though war has not been declared by any nation more people have already been killed than in war with Spain when that country lost Cuba, Porto Rico and the Philippines. There are really two Chinas, different from each others, the Manchu dynasty, survivors of the Tartar hordes who are opposed to any kind of reform or invasion of Europeans and have caused all this trouble; the other is the reform party which is willing to purchase foreign goods and adopt foreign methods whenever their superiority to native products or plans is perceived. When the day of settlement comes, if the European powers are not solely actuated by the feeling of blind revenge for atrocities committed, or by insatiate greed for territory, they will do wisely to take the reform party of China into account. But when will this final settlement come? Already the allied powers are out of harmony. It seems impossible for them to agree on a commander for the com-

bined forces. Japan has the largest army there and should have command, but Russian soldiers object. Russia has the next largest force, but the other nations dare not trust her with the reins. The other nations have such small forces there that it would be ridiculous for any one to expect to lead. Had this happened four years ago China would have been partitioned and divided among the European power, for at that time America was looked upon by other nations as a small boy who was neither old enough or big enough to be taken notice of, but America today is liable to be the dictator in the settlement, and if so, China will still be China but with an open door and a new reform government.

A Kindly Critic.

Most Englishmen after visiting Chicago and returning to their own "blarsted" country have treated us with illnatured and unjust criticisms, but Prof. Duncan, lecturer on art to the students of the Chicago Institute says he is "astounded at the beauty of this young town," and has been happily disappointed. He further says:

"I am going to lecture on art to these students—art as it appeals to children," said the professor. "I shall find plenty of inspiration in Chicago. There are so many artistic things here. There is the Zoo in Lincoln park, for instance. That fascinates me. There is not one so beautiful in Europe. There they adapt the surroundings to the habits of the animals and give a natural and artistic setting to each of them. I have spent hours at that Zoo, and I think I will never tire of it. And your buildings, and your lake shore—ah, there is no lack of inspiration in Chicago, either for the grown folks or for the children."

In general Prof. Duncan may be said to represent the kindly class of critics—men and women who know that light and shade are to be found in all cities and who do not therefore feel it incumbent upon them to pick out the shade and exclaim: "How dark!" While to the man, whether novelist or dean, who gropes about Chicago by night with a piece of phosphorus for a candle, there may be but little in the city that appeals to him, the man who, like Prof. Duncan, stands on the smooth

lawn with the breeze rustling the leaves overhead, the sunlight flecking the shade, and catches at the end of a charming vista a glint of blue that tells of the great inland sea beyond, knows that Chicago has a charm and is never nearer nature's heart of beauty, perhaps, than grimy, historic London or gay, bewildering Paris. The marvel of youth, energy and united possibilities just hinted at in Chicago's magnificent libraries and public institutions is one that never fails to attract the attention of the traveler who knows many lands and yet turns to Chicago and perhaps, like Prof. Duncan, says: "I am to stay six weeks. I fancy I should like to stay almost forever."

In the *Saturday Evening Post* of recent date appears an excellent editorial by Lynn Roby Meekins on "Our Skulkers in Time of Peace," to which all right minded persons will say "Amen." In regard to these "Skulkers," who neglect to vote the writer says:

"Already we hear from the citizen who declares that he will not go to the trouble to vote for the next President of the United States. There is no use bothering one's self, he said. The bosses run everything and obey the behests of the trusts and if the trusts don't win free silver will ruin the country. He is sick of the whole business, and he shows his superiority by staying out of it. He is just too good to mix in the affairs of ordinary people. It is possible that one of his ancestors gave his life that the right vote might be established, and it is quite certain that he is banking all he can in his social ambitions upon the genealogy of this decent member of his family. That he misses the great thing, of course, is due to the modern evolution which has lifted him beyond the sentiments and duties of a true man.

"Of all the pusillanimous persons we have in this country, those who decry the ballot and boast of staying away from the polls are the worst. Caddish millionaires who expatriate themselves because they do not like republican institutions have at least the courage of their convictions.

The little citizens who live under these institutions, receive the benefits of them, and owe their safety and prosperity to their existence, and yet brag that they will have nothing to do with the thing on which the whole fabric of the Republic is built, simply advertise their own lack of the primary principles of manhood and gratitude.

"There never was a time when the ballot of this country was so well guarded as today. There never was a time when a man's vote counted for as much as it does this year. It is the proudest privilege on earth. It is the power that makes every American a sovereign. Whether it be used for the right or for the wrong it is in itself a potency incalculable. Strange as it may seem, the safety of the ballot in these modern times is largely mechanical. It is easy to vote and safe to vote, and nobody but the voter and His Maker need ever know for whom the ballot was cast. In this campaign—particularly at the climax of the century—it should be the ambition of everybody who is eligible to the franchises to cast his vote in accordance with what he believes to be for the right and for the best interests of the greatest nation on earth.

"By all good and sound men the skulker is least esteemed. On the battlefield he is called a coward—and there have been many battlefields in order that the right to vote might be maintained. Not less important is the contest which is decided by ballots, and not less cowardly is the man who shirks his duty in peace than the one who hides or runs in war. In year of all others there should be a full vote in every section of the laud. More than a million young men who could not vote in 1896 can vote next November. Let every one of them do his duty.

The long drought in the northwest is at an end and it is reported that the crops are making an excellent showing, and in many places will be a full crop. The lowest estimation is a half crop, but these are few, and an average good yield is expected.

THE GROWTH OF IRRIGATION IN AMERICA.

THE ACCOMPLISHMENTS OF SCIENTIFIC FARMING IN THE WEST.

BY PROF. ELWOOD MEAD.

Two years ago Western members of Congress, led by Senator Warren, secured a small appropriation to enable the secretary of agriculture to begin the problems of irrigation. The secretary entrusted this work to Elwood Mead, at that time state engineer of Wyoming, and made Cheyenne the central office. The results secured were of such practical value that the first appropriation of \$10,000 was followed by one of \$35,000, and that by \$50,000.

One result has been to awaken an interest in this subject in the East and to stimulate the construction of irrigation works. The results obtained show that the ability to apply moisture when needed is one of the most effective aids to success in the East as well as West. The great field of irrigated agriculture, however, is in the West, where it controls the social and industrial future of more than one-third of the United States.

In the last year book of the agricultural department the commanding importance of irrigation as the basis of western development is set forth by Mr. Mead in an article of great clearness and interest, entitled, the "Rise and Future of Irrigation," an abstract of which is given below:

The earliest pathway of civilization on the American continent led along the banks of streams. In various parts of the Southwest, notably in the Salt River valley of Arizona, in northern New Mexico, and along the southern borders of Colorado and Utah are well defined remains of irrigation works, which have outlived by many centuries the civilization to which they belonged. In at least one instance the bank of an ancient canal has been utilized as a part of modern works.

Riding up the valley of the Rio Grande in the first half of the sixteenth century, Spanish explorers found in the midst of arid surroundings beds of beautiful roses, "not unlike those in the gardens of Castile," as they noted in their diaries. They also found Pueblo Indians irrigating the thirsty soil, as their forefathers had done for centuries before them, and as their descendants are still doing today. In this valley and along the tributary streams, and at other places in the desert wastes of the southwest, Spanish settlements sprang up and maintained themselves by means of these life-giving waters. The

ditches at Las Cruces, N. M., have an unbroken record of three hundred years of service, the history of which is written in the banks of the canal and in the fields irrigated. This is due to the sediment with which the waters of the Rio Grande are laden. Year after year this has slowly added layer on layer to the sides and bottom of these ditches, until from being channels cut below the surface of the soil, they are now raised two or three feet above. It is here that one can yet find agriculture almost as primitive as that of the days of Pharaoh, where grain is reaped with the sickle and thrashed by the tramping of goats.

From these settlements and from the conquered cities of Mexico adventurous missionaries pushed their way still farther westward, until they came in sight of the Pacific, teaching the Indians the crude art of irrigation, which they had learned either in Spain or of the simple inhabitants of the interior, and making oases of bloom and fruitage among the hills and deserts of the coast. So came the early churches and gardens of California and the first impulse toward the conquest of its fertile soil, which must always be gratefully associated with the memory of the Mission fathers.

Measured by their cost or the skill required to construct them, the small, rude furrows which watered these gardens are now of little importance. Compared to the monumental engineering works which have succeeded them, they possess today but little interest. The best preserved of these mission gardens is now an insignificant feature of a landscape which includes miles on miles of cement-lined aqueducts, scores of pumping stations, and acres on acres of orange and lemon orchards, cultivated with thoroughness and skill not surpassed in any section of the Old World or the new. It was far different at the end of the eighteenth century, when the thirty or more of these gardens which were scattered along the coast between the Mexican border and San Francisco were the sole resting places for weary travelers, and their fruit and foliage the only relief in summer from the monotonous landscape presented by the brown and arid hills which surrounded them on every side. They were under these conditions not only successful centers of influence from which to carry on the christianizing of the Indian tribes, but forces tending to break up the migratory impulse by the establishing of homes among the early Spanish explorers.

For the beginnings of Anglo-Saxon irrigation in this country we must go to the Salt Lake valley of Utah, where in July, 1849, the Mormon pioneers turned the clear waters of City creek upon the sun-baked and alkaline soil in order that they might plant the very last of their stock of potatoes in the hope of bringing forth a crop to save the little company from starvation.

Utah is interested not merely because it is the cradle of our modern irrigation industry, but even more so as showing how important are organizations and public control in the diversion and use of rivers.

Throughout the pioneer period of their history the settlers of Utah were under the direction of exceptionally able and resourceful leaders, who were aided by the fact that their followers were knit together by a dominating religious impulse. These leaders had the wisdom to adopt their methods and shape their institutions to conform to the peculiar conditions and environments of a land strange and new to men of English speech. They found that irrigation was necessary to their existence in the home that they had chosen; and that the irrigation canal must therefore be the basis of their industrial organization, which was largely co-operation; hence, the size of their farms, which are less than 30 acres upon the average, and the nature of their social relations, which are close and neighborly.

That the great material results which quickly followed could have been realized without the cohesion which came from an association dominated by religious discipline and controlled by the superior intelligence of the head of the Mormon church, is doubtful; but that the character of institutions in the valleys of Utah, both industrial and social, was chiefly due to the environments in which they were placed is beyond dispute. Co-operation became the dominant principle simply because the settlers were in a land without capital, and it was beyond the power of the individual to turn the mountain current from its course and spread it upon his lands. Only the labor of many individuals, working under organization and discipline, could make the canals or distribute the waters. A small farm unit was chosen, not because men were less greedy for land than in all other new countries, but because it was quickly seen that the extent of the water supply was the measure of production, and their ability to provide this was small. Diversified farming, which is one of the leading causes of the remarkably even prosperity of Mormon agriculture, was resorted to because the territory was so far removed from other settlements that it was compelled to become absolutely self-sustaining. The small farm unit made near neighbors, and this advantage was still more enhanced by assembling the farmers' homes in convenient village centers. One reason for adopting this plan, in the first place, was doubtless for protection against the Indians, but it has become a permanent feature, which is still adhered to in making new settlement because most satisfactory to the social instinct.

The discovery of gold in California created the Overland Trail, which wound its tortuous course across the hitherto trackless wastes of the arid domain. Its stations were usually along the banks of the streams. In the neighborhood of these, settlers had established themselves, and by means of simple furrows turned the waters of the streams upon the bottom land. This was the extent of irrigation throughout the vast region it traversed outside of Utah, before the Union colony at Greeley, Colo., became the second historic instance of

the beginnings of the present system, and one which furnished a different standpoint for a study of the subject.

As Utah is the result of a religious emigration, so Greeley is the creation of the town meeting. Its founding marked the beginning of a new and different industrial development in Colorado. Before this it was the wealth of the mines or the migratory and adventurous experience of the range live-stock business which had attracted settlement. Greeley, on the contrary, represented an effort of home making people, both to enjoy landed independence and social intellectual privileges equal to those of the towns and cities they had left. Among its first buildings was Colony Hall, and among its first organizations the Lyceum, in which all the affairs of the community were debated with a fervor and fearlessness quite worthy of Horace Greeley's following. Co-operation was adopted in the construction and management of public qualities, of which the irrigation canal was the first and most important. The wisdom and justice of making common property of the town site, the beauty and value of which could only be created by the enterprise and public spirit of all, was recognized and put into practice and satisfactory results. The only deliberate extravagance was the erection at an early day of a school building worthy of the oldest and richest New England community. The highest methods both of irrigation and cultivation were sought out through numberless experiments, until Greeley and its potatoes grow famous together. The home and civic institution of the colony became the pride of the state, and the hard-won success of the community inspired numerous similar undertakings and furnished an impulse which resulted in the reclamation and settlement of northern Colorado. Boulder, Longmont, Loveland and Fort Collins were the outgrowth of success at Greeley, and each adopted many of the ideas and tendencies of the parent colony.

Twenty years subsequent to the beginning of Utah, and contemporaneously with the settlement of Colorado, similar influences began to make themselves felt in California, especially in its southern part. Anaheim is called the mother colony. This was co-operative in its inception, and its principal irrigation system has ever remained such. Riverside followed a few years later and represented a higher ideal, but the spirit of speculation in which California civilization was born soon fastened itself upon irrigation, as it had done in the case of mining, and ran a mad race through southern California. Irrigation in this state became corporate and speculative. Where Utah and Colorado had depended only upon their hands and teams for the building of irrigation works, California issued stocks and bonds, and so mortgaged its future. Men began to dream of a new race of millionaires, created by making merchandise of the melting snows, by selling "rights" to the "renting" of water, and collecting annual toll from a new class of society, to be known as "water tenants."

After this brief sketch of the beginnings of American irrigation, some of the lessons which will be considered at a later point in this article, we may appropriately turn to the great region as a whole and the complex legal, economic and social problems with which its agriculture will vex the future.

Mount Union rises in solemn grandeur in the Wind River mountains of Wyoming south of Yellowstone Park. From this park flows three streams, which, with their tributaries, control the industrial future of a region greater than any European country save Russia, and capable of supporting a larger population than now dwells east of the Mississippi river. These streams are the Missouri, the Columbia and the Colorado. The first waters the mountain valleys on the eastern slope of the Rockies and the semi-arid region of the Great Plains; the second, the Pacific northwest, including part of Montana, all of Idaho, and the major portion of Oregon and Washington; the third, the southwest, embracing much of Utah and western Colorado, parts of New Mexico, and California, and all of Arizona.

In this vast district, when reclaimed, homes may be made for many millions of people. To effect this result is a task inferior to no other in the realm of statesmanship or social economies. It is the nation's farm. It contains practically all that is left of the public domain, and is the chief hope of a free home for those who dream of enjoying landed independence, but who have little besides industry and self-denial with which to secure it. As it is now, this land has but little value. In many places a township would not support a settler and his family, and a section of land does not yield enough to keep a light-footed and laborious sheep from staring to death. This is not because the land lacks moisture. Where rivers have turned from their course, the products which have resulted equal in excellence and amount those of the most favored district of ample rainfall.

There are only 6,000,000 acres of cultivated land along the Nile. It is all irrigated. Where there is no irrigation there is desert. This little patch of ground has made Egypt a landmark in the world's history. It supports over 5,000,000 people and pays the interest on a national debt half as large as our own. The Missouri and its tributaries can be made to irrigate three times the land now cultivated along the Nile.

The essence of the problem to be met at the outset is the control and distribution of the water supply, since not only the enduring prosperity but the very existence of the homes created will be conditioned upon the ability to use these rivers for irrigation. The diverse interest of individuals and communities, and even of different states, will all be dependent on streams flowing from a common source. To reclaim all the land possible will involve the spreading of water over a surface as large as New England with New York added. Standing now at the birth of things and looking down the vista of the future,

we can see in the course of these rivers the dim outline of a mighty civilization, blest with peace and crowned with a remarkable degree of prosperity, in case wiser laws and just policies shall prevail in the years of the immediate future while institutions are forming. But if it be otherwise, if greed and ignorance are allowed, and we ignore the experience of older countries than ours, there will remain to us only a gloomy forecast of legal, economic, and possibly, even civil strife.

In discussing this phase of the subject, let us follow the Missouri, Columbia and Colorado rivers in their lonesome course through mountains, plain and desert to the place where one joins the Mississippi, where another mingles its waters with the Pacific, and where a third flows into the Gulf of California. For it is not only interesting but important to see in the midst of what surrounding so large a future population must dwell, and upon what other resources than water and land it will rear its economic edifice.

The climate of the western half of the United States takes its chief characteristic from its aridity or dryness. The heat of its southern summers and cold of its northern winters are alike tempered and mitigated by lack of humidity. Neither the humid heat which prostrates nor the humid cold which penetrates to the marrow is known in the arid region. The western mountains and valleys are a recognized natural sanitarium where thousands of invalids are sent each year by physicians to regain their health.

The dominant feature in the physical appearance of the arid regions is its mountain topography. On every hand a rugged horizon meets the view. From north to south, from Canada to Mexico, the Rocky Mountain range makes the backbone of the continent. Along the Pacific coast the Sierra Nevada and Cascade ranges lift the barriers to intercept the moisture and condense it into snow. Between these two principal chains, with these connecting ranges and outlying spurs, are many minor systems, so that the whole country is a succession of mountains and valleys, of forests and deserts, of raging torrents and sinuous rivers winding in their sinks upon the plains or making their difficult way to the distant ocean. The far West is thus a land of the greatest scenic beauties, and widely celebrated as such.

The cultivated lands lie in the valleys, rising with gradual slope on either side of the stream to meet the foothills. Narrowing to the mountains, these valleys widen as the river loses grade and approaches the sea or its confluence with a larger stream. There are valleys which will accommodate hundreds, others, thousands or tens of thousands, and a few, like the Sacramento, in California, where millions may dwell.

In the eastern portion of the arid region, and in high altitudes further west, the land is covered with nutritious natural grasses, which furnish ideal range for live stock. But the characteristic badge of the region is the sagebrush. This brave plant of the desert is com-

monly held in derision by those who behold it for the first time, and until they learn to know it as the shelter and dependence of range livestock when the terrible blizzard sweeps from the north and as the sure indication of good soil and the humble prophet of the field, orchard and garden. Thus it happens that to the casual traveler the appearance of the region is forbidding. It is only in localities where the work of reclamation has been in progress long enough to permit the growth of trees, with farms and homes, that the value of the soil and climate can be appreciated. There are such instances in all the seventeen states and territories of the far West. One of the most striking is the Salt River valley of Arizona. Here the traveler, after a long and tiresome journey through waste places, finds himself suddenly confronted with homes rivaling in taste and luxury those of eastern states, and with orchards and gardens which resemble more the century-old gardens of France and Italy than a creation of the last twenty years.

Similar instances are the San Bernardino valley of Southern California, the Salt Lake valley of Utah and the Boise valley of Idaho.

Another fact which contributes to the breadth of the economic foundation of western agriculture is the variety and value of its mineral wealth. In this it is richly endowed, not only with the precious metals, but with the baser ones used in arts and industries, and with unusual quantities of coal, ore and building stone, the latter of which includes many rare and valuable kinds, such as marble, onyx and agate.

While the annual value of these products runs into the tens of millions of dollars, it is literally true that their development is yet in its infancy. With the extension of railroad facilities, the improvement and cheapness of mining processes, the extension of agriculture, and consequent increase in the volume and decrease in the cost of home food supply, the gain in annual production will assure in the future dimensions which would now be considered beyond belief.

To the mines must be added the forests which cloth the mountain sides, especially those of the northern part of this region. To a large extent this is still virgin ground, where only the foot of the hunter and explorer has trodden. It is a region unrivaled in its opportunities for such development of water power. The Shoshone Falls in Idaho are scarcely inferior to those of Niagara. The hundreds of streams which fall from the 10,000 level of the Rocky Mountain range to the 4,000 foot to 5,000 foot level of the plain at their base are destined to turn more wheels of industry than have yet been harnessed west of the Mississippi river. Back of the irrigated lands are the grazing lands, of which there are probably not less than 400,000,000 acres. Those lands have been the dominant factor of the pioneer life of many of the arid commonwealths, and they are destined, under proper management, to always constitute the great nursery of cattle, sheep and

horses. The irrigated farm has back of it the mine, the furnace, the factory and the civilization of Western America can not fail to have a prosperous and varied industrial life. Here there can be no one-sided development, no community exclusively devoted to the production of corn, wheat, or cotton, to manufactures, or to commerce. The farm, the stock ranch, the lumber camp, the mine, the factory and the store are destined to grow up and flourish side by side, each drawing support and furnishing sustenance to the others.

It is well to consider by what methods and by what measures of legislation the splendid resources of the arid region may be opened to development.

The first step is to determine the proper control and just distribution of the water supply. The problem varies with the different portions of the arid region. In the South streams are generally torrential in character, furnishing the bulk of their waters in heavy floods, which must be stored in the many natural sites available in the mountains at a distance from the places where the water is to be supplied to the soil. In the North, on the other hand, the problem is not that of storage, but of the diversion of great rivers like the Yellowstone, the Snake, the Columbia and the Missouri. Here works adequate to the reclamation of the areas of arid land which remain can only be built at great cost, rivaling those along the Ganges and the Nile.

Before such development proceeds further it is desirable that some common agreement should be reached concerning the true character of water rights. The idea of private ownership of water apart from the land cannot prevail without creating institutions essentially feudal in character. A water lord is even more undesirable than a landlord as the dominant element in society. It is indisputable, as has already been said, that the man who owns the water practically owns the land. A proposition which contemplates the turning over of all the land to a private monopoly, thus making a tenantry of those who may have their homes upon it in the future, could not hope to command popular support. But the idea of a private ownership of water, amounting to a virtual monopoly of this vital element, has been permitted to grow up in the West. To a certain extent it has obtained recognition in legislation and protection in judicial decrees and decisions. In other countries the doctrine has largely disappeared, and in our country it should give place to a more enlightened conception, and to the only principle that can safely be adopted as the foundation of the agricultural industry in the West.

The right to water which should be recognized in an arid land is the right of use, and even this must be restricted to beneficial and economical use in order that the water supply may serve the needs of the largest possible number. Ownership of water should be vested, not in companies or individuals, but in the land itself. When this

principle is adopted the control of the water is divided precisely like the land, among a multitude of proprietors. Reservoirs and canals are then like the streets of the town, serving a public purpose and permitting ready access to private property on every hand. Water monopoly is impossible under this method, and no other abuse is encouraged by it. Years of painful experience have abundantly proven that peaceful and orderly development cannot be realized except as water and land are forever united in one ownership and canals treated merely as public or semi-public utilities rather than as a means of fastening a monopoly upon the community. In Wyoming and Nebraska the true principle has already been adopted by the state boards of control and put into practice with the above results. If it can be maintained and speedily extended to the other states, as it surely must be in time, it would mark an economic reform of the highest significance in the life of the West.

The entire discussion leads up to one inevitable conclusion: This is that irrigation, over and above all other industries, is a matter demanding supervision and control. Every drop of water entering the headgate, and every drop escaping at the end of the canal, is a matter of public concern. The public must determine through constitutions and statutes the nature of water ownership. The public must establish means for the measurement of streams and for ascertaining how much water may be taken for each acre of land under the principle of beneficial use. The public must see that justice is done in the distribution of water among those who have properly established their rightful claims to it. We have thoroughly tried the method of leaving all this to private initiative and management, and, along with magnificent and material progress, we have reaped a large crop of deplorable financial results.

While much must be left to the action of states and committees, there is still a wide field for national effort. Only the nation can legislate as to the public lands and reform the abuses which have been referred to in connection with the present system of land laws. There is a strong popular demand in the West for legislation providing public aid in the construction of work of too great magnitude and cost for private enterprise and a growing belief that one of two things should be done. Either the arid states should be placed in a position to extend this aid, or the general government should extend the work it is now doing in the reclamation of certain Indian reservations to the reclamation of the unoccupied public lands. One policy much discussed and widely favored is legislation which will permit of the leasing of the public grazing lands for a term of years at a small annual rental, the proceeds to be given to the several arid states, and applied by them to irrigation development. If this is carried out the settlers owning the contiguous irrigated lands should be favored the object.

being to unite with the lands reclaimed a certain portion of the public pasture.

The national government alone can make the best and broadest study of the various economic questions related to the development of agriculture on arid lands. This includes not only the measurement of streams and surveys of reservoir sites, but also a consideration of practical methods of applying water to the soil and of social and industrial institutions adapted to the environment of the arid region. The nation alone can deal with the conflicting rights in interstate and international streams and with the construction of great reservoirs at their headwaters, with a view to benefiting the several states lying along their course. The national government is already active along all these lines, and the field for the expansion of its efforts is wide and inviting.

THE MISSOURI MULE.

So long as cannons bellow and gods of
battle rule

There'll be a place for Kicker, the old
Missouri mule;

And now he's sailing eastward, stamped
with the "Mo." brand,

And the old Missouri kicker is bound for
China land.

His brothers died in Cuba amid the can-
non rolls,

And others fell with burgher men around
the kopje knolls,

And now he'll board the transport and
follow the command,

For the old Missouri kicker is bound for
China land.

Strange beast, with ears that quiver and
open like a fan,

Will roam along the tea beds to scare the
Chinaman,

Will bray his very loudest in concert
with the band,

For the old Missouri kicker is bound for
China land.

His legs are like a catapult, taut for a
target aim,

Like steel and flint combined are they, for
they were made to maim,

And woe unto the Boxer man who comes
and takes his stand

Near the old Missouri kicker in far-off
China land.

IRRIGATION METHODS IN CHINA.

BY GUY E. MITCHELL.

Although the vast mobs which infest Peking and the larger cities of China, worked up to a state of frenzy and fanaticism, have rendered impossible any satisfactory action by the available forces of the Powers, the great Chinese population proper is agricultural and naturally extremely peaceful and peace-loving. Agriculture, however, is most primitive and the wonder is how such an immense population can be supported from the soil, until the great economy practiced in all things is understood. On the Great Plain of China, every available foot of land is utilized for growing something and every particle of fertility returned to the soil. Waters are used for irrigation and in many cases laboriously distributed over the fields.

The Great Plain itself is one of the most wonderful sections of the globe. It is about 700 miles in length and varies from 200 to 400 miles in width, occupying the northwestern part of the empire, and containing over 200,000 square miles of wonderfully fertile soil. The most interesting feature of this plain is its enormous population as it supports, according to the census of 1812 not less than 177 million human beings, making it the most densely settled of any part of the world of the same size, its inhabitants amounting to nearly two thirds of the entire population of Europe.

The most wonderful feature in the physical geography of China is the existence of a vast region of loess in this portion of the Empire. Loess is a very solid but friable earth, brownish yellow in color and is found in many places from 500 to 1000 feet deep. The loess hills rise in terraces from 20 to several hundred feet in height. Every atom of loess is perforated by small tubes after the manner of root fibers only the direction of these little channels is always from above downward so that cleavage to the loess mass is invariably vertical. The loess region of China is perhaps the most broken country in the world, with its sheer cliffs, and upright walls, terraces and deep cut ravines. Owing to the ease with which it can be worked, caves made at the bases of straight cliffs, afford homes to millions of people in the densely populated northern provinces where the Boxers have thus far been most active. Whole villages cluster together in carved out chambers, some of which extend back more than 200 feet. The capabilities of defense in a country such as this, where an invading army must necessarily become lost and absolutely bewildered in the tangle of interlacing ways and where the defenders may always remain concealed or have innumerable means of escape is peculiarly significant at this time when consideration is being to a conquest of China.

It may not be generally known that the Chinese were the discoverers of coal as a fuel. The Venetian traveler Marco Polo says, "It is a fact that all over the country of Cathay (China) there is a kind of black stone existing in the beds of the mountains which they dig out and burn like firewood. This stone burns better and costs less."

The rivers of China are her glory and there are few countries in the world so well watered and none with such splendid natural water transportation facilities. The three great rivers of the Empire are the Yang-tse-Kiang (Child of the Ocean), the Hoang Ho (Yellow River) and the Chu Kiang (Pearl River or Canton River). Of these the Yang-tse-Kiang is much the largest, flowing through extensive and fertile plains and finally emptying into the Eastern Sea, after traversing a distance of over 2000 miles. Its discharge is estimated at one million cubic feet per second. The banks of the Yang-tse are crowded with towns and villages, the most famous of which are Nankin and the new treaty port of Hankow. The Hoang Ho or Yellow River is noted especially for its frequent and violent floods. Its current is very rapid and its course sinuous, nearly approaching in length the Yang-tse. The Pearl or Canton River while not nearly so large as the others is a stream of great importance and innumerable vessels trade upon its waters. At some points it spreads into large lakes; in others it passes between narrow gorges which if dammed would afford large storage capacity for irrigation. The Chinese, however, have not practically worked out irrigation in its different phases as completely as would be expected of such an agricultural people.

Irrigation, nevertheless, is practiced to a considerable extent through the use of the waters of the Grand Canal and by wells. The Grand or Imperial Canal is a work of great magnitude. It was constructed in the 7th century and enlarged in the 13th century. It traverses the Great Plain and flows with but slight current for a distance of 700 miles. While built for purposes of communication its waters are used largely for irrigation and thousands of drains and creeks have been made to connect with it along its route.

The modes of irrigation are ancient and crude. One of the most picturesque is by means of the water-wheel which is used where the land to be watered is well above the channel of the river. The wheel is turned by the force of the current and is perhaps thirty feet high. Its buckets being sections of bamboo which as they are raised by the stately motion of the wheel empty their contents into troughs or ditches. Hollow bamboo pipes or tubes are sometimes used for distributing water over the fields. They rest upon wooden supports and branch in every direction from the source of supply. The chain pump is also a common means of lifting water, the chain running up from the water on a slant and being provided with little buckets at intervals, which as they reach the highest point and begin to descend, discharge their contents. These machines are worked by buffaloes or sometimes by human labor, a man working a crank with his feet something after the manner of riding a bicycle. The most primitive and laborious method is the ancient well sweep, such as is seen today on many an old New England homestead.

AGAINST IRRIGATION.

EASTERN OPPOSITION IS NOT AS VIVID AS IMAGINED.

Opposition to the irrigation problem among eastern men seems to be the spectre which is frightening so many people of the west, and paralyzing them into such inaction against what seems to be such an insurmountable obstacle, that it seems not out of place to quote a few words of Mr. Frederick H. Newell, the hydrographer of the Geological Survey along the lines of what the east really thinks of irrigation and showing that it is becoming more and more educated on this subject and more reconciled to a policy of government expenditure which will eventually reclaim the arid lands of the west. Mr. Newell, as is well known, is an expert on irrigation. He has studied the subject for many years and looking into the future of this question he commenced years ago a plan of systematic education of the country on this subject. He has delivered hundreds of lectures on irrigation for the great west, throughout the length and breadth of the land. They have always been given deep attention by his fellow scientists and a few people who have gained a good understanding of the subject, but the question, he says, stands in a very different light today with the populace of all sections from what it did some years ago.

“In years back” he said, “when I delivered a lecture on irrigation, it was considered a new thing, a fad in this country. The newspapers knew nothing about it, and nine out of ten newspaper men, having to write something about it, wrote something purporting to be funny or ridiculous. It was not that they were hostile for they knew nothing of the subject, but that plan seemed to be the easiest way to produce something readable for their papers. My lectures were a subject for the newspaper paragraphers and what publicity I secured did not help the cause of American irrigation. But there is nothing of that kind now. The newspaper man has learned something about irrigation in this country, of its possibilities and future, and he treats the subject as one of the great national questions. I am doing considerable lecturing this year—all the time I can spare for it—and the newspapers are alert to know what is being done and what has been done. Their readers take an interest in the question and anything concerning it, is news.

“Irrigation is an art almost as old as the world. It is new to this country because the influx of population came by the Atlantic seaboard instead of by the Pacific and so great acres of humid country was appropriated and settled before the arid lands were reached.

When I view the progress that has been made, however, in informing the inhabitants of this humid region of the United States of the possibilities lying in the arid region through a great system of national irrigation, and when I see the evident interest which is being manifested by them today, I think that the prospectus for the west to receive a full recognition in the near years of the future, are very bright and promising."

The surveys which the government is carrying on along irrigation lines throughout the arid west interest deeply not only that section of the country, but likewise many interests in the east. For their future highest development the east and the west must necessarily pull together. One country, one prosperity! No section of the country benefits that some other section does not likewise profit. Take the east and the west in a broad general sense. The east is a great manufacturing region. Her factories are scattered about in every eastern state. They must find markets for their goods. A home market is the more preferable. The west is a great producing section. Under a complete irrigation its population and production would be ten times doubled and ships of commerce would pour its products into the Orient. But this vast western population would draw heavily upon the manufacturing east for the products of those same factories looking for markets for their goods, and the gold of the Orient and the West would go back to the eastern manufacturers, whose increased labor demands would likewise draw heavily upon the products of the eastern farmer.

In no other country having an arid belt has the general government done so little in the matter of irrigation development. Everything in the United States has been left to individual enterprise and to State regulation, until in many of the western states and territories, water rights and the like have come to be in a badly tangled condition. It needs the hand of the central government to adjust and control matters which are interstate in the character, and until this is done, settlement, investment and the development of the country cannot but be retarded. The sooner the West instructs its Senators and Congressmen to work for a system of national irrigation, the sooner the West will reach a state of highest development and production.

THE DIVERSIFIED FARM.

SUBSOIL PLOW.

(Paper read at the Highgrove and Pasadena Farmer's Institutes by J. H. Reed).

Citrus fruit growers have made a great advance in the science and practice of orchard cultivation during the last decade. How great, I do not think we appreciate till we carefully review the cruder methods and more or less mistaken notions prevailing ten years ago. But in spite of the much we have learned, new problems arise continually, which require new study. Just now one that is attracting considerable attention is the difficulty found, especially in some of our older orchards, of getting the soil to take irrigating water as readily as is desirable. The cause is found in a hard stratum of earth just under the cultivated portion, varying in thickness from a few inches to a foot or more, which is sometimes almost impervious to water. The result is, difficulty in keeping the root stratum underneath sufficiently moist. This hard layer is doubtless caused by frequent wetting and drying out. Not being disturbed, it becomes harder after each irrigation, the same as the surface would if not carefully stirred, only to a lesser degree. The cultivator shovels constantly running over this layer also has a firming effect on it. The first question is, how best to get rid of this objectionable stratum of earth. In the East, we remember, that it is very desirable to break up the sub-soil without bringing it to the surface. This their modern sub-soil plow does effectually.

The plow is now being introduced here for the purpose of breaking up this hard layer. And those who have tried it, so far as I can ascertain, seems favorably impressed with the results. The plow is

usually run in the center of the spaces between trees once each way from 12 to 16 inches deep. It does not disturb the surface further than the mark left by the thin standard, but lifts the sub-soil sufficiently to break it up to the width of 12 to 20 inches on each side. The draft, where the ground has become hard, is necessarily heavy even with the small shoe and thin standard, requiring from six to eight good horses. These narrow broken spaces take in the water very readily. How long it will take it to work out under the unbroken squares till the entire root bed is wetted, and how permanent may be the results are questions yet to be determined. If the same general treatment of the orchard is followed, the hard layer will doubtless gradually reform, and this special process need to be repeated.

An important consideration is the effect of the disturbance of the roots necessarily made by this deep plow. I have not been able to see its workings in an old orchard. In orchards seven to ten years old the leaders at that distance from the trees have not become large. But the root stratum commencing immediately below the cultivated portion, to an indefinite depth, covers the entire area, between trees even at an early age of the orchard. This is crowded full of roots, from the minutest fibers to the largest branches of the leaders found in running the plow fourteen inches deep in an eight-year old orchard. Many roots were cut from three-eighths of an inch down. To get the full force of this, we must remember that a root even a quarter of an inch thick may extend for yards from the point where severed, with its thousands of branchlets bearing the

minute hair appendages that take up the tree's nutriment.

This makes pretty severe root pruning. How considerable the injury, considering the great mass of roots from which such trees gain their support and the quick recuperation after injury, this will occasion, I can yet form no opinion of any value. But certainly there will be a lot of root growth to be made up, and in the time a lot of little mouths lacking to take up the food of the tree. But there may be cases where the advantage to remaining roots may more than make up for this loss. In any event, it would be greatly better not only if this root pruning, but all the expense connected with the deep plowing, did not need to be. And this brings me to the second part of my subject.

Can the necessity for it be avoided by guarding against the formation of this obstructing layer while orchards are young? I am quite of the opinion that it may. But my experience has been with orchards under ten years old and I have learned that we are frequently obliged to revise opinions very confidently held, as our actual experience extends under new conditions, and this opinion may be quite wrong. If the hard layer is occasioned by repeated drying out after irrigations, if but a portion of that stratum should be thoroughly broken up once or twice a year before becoming hard, the balance of it, I think, can be kept from hardening by careful irrigation. This opinion is based on a good many years' experience in all soils from the sandy loam to stiff adobe, without any of this troublesome layer; yet you will allow me to refer to this experience in illustrating—not in any dogmatical spirit, for every year more and more I find that different men will accomplish the same desired results best, by quite different means. Once a year we thoroughly break up the surface with a walking plow, as deep as we can without permanent injury to the root system, from six to nine inches. In our earlier planted orchard where we did not commence with specially

deep plowing we have trouble with the roots even at six inches. In our later planting on deep plowing, repeated each season, we can keep a depth of seven to nine inches easily. With this annual plowing we have no trouble in getting the water into the ground during the irrigating season. We aim to make the irrigation most thorough every time. As aids to this, I want to mention two or three things that we have found of great importance.

First, we make our irrigating furrows as nearly the depth of the annual plowing as possible. Thus putting the water nearest where needed, greatly reducing the surface saturation where so much water is wasted, and facilitating the early covering of the furrows after irrigation.

Second, any portion of the orchard where there is any special occasion we cross-furrow before making main furrows. This done, with a little hard work, the short pieces of the cross-furrows are easily filled and kept full. (This is of special advantage among large trees where the spaces between the furrows, between the trees, are necessarily wide.)

Third, we run water three days in place of two, total amount of water the same. I think this practice may be adopted much more generally than it has been, to great advantage. We find that the third day leaves more water in the ground than either of the others. By this method of irrigation I feel quite satisfied that the root strata could have been kept thoroughly wet in spite of the hard layer, in any of the young orchards where I have seen the subsoil plow used. In older orchards where this layer has been hardening for years, the implement may prove of great service. Of course even in young orchards the desired results can not be secured by the most careful irrigation, except the water when once in the ground is conserved by proper cultivation.

Again, I would like to refer to our own experiences. Instead of waiting for the irrigating furrows to become dry and then

breaking them up thoroughly, bringing much of the saturated earth to the surface, as we used to do; as soon as possible—often within twenty-four hours—we cover the furrows instead of breaking them up. We do this with a single 12-inch upright plank, dragged lengthwise with the furrows. We attach the plank to the shanks of an old two-horse walking furrower. This fills the furrows from their shoulders and leaves a slight coat of pulverized earth on the rest of the surface. The object is to stop the pumping of moisture from the saturated bottoms of furrows as soon as possible. Others doubtless have, or will desire, better methods of doing this. For cultivating, several years we used the Planet Junior, with the widest shovels for the purpose of moving the hard earth at the bottom, which is more easily done than with the narrow shovels. But the objection to bringing so much of the damp earth to the surface had impressed itself upon me, till this season I was persuaded to try the Killfeler cultivator, with its large number of shovel-pointed teeth, which thoroughly stirs all the ground without exposing the wet earth. There are serious objections to this implement, but I must confess to being greatly interested in the results from it. Using it thoroughly once after each irrigation, when the ground is in best condition, after the furrows are covered, then keeping the surface well loosened with a fine-tooth harrow, we have been able, so far as we can determine, to hold the moisture better than we have ever succeeded in doing before, and find no sign of any permanent hard layers forming, to retard irrigation.

I must not be misunderstood as claiming these methods the best for the purpose, nor as recommending the implements mentioned.

I want to say in conclusion, that more and more I find myself examining results first instead of putting so much stress upon theories and methods as formerly, and believe that the individual experiences brought out in these institutes and in our

clubs have the most practical value. But I am sure that this value is trifling and transient compared with what it might be made to be with combined experiences of many upon the same subject, with minute, systematic and authentic records, continuing through a series of years. Should I be allowed a single suggestion to the managers of our institutes and clubs, it would be that during the coming year a special effort should be made to devise some better means of securing such authentic records of extended, actual experiments and observations, and encouraging their continuance, in orchard and farm work.

THE GRAZING LANDS.

The proposition to allow the western states and territories the control of the public lands situated within their borders, with the privilege of leasing them to stockmen and expending the revenue derived for state improvements, is not a new one. It is, however, equitable, and would vastly benefit the states availing themselves of the privilege, and it finds very general favor and endorsement among men who have given the conditions in the West any serious thought.

“The policy of leasing the grazing lands of the West by the states,” Secretary Wilson of the Department of Agriculture said, “cannot but operate very beneficially to those states, and would eliminate much of the trouble which the West is now having over the range question. Let the title to the land remain in the federal government by all means, but give the states the use of the lands—*i. e.*, the money which would be derived from their rental. Most of the western states have comparatively small settled areas, and these must bear the burden of caring for the remainder of the state which is government property. It would be a very dangerous move to give the land itself to the states, because before long there would then be neither state nor government land; but if it is simply a question of the state disposing of the annual income from rentals, a proper system

of expenditures would soon become established. This would practically dispose of the range question, as leases could be made for terms of years, and there would be then no conflict of right."

Nothing could more forcibly illustrate the absolute necessity for the inauguration of such a leasing system as above advocated by Secretary Wilson, nor the utter inadequacy of the present land system in the arid region, than a recent Cheyenne (Wyo.) dispatch, in which it is stated that open war is threatened on Wyoming ranges. The most strained relations exist between cattlemen and sheepmen. "Especially is this true," the dispatch says, "in Converse and Carbon counties. Near Saratoga, masked cattlemen forcibly removed the sheep from certain mountain ranges, and fear is felt that open war will soon break out. Between illegal fencing and false pretense, homesteading, with corraling of water rights, the general welfare of the bona-fide stockman is being greatly damaged."

This dispatch shows the serious condition which exists to a more or less extent all over the West through the overcrowding of ranges, and emphasizes the statements that it is time and past time for the enactment of laws which shall provide equitable rights for legitimate stock raisers and do away with the dangerous controversies which now exist in every grazing section.

BIG TREES OF CALIFORNIA.

It seems like a desecration, but unless prompt measures are taken either by California or the United States the great Calaveras big tree grove will soon disappear at the hands of the woodman and lumberman. Robert Whiteside of Duluth is the prospective tree vandal, having an option on the big forest. He has no intention to utilize its scenic beauties; he is merely figuring how much lumber the gigantic sequoias will make and how much profit will accrue to him from the purchase of a forest nature has spent centuries in making the most

unique to be found anywhere upon the globe. The San Francisco *Chronicle* gives this description of this magnificent forest and wonderland, and tells what steps are being taken in California to prevent such an outrage as the destruction of these wonders of nature:

The Calaveras big tree grove is sixteen miles from Murphy's, near the Stanislaus river, north of Stockton, and is at an elevation of 4,759 feet above San Francisco bay. Within an area of 3,200 by 700 feet there are ninety-three mammoth sequoia gigantea and more than 100 mammoth sugar and yellow pines. Thirty-one of the sequoias range from 230 to 325 feet in height and measure from thirty-one to sixty-one feet in circumference six feet from the ground. What these heights mean may be imagined from the fact that the Claus Spreckels building is 310 feet high to the base of the flagpole. The famous Keystone State and Gen. Jackson, each 325 feet high; the Mother of the Forest, 320 feet high and sixty-one feet in circumference; Daniel Webster, Richard Codder, Starr King, Henry Clay, Bay State, Abraham Lincoln, Uncle Sam, U. S. Grant, George Washington, Henry Ward Beecher, Florence Nightengale and other stately forest giants thousands of years old and known to tourists all over the world are to go to the sawmill at the trifling rate of less than \$26 an acre for timber and land together. At this rate these mighty forest sentinels are being bought up at about \$5 apiece, for there are several of them to the acre.

Now that these trees, the like of which exist in no other part of the world but California, are about to be felled, tardy public interest is being aroused. The Sierra Club and the San Joaquin Valley Commercial Club, the Water and Forestry Association, the Pioneer Club, the California Club and both universities are considering methods of preventing the wholesale vandalism. Two courses are open. Money enough may be raised to pay Robert Whiteside the lumber value of the whole

tract, or he may somehow be deterred from setting his saw mill in operation until by memorials and personal efforts of legislators congress or the state legislature may be induced to decree that the Calaveras grove shall be a public park purchased at public expense.—*Chicago Record*

MAKING PORK OUT OF SNAKES.

Snakes as food for hogs beat chestnuts, acorns or any of the foodstuffs. Of course you know that in some parts of Europe pigs have killed out the vipers. I was in West Virginia some months ago and found that a novel industry had been undertaken by a number of men whose lands were overrun by the small variety of snake that infests that section. The snakes were so numerous as to be a nuisance. One farmer tried the hog as an exterminator. He succeeded so well that he found the drove of animals he had turned loose on the plantation had not only decreased the number of snakes, but that they were actually thriving on them. He told his neighbors about it, and now the whole valley is one large hogpen in which hundreds of the animals are feeding literally on snakes. Formerly no one would buy land there, notwithstanding

the beauty of the place, because of the snakes, but now that the remedy has been found and at the same time big money is made on the pigs that grow fat on snake food the land is destined to be in great demand, as it is the most fertile land in West Virginia. This may sound like a fairy snake tale, but I assure you that it is correct and that hundreds of pigs are sold from the valley every year that have literally become fat on snakes.—*Washington Post*.

NOTES ON FORESTRY.

A system of co-operation for the coming summer has been arranged between the Division of Forestry and the forest reserve work of the U. S. Geological Survey. The latter is a branch of the Department of the Interior. Field parties of each division will collect information desired by the other, and, in some instances exchange of men may be made. This system marks a distinct change from conditions of a few years ago, when there was sharp rivalry between the scientific branches of Government service. The Geological Survey will give especial attention to collecting data on forest fires for the Division of Forestry.

PULSE OF THE IRRIGATION INDUSTRY.

ANCIENT IRRIGATION.

Discoveries were made recently in the lava beds of New Mexico which prove that thousands of years ago there existed in New Mexico a system of reservoirs, irrigation and viaducts that is unparalleled at this age.

Under the lava, which covers hundreds of square miles, are found traces of cemented ditches and reservoirs that are marvels of civil engineering. Our irrigation engineers have much to learn from the people, older than the Pueblo race, who inhabited New Mexico when the race from which Columbus sprang were still barbarians. The ancients provided against seepage by cementing the bottoms of their ditches whenever they were conducted across loose soils. Their ditches wound in and out at the base of mountain ranges, following the sinuosities of canyons and rounding points in such a manner as to catch all the storm water before it was absorbed by the loose sands at the mountain's bases.

Reservoirs at convenient basins stored the waters, which was led in cemented ditches across the loose soils where it was needed for use. Chasms were crossed by viaducts and wonderful engineering devices were used for the removal of silt that might be used as an aid to the fertility of loose and rocky soils, otherwise valueless. Into some of the ditches lava had run, showing their great antiquity. Others are now covered with shifting sands, but enough are still visible in many places in New Mexico to enable the skilled engineer to understand the system which prehistoric New Mexicans rendered so effective.

In those days the deserts bloomed like a garden and a civilized race of millions oc-

cupied the arid southwest. If congress desires to aid the work of reclaiming our arid lands they can do it no more effectively than by sending out a competent engineering force to study the few remains of the most ancient inhabitants of this country, enough of which are still visible to teach valuable lessons of water conservation.—*National Advocate*.

A STUDY OF THE WATER-RIGHT PROBLEM OF CALIFORNIA.

In response to a petition signed by many of the leading citizens of California, the U. S. Department of Agriculture has, through the Irrigation Investigations branch of the Office of Experiment Stations, begun an exhaustive inquiry into irrigation conditions in that state. The petitioners say that "nowhere in America are there irrigation problems more important, more intricate, or more pressing than in California * * * [where] great sums have been lost in irrigation enterprises, still greater sums are endangered, water titles are uncertain, and litigation is appalling."

During the last ten years the State Supreme Court has heard more than 100 irrigation cases, while many of the most important issues have been heard in the United States Courts, some of them going to the U. S. Supreme Court. This litigation not only renders existing property rights insecure but puts a stop to further investment along this line.

In addition to the general work on the use of water in irrigation, which is being carried on in all the arid states, the work in California includes a comprehensive study of the whole irrigation situation, looking to the remedying of the evils which

are checking development along this line in that state.

The work is under the general supervision of Mr. Elwood Mead, the expert in charge of Irrigation Investigation. The field work will be in charge of a corps of experts, including Mr. James D. Schuyler, of Los Angeles, Prof. F. Soule, of the State University, Prof. C. D. Marx, of Leland Stanford University, Messrs. C. E. Grunsk and Marsden Manson, of San Francisco, Wm. E. Smythe, of Susanville, and Mr. J. M. Wilson for several years the state engineer of Nebraska.

The work being done on the streams and irrigation systems selected for investigation includes study of the following:

(1). Abstracts of the records of claims to water, character of those records, number of claims, total volume claimed, places where recorded, and the ease or difficulty with which the validity of any claim can be determined.

(2). Rights to water for purposes other than irrigation, namely, mining, power and domestic purposes.

(3). Methods by which the amount and character of water rights are determined, accessibility, and completeness of the established rights.

(4). Character of litigation over water rights, its causes and cost, its influence on irrigation development, and the principles established by decisions rendered.

(5). Rights for storage and underground waters, how acquired and how affected by rights to the surface flow of streams, and the influence of the underground waters on the streams's discharge.

(6). Nature of an appropriation of water. To determine who is the appropriator, the ditch builder or the owner of the land on which the water is used; or is the land itself the appropriator. Also to determine the true measure of its amount, the size of the claim, the capacity of the ditch, or the area irrigated.

(7). The volume of return or seepage water and its availability for being again

diverted, and influence on value of irrigator's rights.

(8). Size, number, location, and capacity of ditches and other distributing works established, and irrigation duty of water.

The work also includes collection of data showing how water is divided among different ditches from the same stream; how it is distributed among users; the nature of water-right contracts between canal owners and water users; what contracts have proven satisfactory; and what forms of contracts have given rise to controversy, and the reason therefor. Facts showing rates for sale or delivery of water and the methods by which these rates have been established will also be collected.

When the field work has been completed a conference of all those taking part in the work will be called and a thorough study of the data obtained will be made. It is hoped that the results will be published by the time the State Legislature meets, in order that the data collected and the conclusions drawn from them may aid in giving to California a code of irrigation laws which will protect present investments and remove all checks to the future development of agriculture by irrigation.

The work has the hearty co-operation of those most interested in the development of agriculture in California. It has been endorsed by the California Water and Forest Association, an organization whose object is the storage of water for irrigation, and the two great universities of the state have given the services of representatives of their faculties, without pay, except actual field expenses.

WHAT OTHERS SAY.

I have had a little experience in irrigation, and in a different way from most other folks, I reckon. In the summer of '97 I was raising truck, and dry weather coming on, the supply was running far behind the demand. About this time my brother returned from a visit to Valley Mills and told a great tale about a man who irrigated with a wind pump and tile

ditches. Now it happened that right under one end of my truck patch ran a tile ditch. It was fourteen inch tile and carried the water from a never failing spring. The ground along the course of the ditch was very productive and also very dry and loose. So I thought I would imitate the Valley Mills man as best I could, and went to the lower end of the ditch and threw up a dam. In a few days great damp spots began to appear on the ground over the ditch. These spots would fade away in the heat of the day, and then appear again in the morning. It was not long until there was a change in vegetation. The first thing noticed was that almost the whole surface of the ground along the ditch was covered with little weeds, which had a decided inclination not to stay little. I tore away some of the dam, letting some of the water out, and ploughed and hoed the irrigated part. Then I built the dam again. And how the truck did grow! I think it was fifty per cent better here than elsewhere. In this part of the patch I had cucumbers, tomatoes, sweet and Irish potatoes, and many were the exclamations of surprise and delight when I marketed them. I have had some experience in irrigation by running a spring branch over the surface of the ground, but it is just nothing when compared to the tile ditch. In irrigating by means of a tile ditch, care must be taken not to get the ground too wet, as it will rot the roots of the truck. For fear someone will draw a wrong conclusion as to the amount of water I had, I will say that a two inch tile would have carried all the water in a dry time.

* * *

Irrigation certainly pays from what experience I have had. We have a truck farm on muck soil, and in draining it we made the ditches in such a manner that we could use them for irrigating them if necessary. We have a water supply higher than our farm, but it must pass through their farm. Whenever we need the water, the main ditch is closed and the water turned down a lateral ditch. On the

ditches we use wedge shaped boards, and put them where needed, and the water can be raised or lowered at the operator's will. It costs little or nothing to do this, and the help to the the crops is quite an item. We raise mostly onions on this muck soil. On such soils water can be used to better advantage than on clay land, as the water is more porous.

* * *

It is evidently not common to irrigate in the central west. Many do not appreciate that in large sections of country we live over a lake of water. About here it is often within 20 feet of the surface. Another fact that many do not consider is that our machinery for pumping is now so very simple and economical. Pumping water is one of the most simple problems of mechanics. I have a friend who grows small fruit and garden plants for market. He uses a wind mill to irrigate one-half acre. And he says that in the berry season he drenches the soil every other day, if dry weather. That it makes a uniform growth and large and high flavored fruit. It also largely increases the yield. He tells me that with a good well he can irrigate an acre enough for small fruit with one wind mill. I once tried watering a few hills during a very dry time, and I found that to overflow the ground hardened it, and of course when hard, it dried out more than ever. A man came to my creek one day with a water tank to get water to wet some currant bushes. But a little vigorous talk induced him to invest in a wind mill. In irrigation as in manuring too many are wanting to water their plants when they are not half tilling the soil to save what moisture they have. If the soil is fairly damp, a dust mulch two inches deep will stop the evaporation at least ten tons per acre a day. An inch of rain is 113 tons. So in thirteen days one may save as much water from evaporating as equals an inch of rain. There is more in a shower than simply the falling of water. In fact the condition of a low barometer and presence of clouds are often

worth more than the water that falls. One can have some of these advantages by watering in cloudy weather, but much of the irrigation must be done in dry weather with a low barometer. A Wesleyan preacher said the other day, that the more religion a church has the less ice cream it took to run it. Is it too strong to say that the better tillage one has the less irrigation it takes to run the cropping? I was looking at a field of corn a week ago when

it was dry and to the owner that that corn had a rough surface all over the field and looked hot like brick. The ground was thin and the corn small enough so that the soil shone on it white and hot. What could he expect? Irrigation may be quite profitable in gardening. I should try it. But not in field crops in Indiana, with wheat at 60 to 70 cents.

* * *



WITH OUR EXCHANGES.

SCRIBNER'S.

For July contains so much that is excellent that it is hard to decide what to mention. "The Tendency to Health," by Daniel Gregory Mason, is such a helpful, practical, and withal, entertaining article that it should be widely read. "'Seek and ye shall find' is true of unpleasant as well as of pleasant things," says the writer. "The better way is not to seek. Happy is the man who forms, early in life (or if not early, then late), the habit of taking all the light and warmth and cheer he can get—with a fine glow of appreciation, looking, meanwhile somewhat sidewise at those opposite experiences he cannot escape. "Let him squint a little or look the other way." This is good advice and one finishes the article with a resolve to look on the bright side of things and forget aches and pains as far as possible. The first article in the magazine is "The Slave Trade in America," by John R. Spears, and a number of fine illustrations by W. A. Clark adds to its attractiveness. Fiction is ably represented by two stories—"A Vain Shadow" and "The Colligo Club Theatricals," while "Trees," by Frank French, and "The Relief of Ladysmith," by Richard Harding Davis, are among the other things which seem to make this number so attractive.

M'CLURE'S

For July contains the first article of a series of studies of the most conspicuous of our present day political figures, written by Wm. Allen White, of "What's the Matter with Kansas?" fame. An editorial note states that the characters to be presented "have been chosen irrespective of the political sympathies of either Mr. White or the editor." Mr. Bryan is the subject of this first sketch, and whether

he will be pleased by Mr. White's delineation of his character is subject to question. Rudyard Kipling contributes a tale of the Boer War entitled "The Outsider," and Bret Harte gives one of his characteristic American stories—"A Jack and Jill of the Sierras." "The Star Spangled Banner," by Marion Hill, is an amusing article showing what queer ideas school children have of the patriotic songs they sing.

THE REVIEW OF REVIEWS.

Campaign year furnishes the cartoonists an opportunity which they are not slow to take advantage of. The *Review of Reviews* for July gives a number of the best of the cartoons for the month. The pictures of the presidential candidates are given together with short articles regarding them. Hugh H. Lusk, formerly a member of the New Zealand Legislature, writes of "The Australian Constitution," showing in what it resembles and in what it differs from ours. Helen R. Albee urges the advantage of a philanthropy which shall provide remunerative employment for country dwellers. She says that in founding libraries, art galleries, etc., philanthropic persons have "almost wholly ignored a most promising field of operation. It has overlooked the undeveloped and unused labor of young men and women who, for lack of steady and remunerative employment leave their homes and add to the increasing throngs that seek the large cities, thereby rendering the problems of our population and the unemployed more and more complicated." Cabinet making, lace making, and weaving are some of the employments which might be opened to the country people if the right means were taken. Another timely article in this number is "The Provision for Chil-

dren in Public Libraries," by Katherine Louise Smith.

THE LITERARY DIGEST.

In its issue of July 14 discusses the "Opening of the Democratic Campaign," "The Pekin Massacre," "Ending of the Chicago and St. Louis Strike," and "Boston's Experiment with Municipal Ownership." Letters and art, science, invention, religion and foreign topics all receive due attention in their various departments.

THE SATURDAY EVENING POST.

"Rural Free Delivery of Mails," by Perry S. Heath, Assistant Postmaster General is included in the contents of the July 14 issue. This is one of the most important things to farmers and the ably written article of Mr. Heath gives a concise account of the beginning and gradual growth of this system. The rest of the magazine is up to its usual high standard of excellence.

THE LADIES' HOME JOURNAL.

Four short stories, the beginning of one serial, and the concluding chapters of another give the August *Ladies' Home Journal* claim to the title of Midsummer Story Number. There are besides upward of thirty other features: "College Girls' Larks and Pranks," "The Haunted Houses of New England," "My Summer with Some Chipmunks," "A Missionary in the Great West," by Rev. Cyrus Townsend Brady. "How a Girl Can Work Her Way Through College," "Conversation and Good Form in Public Places," etc. Pic-

torially the August *Journal* is made unusually sumptuous by the work of nine illustrators and by innumerable photographs. "Through Picturesque America" will command particular attention, and Howard Chandler Christy's "American Girl in Society" is another notable artistic feature. A waltz, "Golden Poppies," is attuned to the slumberous summer days and is exceedingly pretty. From cover to cover the August *Journal* is entertaining and attractive. By The Curtis Publishing Company, Philadelphia. One dollar a year; ten cents a copy.

THE FORUM.

The July *Forum* is of such even excellence that among the thirteen articles presented therein it is difficult to select any one as especially worthy of mention. If preference must be given we may name "Our Relations with Germany," by Wm. C. Fox of the Bureau of American Republics; "Kiaochou: A German Colonial Experiment," by Hon. Charles Denby, Jr.; "Social Reform and the General Election" (in England) by Thomas Burke; "The Shipping Subsidy Bill," by the United States Commissioner of Navigation, E. T. Chamberlain; and "The Passion Play at Oberammergau," by Professor Hans Devrient. Other articles deal with the alleged increase of crime in the United States, the position of the United States as a world power, the real story of Hawaii, Chinese civilization, the advisability of entering the government service, and the growth of American outdoor literature.

ODDS AND ENDS.

STRANCE MONEY.

"The strangest money I ever saw." said a commercial traveler to a Washington Star reporter the other day, was in the mountain districts of Kentucky and West Virginia. Early last spring I was making my semi-annual tour through this region, and I stopped at a little grocery store and saloon, not to sell goods, but to get a drink of the 'mountain dew.' While I was pouring out my drink a big, husky mountaineer entered the place and called for a drink. As he finished gulping it down he reached into a large pocket and drew forth what looked to be a coonskin. He laid the skin on the counter; the barkeeper took the skin, and, opening a drawer, hauled out a rabbit skin, which he offered as change. The mountaineer picked up the skin and started to the front part of the store, which was the grocery department. He there bought a twist of plug tobacco and tendered the rabbit skin in payment. He received a big twist of long green, and I was surprised to see the storekeeper reach in another drawer and tender him a squirrel skin. The mountaineer tucked the squirrel skin in his pocket, walked out, unhitched his horse and rode away.

"I became interested, and engaged the proprietor in conversation. He told me that sometimes he would go for months without seeing any real money, and that the mountaineers used the skins in all kinds of trades, such as buying provisions, horses, etc. He said that four times a year a hide-buyer from Lexington or Cincinnati visited the country and bought up all the skins, which were generally concentrated in the few stores in the vicinity.

"But of all the queer financial transactions I have ever known," continued the

drummer, "the oddest came under the head of 'paying the fiddler.' It had been noised abroad that a dance was to be given a little way up the mountain, and I agreed to go along with one of the boys to see the fun. After going through the elaborate preparation of blacking his boots and putting on a white shirt and collar, I saw my companion go to the potato bin and carefully select a dozen nice potatoes and put them in his pocket. No sooner had we arrived at the 'music hall' than he gracefully surrendered his vegetables for an entrance ticket. But what puzzled me the most was that upon coming out, after dancing all night, he was given two onions as change. I have been trying to make up my mind ever since just what that dance was worth in the 'currency of the realm.' "

THE WRONG STATION.

The train was roaring along about forty miles an hour, and the conductor was busily punching tickets full of holes, when a little, thin old man who sat in one of the corner seats plucked his sleeve.

"Mr. conductor, you be sure and let me off at Speers Station. You see, this is the first time I ever rode on steam-cars, and I don't know anything 'bout them. You won't forget it, eh?"

"All right, sir, I won't forget."

The old man brushed back a stray lock of hair, says Harper's Round Table, and, straightening himself, gazed with increasing wonder at the flying landscape, every now and then exclaiming, "Gracious!" "By gum!" etc.

Suddenly there was a crash, and after a number of gymnastic moves that made him think of his school days, he found himself sitting on the grass of the embankment alongside the track.

Seeing another passenger sitting a short distance away, patiently supporting various parts of the splintered car across his legs, he inquired:

"Is this Speers Crossing?"

The passenger, who was a drummer, and not altogether new to such happenings, replied, with a smile, although in considerable pain:

"No; this is catastrophe."

"Is that so," he irritably exclaimed. "Now I knew that conductor would put me off at the wrong place."

NOTABLE SAYINGS—REVISED.

The Mobile, Ala., Register, (Dem.) suggests that in view of the attitude of many Americans regarding the nation's policy in the Philippines, and in following out the pull-down-the-flag idea, it may become necessary to revise the sayings of some of departed heroes, and submits the following examples:

Give up the ship.—Lawrence.

Be sure you are, then apologize for it.—Davy Crockett.

We have met the enemy and ours are theirs—Oliver Hazard Perry.

Wait until you see the whites of their eyes, boys; then run.—Andrew Jackson.

Don't hold the fort; I am running.—W. T. Sherman.

Damn the torpedoes; take a sneak.—David Glasgow Farragut.

I propose to get out of this line if it takes all summer.—U. S. Grant.

There stands Jackson like a stone wall; but he is a fool to do it.—General Lee.

When you are ready, Gridley, you may skedaddle.—Dewey.

HEALTH BEFORE BEAUTY.

Two Irishmen who had not met for years ran across each other in Derby, and after a period of handshaking adjourned for some moist congratulations.

"Long time since we met, Pat, isn't it? Great lot of things have happened since then."

"Yes, indeed. Look at meself. Sure, it's married I am," replied Pat.

"You don't tell me."

"Faith, and Oi've got a fine, healthy boy, and the neighbors say he is the very picture of me."

O'Grady looked at Pat, who wasn't built on the lines of a prize beauty.

"Och, well, what's the harrum so long as the child's healthy?"—*New York World*.

FASHIONS IN WORDS.

There are fashions in words as in things that we wear,

They rise and they reign without reason,
And the word that to-day may seem pleasant and fair

To-morrow may be out of season:
The expression that now in Chicago we've caught,

For pen and for tongue always ready,
Is the "strenuous" one that was recently brought

And left by the "strenuous" Teddy.

It is good, I admit, and it fits to a T
With Teddy, the daring rough rider,
But applied to all sorts and conditions,
you see,

Is often a sorry outsider;
For since Teddy was with us and gave it
us pat

We make the word suit every action,
And from "strenuous" this and from
"strenuous" that

Derive a superb satisfaction.

When the mayor speaks out 'tis in
"strenuous" way,

His votes are "strenuous" measures,
And when aldermen felt one another in
play

They're taking their "strenuous"
pleasures;

When a bandit is shot after "strenuous"
fight

The shooter's a "strenuous" fellow;
When convicted ex-bankers are shut out
of sight

They utter a "strenuous" bellow.

We have "strenuous" days when the
heat is intense,

And "strenuous" nights when 'tis
cooler,

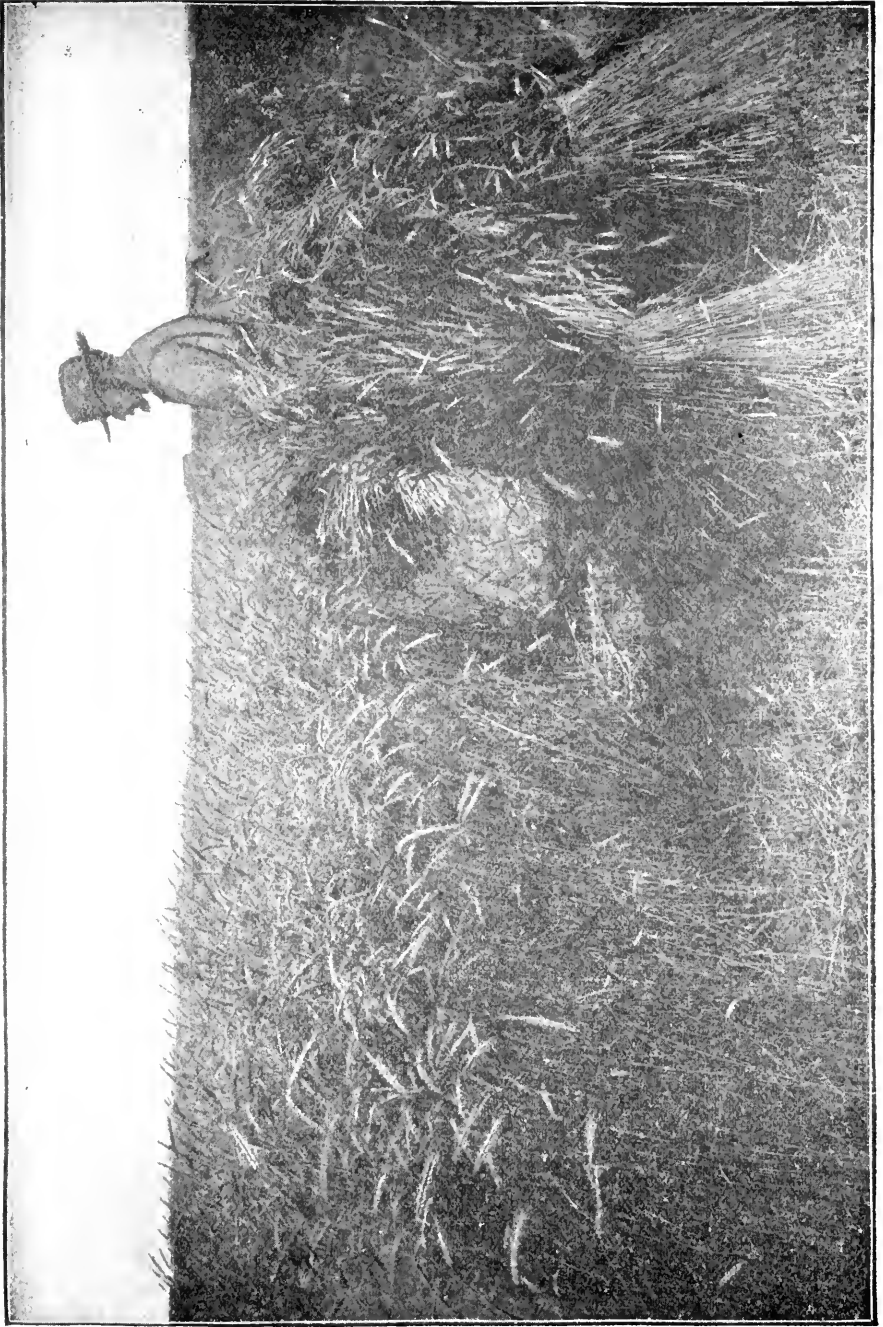
And that "strenuous" phrase gives the
greater offense

As "strenuous" ushers grow bolder;
Still all fashions go by, be they wise or
absurd,

For time their pretensions will smother,
And now in exchange for that "strenuous"
word,

Good Teddy, just pass us another.





THE IRRIGATION AGE.

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THE PROGRESS OF WESTERN AMERICA.

Eastern Interest That the eastern manufacturer is awakening to the possibilities of an irrigated West as a market for his products is shown to some extent in the remarks of Mr. Tom. L. Cannon, the representative of an Eastern manufacturing association, at the recent Trans-mississippi Congress. Mr. Cannon said in part: "If the water that goes to waste in the mountains of the arid regions were stored and controlled it would save to the federal government, by preventing floods in the overflowed lands along the Mississippi river, more than the cost of construction and operation of reservoirs. If arid America were made humid, the crops produced would give to the federal government revenue in the way of increased taxation: millions of people would be employed, millions of homes would be established, and the richest country ever known to the world of commerce would be developed.

"If steps were taken for the construction of storage reservoirs by the federal government for the reclamation of arid America, the next fifty years would show a ratio of increase in population far greater in this section than during the past fifty years.

"I believe it to be the duty of every man who is interested in populating the western half of this hemisphere as densely as the eastern half is populated, to aid in the reclamation of arid America through irrigation by means of federal storage reservoirs, which will serve the double

purpose of irrigation supplies and flood protectors."

Fraffic with our Islands. Commerce between the United States and Porto Rico during the two months in which the new tariff act has been in operation shows an enormous increase over that of the corresponding two months of the preceding year. This is the more observable because of the assertion which has been frequently made during the past few months that the island is practically impoverished since the storm of last August. Notwithstanding the conditions due to the storm both as to material for exportation and facilities for purchase, the exports to the United States in May and June, 1900, were 50 per cent in excess of those of the corresponding months of 1899 and the imports from the United States were more than double those of the same months in 1899. In May and June, 1899 the imports into the United States from Porto Rico, as shown by the Treasury Bureau Statistics were \$1,461,998, and in May and June, 1900, they were \$2,322,124. In May and June, 1899, the exports to Porto Rico from the United States were \$666,987, and in May and June, 1900, they were \$1,587,478. Thus the imports into the United States from Porto Rico show in May and June, 1900, an increase of 60 per cent over those of the same months of 1899, both of which occurred prior to the storm of that year, and the exports from the United States to Porto Rico show an

increase of 140 per cent over the corresponding months of 1899.

The figures of the total commerce with Cuba, Porto Rico, Hawaii and the Philippines show in each case a marked growth, especially in exports. To Cuba the total exports of the year are \$26,513,613 against \$18,616,377 in the fiscal year 1899, and \$9,561,656 in 1898. To Porto Rico the exports in 1900 are \$4,640,435 against \$2,685,848 in 1899, and \$1,505,946 in 1898. To the Hawaiian Islands the exports for the year 1900 are \$13,509,148, against \$9,305,470 in 1899 and \$5,907,155 in 1898. To the Philippines the exports of 1900 are \$2,640,449, against \$404,193 in 1899 and 8127,804 in 1898. To the Samoan Islands the exports of 1900 are \$146,267, against \$56,522 in 1899 and \$39,982 in 1898. To Guam the exports of 1900 are \$13,247, against 6,883 in 1899, and \$1,070 in 1898.

Chicago acknowledges that she is noisy and dirty, that her men are always in a hurry and her women all have big feet, but she is now prepared to refute the charge of being a divorce center. This might have been some years ago but is not at present since recent statistics prove Cleveland, O. to have the same ratio of divorce applications to marriage licences as Chicago. During the year ending June 30, 1900, Cleveland had 646 applications for divorce and 3225 marriage licences—a ratio of 1 divorce application to five marriages. In Chicago for the past six months there were 1912 divorce petitions and 9340 marriage licences issued, which gives the same ratio as for Cleveland one to five. In Massachusetts the ratio is about one to fourteen.

Commenting on these statistics, the Springfield Republican says: "Now, it is true that there has been considerable progress toward uniformity in divorce legislation among the states, and sufficient cause for divorce in Illinois and Ohio is, generally speaking, sufficient cause in Massachusetts. It would, moreover, be difficult to maintain the proposition that marriage is more generally happy, or its requirements more generally observed, in Massachusetts than in the Central West; and while it may possibly be true that the

more sturdy and sober New England character will endure an unhappy union from religious or other motives longer than our descendants in the West, no probable difference on this score will explain to any appreciable degree the great difference in the figures. It seems to be the case that while the divorce laws of the West are nearly or quite as strong as our own, their administration is much weaker."

Under the title "Water Cure for National Ills." the Chicago **Irrigation Next to Divine Providence.** *Inter Ocean* of the 15th inst.

has the following to say of our friend, Mr. William E. Smythe:—"William E. Smythe is apparently neither a hydro-pathist nor a prohibitionist, but he has lately published a book surpassing all other literary productions in its enthusiasm for water. He believes that if cleanliness is next to godliness irrigation is next to divine providence in the regeneration of mankind. His theme is, 'The Conquest of Arid America,' and he draws a most enticing picture of our Western plains as they will be when water shall be made to do its perfect work.

Irrigation, says Mr. Smythe, will reduce farms to minimum size, for it will make the soil so fertile that one family need till but a few acres. Thus the arid region will become a series of vast villages embowered in orchards. Its people will be alike free from the unsocial gloom of large farms and the unwholesome influences of great cities. They will be the happiest people on earth.

In his enthusiasm Mr. Smythe is almost ready to contend that it is better for a nation to be compelled to irrigate arid lands than to possess large areas naturally fertile. He calls Professor Hilgard of the University of California to witness that irrigated desert lands are more fertile than those where regular rainfalls and luxuriant vegetation have prevailed for ages. He argues that the leaching of the soil by rain more than offsets its enrichment by vegetable deposits, while arid lands have retained the chemical elements required for the most intense fertility.

Irrigation, says Mr. Smythe, sets the chemical forces to work, combines the dormant elements, and makes an alkali plain richer than the famed delta of the

Nile. He recites the history of many lands to show how irrigation and small farms have enabled men to attain the very best conditions of life and the most constant and equable happiness.

Mr. Smythe's optimism extends to his political views. He sees his country's future with loving eye and rebukes Andrew Carnegie's present pessimism by quoting his eloquent prediction of a twentieth century America with 500,000,000 of free and prosperous people, dominating the world for the world's good. He sees in the advance of American law and liberty across the Pacific an 'impulse now clearly apparent in the intellectual and industrial life of that part of the world which will materially assist in the settlement of the far West and indefinitely widen the market for its products.'

Mr. Smythe's conclusions may sometimes outrun his facts, but his enthusiasm is in refreshing contrast with the weakly wailings of many writers when they deal with the future of their country."

Mining Development. The western half of the United States today supports a population ranging some where around five million. Much of this population has been attracted by the cry of gold and the capital invested today in western mines is enormous. Yet it is not a title of the amount which the value of the mineral laden ore of the West warrants; only these minerals are locked largely in the grasp of the arid belt. Water is what is needed. Hills and mountains of extreme richness lie undeveloped and desolate, surrounded by barren deserts or sagebrush plains. Capital is slow to venture into such places, even with great mineral wealth in sight. Gold is not the only metal, tons of which are locked in the rocky bosom of the western sierras, but all the family of baser metals are richly represented and the question of transportation enters largely into their mining. Railroads will not follow mining camps alone. But reclaim the arid lands of the West; give to them a settled agricultural population, and railroads will quickly pierce the desert. And here too will be a source whence to feed the men and the mules that work the

mines; feed them at reasonable rates. Many a torrent of great volume rushes down the slopes during the period of melting snow and spreads away in a glistening stream across the brown plain, but before a crop can be raised, its volume has waned and its bed become dry sand. Yet store this water in a mountain reservoir and it would afford a perennial supply, capable of irrigating land whose fertility has never felt the washing, weakening power of rain. Then, along with the agricultural development would come mining development.

There are many regions where irrigation has transformed the agricultural lands and railroads have been quickly built, where adjacent mines—the necessities for man and beast and transportation at hand—have been simultaneously developed, adding vast sums to our mineral output which might have otherwise lain always dormant.

For a long time the Department of Agriculture and its free distribution of seeds to the farmer was the foundation for many a newspaper joke, even the farmer himself was disposed to regard it suspiciously, not being sure whether it was a harmless fad of the government, or a deep laid confidence game. The farmer has slowly but surely come to realize what benefit this department is to him and to appreciate it as it deserves. Speaking editorially on this subject the Chicago *Inter Ocean* says: "The farmer has learned that the department's 3,000 employes are working to fatten his pocket-book, and he regards their work very seriously. He once looked upon the 'scientific' farmers of the experiment stations with hilarious contempt. Soon he found that the scientists were protecting him against fraud in commercial fertilizers. Then he discovered that they could save him time and money in making experiments. Now he is going to them for advice and depending upon their counsel. To millions of American farmers today the admonitions signed 'James Wilson, Secretary of Agriculture,' have almost the binding force of law."

Continuing the article says that a bare enumeration of what the Department of Agriculture has done and is doing for the

farmer is sufficient reason for the change. "It has discovered remedies for diseases of wheat, corn, cotton, fruit trees, and garden crops, and told the farmer how to apply them. It has taught fruit-growers how to care for and improve the orange, pineapple, and other fruits; how to pack fruits for shipment, and the secret of propagating the fig. It is constantly hunting up new crops, furnishes him with seeds, and directs him to a market. It has shown him that jute can be raised with profit in the South and flax equal to Ireland's on Puget sound. It tells what crop best suits his land, and teaches him how to judge the fitness of soils for different sorts of vegetables. It warns him of the appearance of dangerous weeds and noxious insects, and tells him to combat them.

"Nor do the department's activities end there. It separates the farmer's diseased from his healthy cattle and puts upon the latter a mark which assumes the highest price in both domestic and foreign markets. It tells him what kinds of butter and cheese are desired in the several markets and how to pack these products. It counsels him about sheep and goats, poultry and bees, and tells him how to raise calves on skimmed milk. It has decreased the number of forest fires, stimulated interest in forest preservation, and told the farmer how to manage his wood lot. It instructs the farmer how to make good roads at the lowest cost, and is gradually convincing him of the value of such roads. It warns him of the approach of storms, and tells him the best way to save weather-damaged crops and live stock. It is at work for the farmer all the time.

"The United States annually spends about \$3,000,000 in performing these services for the farmer, and the money is well spent. For the farmer provides more than 65 per cent of the materials for our

export trade, and in making his business more profitable every line of industry is helped. Out of that \$3,000,000 the weather bureau, whose storm warnings have saved thousands of lives and millions of shipping and other property, is also maintained. All foreign observers agree that the United States does more than any other government for its farmers, and does the work better and cheaper. It is very doubtful if the American people have any investment so profitable as the \$3,000,000 which they annually spend upon their Department of Agriculture."

With such advantages as these, it is no wonder the farmer has ceased to regard the Department as a yoke.

Interesting irrigation development is reported from the island of Hawaii, in the discovery of underground currents. Immense subterranean streams of the purest water have been uncovered from 1,500 to 2,000 feet above the sea level. The water will be flumed down to the sugar plantations at lowest elevations, affording an abundance for irrigation.

From five subterranean streams tapped within the past few weeks the Olan plantation has secured a continuous flow of 20,000,000 gallons every twenty-four hours, more than enough to irrigate the plantation which is the largest in the island. The water has drained from the surface into the subterranean beds of ancient lava.

In the Hawaiian cane fields, under irrigation, the average yield is reported as 5½ tons of sugar per acre and reaches in some cases as high as 10 tons per acre. The Louisiana sugar yield is on an average only 2,800 pounds per acre and reaches as high as 3,200 pounds or a little over 1½ tons.

IN A WINDMILL LAND

ALFALFA THE "MORTGAGE LIFTER" IN NEBRASKA.

BY WILLIAM E. CURTIS.

Windmills are getting to be as thick in Nebraska as in Holland. There is at least one at every farm-house to pump water; often another at the barnyard, and sometimes several others at the different corrals or feeding places for cattle. In the towns clusters of windmills rise above the roofs and give a quaint and picturesque appearance to the landscape. They differ from the Dutch windmills, however. They are open wheels of wood, while in Holland the wheels are usually made of canvas fastened to long arms which revolve very slowly and in a dignified way appropriate to the Dutch character. The Nebraska windmills whirl with great energy at the slightest provocation, illustrative of the character of many citizens of this state, and some of them creak and croak in a most melancholy manner like other citizens that might be described. People who live in the neighborhood soon get used to this disagreeable noise, and do not mind it any more than the industrious and progressive elements mind the croaking of the "misfortunists."

One of the first questions that troubled the settlers of that state was the lack of good water. In early times the travelers on the overland trails had regular stopping places at springs and streams and buffalo holes. Sometimes there was a long stretch of prairie between them, and during the summer they dried up and caused a great deal of trouble and suffering. The soil in certain sections absorbs the rainfall like a sponge. The Platte river often disappears entirely at intervals and leaves its bed as dry as a bone, while the water follows an underground channel. But Nebraska should not be judged entirely by external appearances in this or in many other particulars. There is always plenty of water under the deep rich loam which produces the corn and the other crops of this country—an inexhaustible supply that can be obtained by digging or boring in any section of the state. It took a long time to discover this, like other hidden blessings of nature, but its value was appreciated all the more when it became known. Sometimes they do not have to go down more than twenty-five feet, but sixty feet is the average depth of good wells. The water is pure, cold and always plentiful. The common practice is to erect a tank and keep it full by a windmill, which works a pump whenever there is the slightest breeze. The

cattle understand the arrangement, and whenever they are thirsty start for the nearest windmill, where they always find an abundance of good water.

These artificial sources of supply are never polluted and the cattle escape the diseases that are often produced by drinking surface water. It costs \$20 to bore a well, and the windmill, tank and attachments can be put up for \$50 or \$60 more.

Irrigation begins about the longitude of the town of McCook and a considerable area of what was formerly cattle pasture is now under cultivation. Companies have been formed to build irrigating canals, some with local capital, but most of them with money from Lincoln, Omaha and Denver. There is a good deal of Chicago money invested in irrigation ditches, which have proved to be profitable as well as secure investments. At Bayard, in the northwestern part of the state, a ditch eighteen miles long, which takes its water from the Platte river and is capable of supplying 15,000 or 20,000 acres, has been built by the farmers themselves, without money or stock or bonds. It did not cost a dollar in cash. Every shovelful of earth was handled by the men who own it. A co-operative partnership was formed and each member undertook to complete a certain section of the canal. Some dug a mile, others half a mile and some not more than a quarter of a mile, and their interests in the property are rated accordingly. They are now organized into a company, with a manager, who receives a monthly salary for looking after affairs. The primary object of the enterprise was to irrigate their own farms, but they are now selling water at the very low rate of 50 cents an acre for the season as an inducement for people to take up the adjoining lands and build their own connecting ditches. The result has been to increase the value of farm property in a remarkable manner, for wherever water can be obtained by irrigation the crops are always sure and plentiful.

This is beyond the corn belt, but wheat will run forty-five and fifty bushels to the acre, oats seventy and eighty and barley and other grain accordingly, with never a failure. Alfalfa, fruits and vegetables are always sure and grow with great luxuriance, although irrigated fruit and vegetables have not so good a flavor as those raised by the natural rainfall, because so much of the growth goes to fiber.

Alfalfa is the great crop of the middle section of Nebraska. There is less labor and more profit in it than any other. It is what they call a "dead cinch" every year. Neither drought nor grasshoppers nor any other of the evils that have afflicted the farms of Nebraska ever interfere with the alfalfa field. It is an audacious and a stubborn plant and will grow in spite of all obstacles—on the clay hills and other places where the land isn't good for anything else—and the wise farmer makes profit out of that perversity. They call

alfalfa a "mortgage lifter" out here, and it has assisted in the payment of a large portion of the farm debts of the state.

Alfalfa is the Spanish clover. In every town of Spain and South America long strings of donkeys come in every morning with everything but their heads and their pipestem legs concealed by their burdens of alfalfa. The peons sell it on the curbstone to feed the cows, the pigs and the goats of the poor and the saddle horse of the proud hidalgos. Out here in Nebraska they convert it into beef, mutton and pork, and it is by far the most certain as well as the most profitable plant that grows in this region.

Alfalfa is comparatively a new thing in North America, although it is as old as history in Europe. The legions of Cæsar and Alexander the Great fed their horses upon it. It was introduced into South America by the Spaniards and flourished there for three centuries before it was brought to California, where its usefulness was soon demonstrated, and gradually worked its way eastward over the mountains into the dry portions of the prairie states, where it has now become the most important staple.

Alfalfa will not grow without water any more than corn or wheat, but it can get along with less and its roots will penetrate the ground to a depth of thirty feet or more in search of moisture. It is said that alfalfa roots have been found as far as sixty feet from the surface, reaching the very artesian basin. It thrives best in porous soils, which offer the least resistance to its roots. On good land it produces four crops during the season, from one to one and a half tons an acre, and a fifth crop that is used for hog pasturage late in the fall. Cured alfalfa sells at from \$3 to \$7 a ton according to supply and location. The price here to-day is \$7, which is due to an active demand from cattle feeders. Thus not less than \$20 in cash an acre ought to be derived from alfalfa under ordinary circumstances.

One crop of seed, about four bushels to the acre, is usually saved and sells for about \$4 a bushel. There is a ready market and an increasing demand. The hay from which the seed has been threshed is fed to horses, but is not good for fattening cattle.

A by-product of the alfalfa fields is honey. Nearly all the farmers' wives keep hives of bees, which feed upon its purple blossoms.

Somehow or another it is impossible to obtain official crop statistics in Nebraska. The labor commissioner makes an annual report which contains estimates of surplus farm products and the output of the manufactories, but they are not complete and are of comparatively little value because they are not published until a year or more after they are collected. It would be easy to obtain reliable returns through the county clerks and other officials, as is done in other states, but Nebraska has never tried it. Kansas has an admirable system of statistics of all kinds of industry, better than you can find in almost any other state, and what is equally important, promptly published.

IRRIGATION OF ALFALFA.

HOW MUCH WATER GIVES BEST RESULTS.

By GUY E. MITCHELL.

"Alfalfa as a Hay Crop" is the title of a bulletin prepared by Prof. B. C. Buffum, the agriculturist of the Wyoming Experiment Station, and his treatment of the subject is of more than passing interest to farmers of the great arid region, where no other plant is held in such high esteem by those who have had the largest experience in irrigation farming.

"Although alfalfa is extremely hardy," says Prof. Buffum, "and will live through long periods of drouth it will not produce hay unless irrigated. It is of vital importance to apply water at the right time, and conduct the irrigation in the right way. Flooding as the native meadows are flooded for long periods of time, is much more quickly fatal to alfalfa than it is to our best native grasses.

"It will not do to turn the water on and look at it once a week to see that it is still running. Alfalfa soon dies if its feet are kept wet, and it needs long breathing spells and warm growing weather. Where the irrigating water is cold it produces a chilling effect, and the irrigation should be done quickly and the water turned off as soon as the ground has become thoroughly wet. The best time to irrigate alfalfa is immediately after the hay has been removed. Some irrigate just before the hay is cut, but our observations indicate that much better results are obtained by irrigating after cutting. If the weather is very dry, light irrigations may be needed between the cuttings. We believe in irrigating in the fall, some time after the last cutting has been made, to keep the soil from becoming too dry during the winter. It should not be done so late, however, that the ground is apt to freeze hard while very wet, as this seems to be the principal cause of winter killing.

"Too much water is fatal either in the summer or winter. On the Wyoming Experiment Farm one season we irrigated one-half of a field of alfalfa as late as October, leaving the other half without water. The part irrigated started earlier the next spring and up to the time of the first cutting the dividing line between that which had not been irrigated and that which was watered late in the fall was distinctly visible, as the hay grew two or three inches higher on the fall irrigated portion.

"By duty of water we mean the amount which is used on the land. Alfalfa is a perennial plant which occupies the land all the time. Its

growing season is long and that it requires a proportionally large amount of water would be expected."

Here Prof. Buffum presents a table showing the amounts of water used on fourteen different crops of alfalfa. "The table shows," he continues, "that we have not used very large amounts of water in the production of alfalfa. Our measurements of water used on native hay shows that only about one-half the water was used on alfalfa as on the native hay." An average of these fourteen measurements made at Laramie as set forth in the above mentioned table shows the depth of water applied to alfalfa to have been 2.22 feet. An average of six measurements made by the station on oats, wheat and barley, shows 2.74 acre feet applied to each acre of those crops. The only class of plants upon which less water has been used by the station than on alfalfa has been root crops.

The first seed of the famous Turkestan alfalfa was imported and sent out by the Department of Agriculture in 1895. Little attention was given it until the severe weather of winter before last put its hardiness to the test. On all parts of the farm-plots at the Wyoming Station the ordinary alfalfa showed more or less winter killing, but not a single plant of the Turkestan variety had been hurt. Similar reports were received by the Department of Agriculture from many other sections. Not only does it seem hardier but it has generally produced heavier yields than the common alfalfa. On the Wyoming Experiment Station farm, averaging the results for the last two seasons, when cut for hay and cured alike, the Turkestan variety clearly showed superior cropping qualities, producing over three-fourths of a ton more hay per acre.

Secretary Wilson of the Department of Agriculture is greatly pleased at the discovery of this variety of alfalfa and its apparent hardiness and heavy yielding qualities and his department is preparing to introduce it generally in small lots throughout the West. Farmers who desire to make a trial of it should mail a request to the Secretary of Agriculture at Washington for some seed.

IRRIGATION IN ITALY.

THE LATE KING HUMBERT A CHAMPION OF INTERNAL IMPROVEMENTS.

By GUY E. MITCHELL.

Through the assassination of King Humbert of Italy, the poor people of that historic land, lost a conscientious friend. Although Rome, and later Italy, have supported many tyrants who have trampled upon the necks of the people as upon worms, others of its rulers, King Humbert among the number, have had the good of the peasants thoroughly at heart and have endeavored to improve and ameliorate their condition. Especially notable as a means to this end have been the irrigation works of Italy, largely undertaken and fostered by her successive monarchs and ministries.

The early Romans were careful irrigators and Italy is known in history as the classic land of irrigation, although it is not believed that any large irrigation systems or great canals were constructed until in comparative recent times. As in the far East, springs, wells and small streams, easily diverted from their channels, were the sources of supply; but in the last few centuries Italy has developed some magnificent systems. In the districts of Piedmont and Lombardy hundreds of thousands of poor people have found relief and comfort through the revivifying influence of water, great tracts of marsh and waste land having been reclaimed to irrigation. Nothing could be more striking than the contrast between some of the irrigated and the unirrigated districts. Many of the latter are among the most densely populated regions of Europe. Their soils have received just the element needed to call forth their inherent powers and instead of arid wastes and extensive marshes, corn fields, rice grounds, flax fields and green meadows producing wonderful crops, cover the face of the country with prosperous farms and cottages surrounded by the vine and the fig, and inhabited by happy families. It is only necessary to compare the present conditions of the provinces where irrigation exists with their destitute past to see the good which a wise government policy has wrought for the people. Nearly six hundred years have been required to perfect the splendid canal system of Piedmont, and to change its once arid wastes and dreary marshes into sheets of cultivation. The moral presents itself that to irrigators in the United States, who are but beginning this work, they have cheerful hearts in sight of what has already been accomplished in this country by private capital in a fiftieth part of that time.

The late king always evinced a particular interest in the irrigation work of the state and in the possibilities of rural improvement through water reclamation. While about seven million acres of land in Italy are already under irrigation, this is by no means all the land subject to reclamation, and projects are now on foot for additional development, the possibilities of which are very great. The great government irrigating canals in Italy have a length of over 140 miles and the vast network of distributing channels aggregate a total length of something over 4,000 miles.

It is understood that the new king, Victor Emanuel III, will devote himself largely to internal improvements, first breaking away from the staggering expense to the state of foreign entanglements and alliances.

Italian history contains many interesting accounts of wars and strifes over the sources of irrigation during the days of feudalism and of conflicts with foreign nations. An interesting incident is told of the temporary destruction and immediate repair of the Naviglio Martesana, the large canal of Milan. During the last century, owing to excessive pressure, about 600 feet of the channel near Milan was carried away, cutting off the water supply of the city, and, occurring in April just as the demand for irrigation was commencing, it necessitated the utmost energy to complete the repairs in time to save the great crop dependent upon its waters. It was considered necessary, among other things, to replace the ancient earthen embankment by a vast retaining wall of brick masonry. The government acted with great vigor and the work was successful, six weeks of tremendous effort sufficing for its completion. At such times the people of irrigated countries appreciate the exertions of their governments. When the British government in India reopened the Delhi canal, great concourses of people accompanied the waters as they passed through the new channel—flowers were thrown into the stream, and the multitudes loudly expressed their joy, and welcomed with glad cheers the sight of the long desired waters. Similarly the inhabitants of Milan collected in vast numbers along the banks of the Canal Martesana upon its reopening and cheer after cheer arose as the water poured past. All classes and parties united in bestowing the highest praise upon the engineers and the administration for their energy had saved the crops of the year.

LAND TO BE IRRIGATED.

BY F. V. COVILLE.

As the years roll by the country will see millions of dollars saved to the farmers of the West and millions more made. The advocates of irrigation for the West claim that the carrying out of their proposition would create a vast empire where is now the Great American desert. Seventy million acres of arid land is the amount estimated by the geological survey as susceptible of irrigation with the present surface water supply of the arid region.

This utilization of all Western waters would increase the arable area of the United States less than 10 per cent., and while it would open up a channel of vast possibilities, I think that we are working along lines which will add almost as much to the Nation's development as would the storage and utilization of all her Western waters. What can a work of such magnitude be? Why, the finding and introduction of plants adapted to the hundreds of millions of acres of land of the arid belt which much always remain arid, even after every drop of water has been conserved by means of storage reservoirs and otherwise. Although the opening up to settlement through irrigation of between 70,000,000 and 100,000,000 acres of land would create thousands if not millions of homes, yet there will always remain these vast tracts of arid and semi-arid grazing lands, which, while useless for most crops, will produce certain plants in profusion. Most of the Western lands are fertile. All they need is water; if not water then some crop which will thrive on the light rainfall they receive; not sufficient to keep alive ordinary crops. We are finding such crops and I think we will eventually cover this arid area with plants of various sorts which will yield millions of tons of additional forage and grain for Western flocks and herds. The Department of Agriculture has explorers all over the world searching out such plants. For every acre in arid America, north or south, of high or low altitude, there is a counterpart in the Old World, and the Old World is full of experience. In Russian Turkestan, in Arabia, on the borders of the Sahara the varied conditions are exactly similar to those of different parts of our Western territory and in these ancient lands they have grown arid-land crops for thousands of years. Every acre of the new West has its double in the old East. Our men are hitting upon valuable things from time to time, and when something of use is discovered, the department makes it its business to see to its distribution. It seems strange that even with our advanced methods of transportation and our mail facilities, valuable discoveries are often buried in communities for year.

Broom corn millet (*panicum milliaceum*) is a plant which I expect in time to see cover great Western areas. It will grow heavy grain yields where it is both too cold and too dry for Indian corn, too cold for Kafir corn, which would otherwise compete with it, and too dry for wheat. It will produce thirty, forty and even fifty bushels per acre of grain excellent for converting into hog fat, mutton or beef, and this upon land where ordinary crops cannot live. The man who has ten acres under irrigation and owns adjacent thereto a tract of arid land will want such crops.

Kafir corn itself is an example of what the proper corn will do for a locality. Ten years ago this plant was an experiment in the United States. It was said to thrive on land too dry for Indian corn and it was tested through western Kansas, where corn-raising was a precarious industry owing to the light rainfall. According to the report of the Kansas State Board of Agriculture, Kansas raised in 1893, 47,000 acres of this crop: in 1898 she raised 535,743 acres valued at \$5,688,380—a reclamation, practically, of half a million acres in a single State. Entire Western counties are now yielding magnificent annual crops of this valuable plant, which, prior to its introduction, consisted of supposed worthless land. Brome grass (*bromus inermis*) is another instance of a fine arid-land plant, which required pushing. Brome grass will undoubtedly reclaim enormous areas of arid land. No grass will grow without moisture, but where most grasses would die, brome grass will simply stand still and wait until moisture comes, when it will immediately start off, producing splendid forage. This grass has been known in several sections for a number years, and it has never been grown extensively even in those sections, and its fame has never spread widely, until last year the department undertook to educate Western farmers as to its virtues and to distribute seed."

THE UNFRUITFUL MADE FRUITFUL.

It has been my pleasure to visit recently the Pecos Valley, a valley which was a few years ago, an arid waste but which, through the skill and intelligence of man, has become a very fruitful district.

Six years ago The Pecos Irrigation and Improvement Company undertook the reclamation and settlement of the Pecos Valley, lying principally in southeastern New Mexico. By the construction of massive dams, extensive reservoirs and great canals at intervals along the river for a distance of 170 miles, 250,000 acres of land have been rendered irrigable, and an abundant and unfailing water supply provided, not only for this large area, but for the additional 150,000 acres over which the canals will be extended as rapidly as may be necessary. Seventy-five thousand acres have already been settled upon by farmers, more than half of which area has been brought under actual cultivation. Hundreds of thousands of fruit and shade trees have been planted, and large sums have already been expended by the farmers in the importation of improved live stock. The Pecos Valley, which six years ago was an unbroken, barren plain, practically uninhabited, is now dotted with farms, orchards and vineyards; while towns and villages are springing up in many places, in which the foundations of prosperous communities are being securely laid. And finally, these results have been achieved by the expenditure, on the part of the projectors of the various enterprises, of fully \$4,000,000.

The prime factor in the great transformation, thus successfully inaugurated, of a desert into a land of verdure and fruitfulness, is the Rio Pecos.

A unique feature of the Rio Pecos is the manner in which its waters are reinforced as they flow through the Valley. Not only is the river fed by numerous tributary streams but as well by thousands of *living springs* which flow from fissures in the limestone floor wherewith the entire region is underlaid. The flow of these springs is constant, never-failing, never-changing; no such series, both as regards number and volume of flow, can be found, certainly within the arid region of the United States, and possibly on the globe. In some parts of the Valley are lakes fed by these gushing founts, the flow from which is so great as to justify the name of river. In the vicinity of Roswell the flow of water from springs is alone sufficient to irrigate 35,000 acres; and from the river bank three miles above Carlsbad a single spring pours forth a supply sufficient for the needs of a city.

A very simple demonstration has been afforded of the replenish-

ng power of these springs. Six miles above Carlsbad an enormous dam has been thrown across the river which, during the storage and irrigating periods, holds back every drop of the river's flow, which is carried miles away through canals. There is no seepage, and the river receives no tributaries, yet the outflow of springs in the river-bed in this distance of six miles causes a very respectable stream to flow past Carlsbad. The sources of water supply are therefore seen to be in a measure independent of surface conditions—being, in fact, practically artesian flows—constituting this supply one of unmatched constancy and reliability in all the arid region.

The valley through which this remarkable river flows has an average width of ten miles, and its surface is in the main as smooth as a floor.

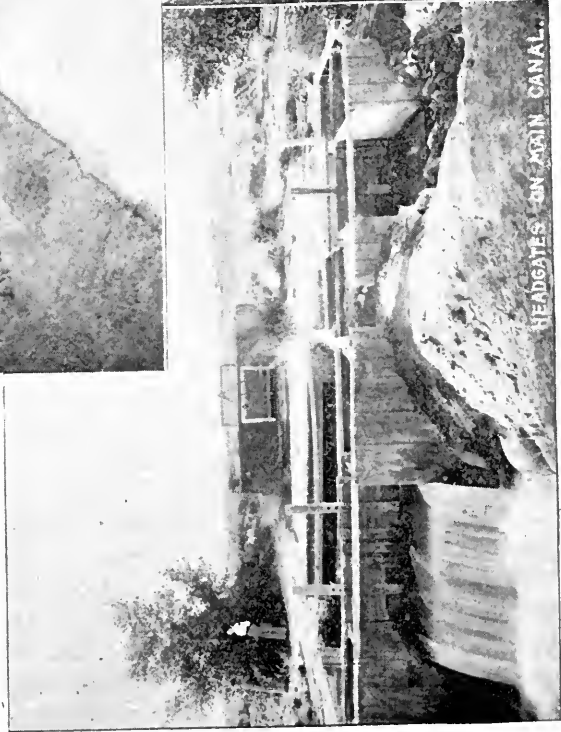
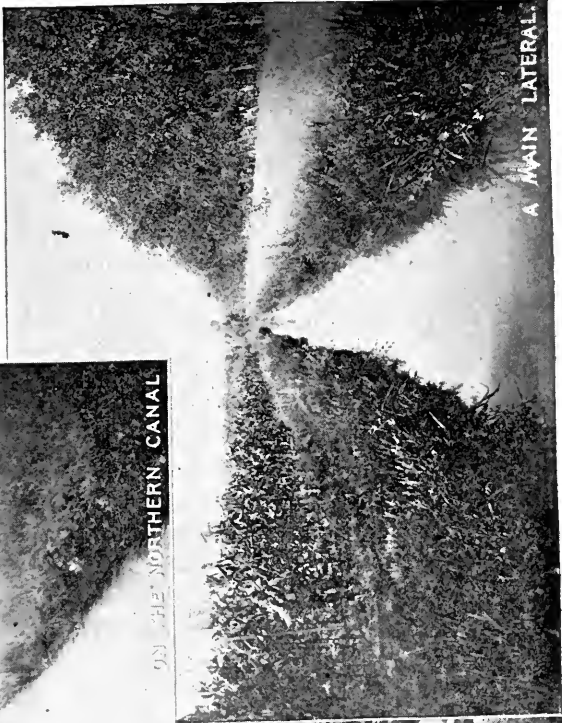
But this fair valley, with all its wealth of water and soil, was nevertheless a desert land, so far as availability for agricultural purposes was concerned. To redeem this valley in all its length and breadth, and to transform its arid plains into smiling fields and the homes of thousands of prosperous people, was a most inviting undertaking, and one of unquestioned practicability; but for its accomplishment time, labor, engineering skill and millions of dollars have been spent. Six years ago The Pecos Irrigation and Improvement Company, with a capital of \$1,750,000, was duly organized and entered upon the great work.

The northernmost of the series is the Northern Canal, which draws its water from the Rio Hondo, a mountain tributary of the Pecos, near Roswell. It is 35 miles long and will be extended southward when needed. It is 30 feet wide and carries a stream 6 feet deep, sufficient to supply the 67,000 acres now under its level. To increase the supply when the canal is lengthened, a reservoir of 1,300,000,000 cubic feet capacity was constructed. To the flow of the Hondo has been added the surplus of the spring rivers about Roswell; and a great deal of land other than the above is already irrigated direct from these.

At present the most important system is that in the vicinity of Carlsbad, and comprises the Southern Canal, taking its water direct from the Pecos, the Carlsbad Distributing Reservoir, and the Seven Rivers storage reservoir, called Lake McMillan.

Eighteen miles above Carlsbad a massive dam resting on rock its entire length has been thrown across the river, intercepting its entire flow. A natural basin lying above this dam is thus constituted a great reservoir, the size of which, as well as of the dam, may be gained from the following figures:

Length of dam	1,686 feet
Greatest width at base	306 feet
Crown of dam	20 feet



Greatest height	52 feet
Capacity of reservoir	6,000,000,000 cu. ft.
Submerged area	8,100 acres

This reservoir, the largest in America and one of the greatest in the world, covers 8,100 acres to a varying depth, in some places 50 feet. The body of water varies in width from a quarter of a mile to three miles, and is 11 miles long. It is provided with ample waste-ways to permit escape of surplus water in case of a sudden rise when the reservoir is already full. Twice in the year it may be filled to its entire capacity, and its waters will irrigate 80,000 acres of farm land from one filling. But to this must be added the constant flow of the Pecos, sufficient to supply nearly as much more land. Hence, since this reservoir is usually wholly for storage purposes, ample water for the cultivation of all the land under the Southern Canal is fully assured.

The Carlsbad distributing reservoir is 12 miles south of the Seven Rivers Reservoir, where a dam 1,150 long, 50 feet high and resting on solid rock foundation, has been thrown across the river. Ample waste-ways protect it from overflow. It submerges an area of 1,032 acres and has a capacity of 300,000,000 cubic feet.

From this reservoir, which is also used for storage purposes, leads the Southern Canal, starting from a rock cut at the east end of the dam. It is now 40 miles in length, is 45 feet wide at the bottom, and carries when full 7 feet of water. Three miles below the Carlsbad dam the canal crosses the Pecos River by means of a flume 468 feet in length. Continuing southward from this point, and known as the West Side Canal, it crosses Black River in a similar manner, terminating 15 miles further down.

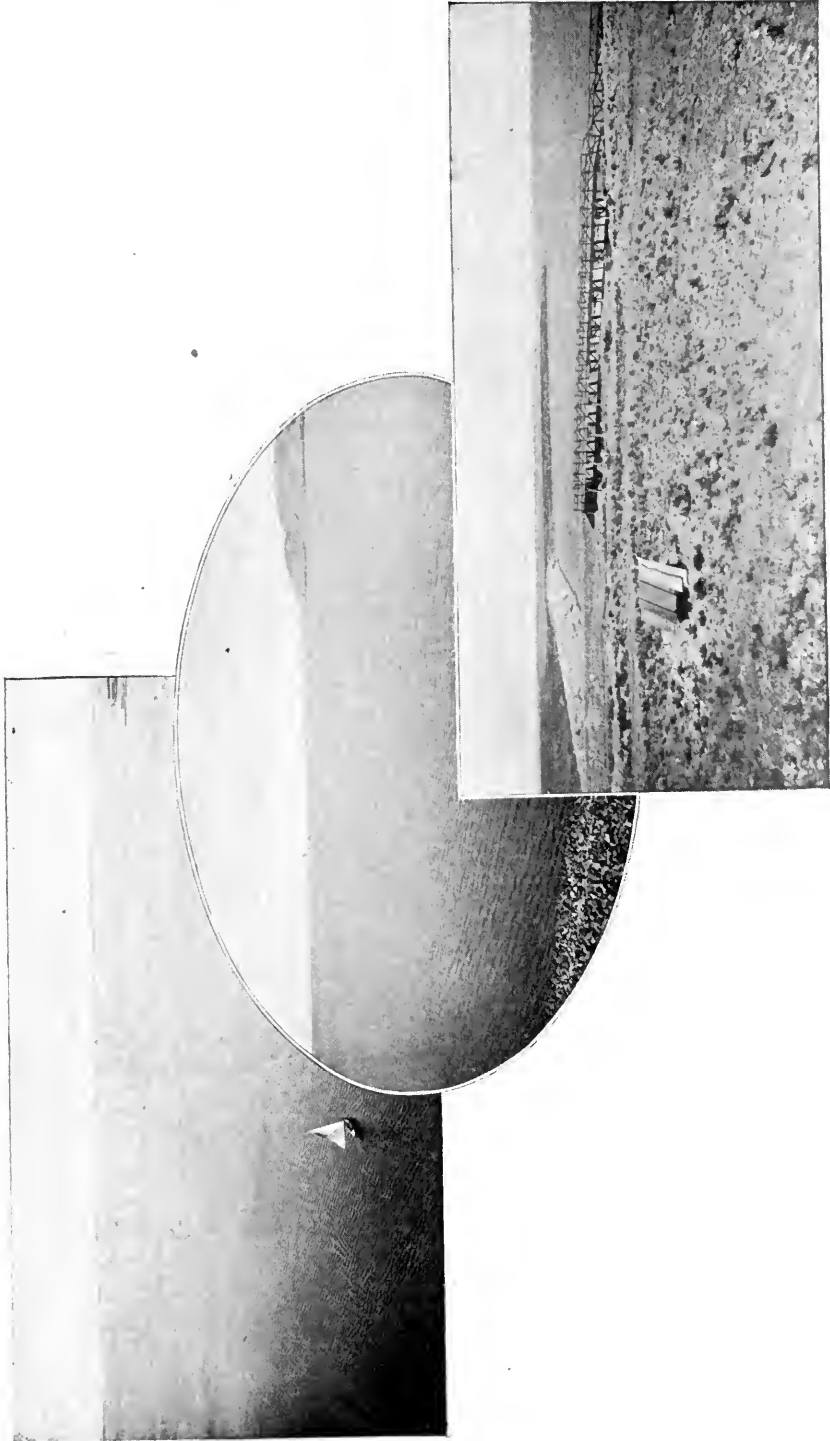
Just before the main canal crosses the Pecos above Carlsbad, it is tapped by the East Side Canal, a branch, 19 miles long, which supplies the farmers and suburban tracts of La Huerta, the northern addition to Carlsbad. This canal is 15 feet wide.

Ten miles below Carlsbad, the river having been amply replenished by springs and by the surplus water from the large laterals, a solid masonry dam has been thrown across to divert the water eastward into the Hagerman Canal and Lake Surprise Reservoir. Surplus water flows over the dam to the river bed below. Under this canal are at present 15,000 acres of irrigable land.

The Highland Canal is the last of the series, beginning about 60 miles below Carlsbad and now extending 13 miles. Its proposed length is 42 miles, and when completed will irrigate the 35,000 acres of land owned by The Pecos Irrigation and Improvement Company in Texas.

Summarizing, the total length of water conduits already constructed and in operation in the Pecos Valley is found to be as follows.

Main canals	121 miles
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Main laterals	273 miles
Sub-laterals	900 miles
Total	<u>1,294 miles</u>

With the exception of about ten miles, where the hills close in upon the river between Seven Rivers and Carlsbad, and for about the same distance near the Texas-New Mexico state line, the Pecos Valley is wide and smooth, the land having just sufficient slope southward and towards the river to insure perfect drainage and distribution of irrigating water. The soil, which is of remarkable uniformity for so great an area as is included in the Pecos Valley, is warm, loose and loamy, and of wonderful depth and richness. Its general color is a light chocolate; but here and there, where disintegrated gypsum—a preventative of alkali, and a natural fertilizer—is a component part, it assumes a much lighter hue. This land through the present system of irrigation has become very prolific and grains, grasses, fruits, vegetables, etc., are raised in abundance.

For years it has been known that apples of the finest quality could be grown in the Pecos Valley, and that the yields were large and unfailing; but it has remained for competent authority, within the past year, to pronounce the Pecos Valley, and in particular its upper portion, the finest apple country in the world. Mr. Parker Earle, president since its organization in 1880 of the American Horticultural Society, and a pomologist of wide reputation, and Messrs. Stark Brothers, the prominent Missouri nurserymen and the largest orchardists in the world, recently visited the Pecos Valley. For years these gentlemen had been seeking a locality where the apple would grow in perfection, free from the blights and numerous diseases to which it seems everywhere subject, and by which the country's apple crop is being steadily diminished in spite of the millions of trees annually planted. These gentlemen, after a most thorough investigation, are convinced that the Pecos Valley is the sought-for place; and they state in the most unqualified terms that here are produced the finest apples they ever saw—simply perfect in form, size, color and flavor. Moreover, they found the trees—many of which are twelve years old and have borne eight consecutive full crops—without blemish of any kind whatsoever, proving that the insect pests and fungoid growths, elsewhere so fatal to the apple, are here practically unknown. These statements and opinions of men so widely known in horticultural matters are most valuable, and speak volumes for the Pecos Valley as a fruit-growing region.

The value to the producer of a superior quality of apple is not exceeded by that of any other fruit; indeed, a prime apple orchard is today worth more, acre for acre, than an orange grove. Apples possessing the perfect keeping qualities of the Pecos Valley fruit have the entire year for their season and the entire world for a market.



They can be shipped from the Pecos Valley to Europe, via Galveston, at no greater cost than from Michigan. It is believed that \$500 net yearly per acre from a Pecos Valley apple orchard is a conservative and altogether safe figure. One apple orchard a few miles south of Roswell, owned by J. J. Hagerman, contains over 500 acres.

In the warm, sandy soil of the Valley the peach attains a perfection of development nowhere excelled. Fully equalling the choicest California product in form, size and color, in flavor it far surpasses.

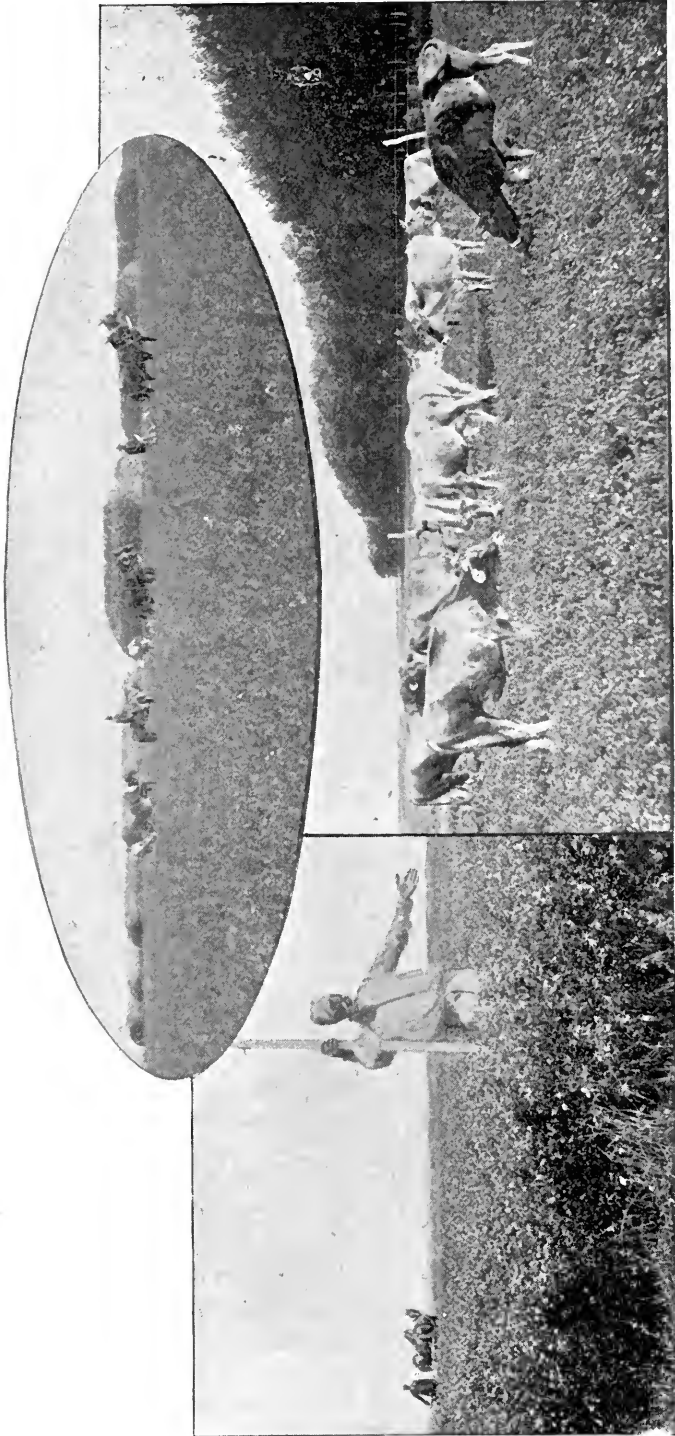
The peach crop of the past season was the greatest in the history of the valley. So great was the crop that the growers were unable to handle it to the greatest advantage, as they had not made preparations for so great a yield. I myself saw peaches there that measured 11 inches in circumference. and a wife of one of the growers said they had some that would measure 14 inches. Some of the trees brought \$9.00 per tree.

Among other fruits successfully grown in the Valley, we may name the fig, grown in the second year from planting; together with the pear, plum, cherry, apricot, quince, nectarine, and prune. It is believed that the olive will be successful; and among the nuts, the pecan and the English walnut will be paying crops.

In October, 1893, Francois Gos, French, commissioner sent to the United States to study the wild vine growths of the country, visited the Valley. He is one of the leading authorities on vine growing, owns one of the largest vineyards in France, and publishes a viticultural journal. After examining the soil and driving over the country, he said, according to an interview published in the *Pecos Valley Argus*: "This is the true vine soil. I think if you would plant nothing but vines in the Valley it would become one of the most famous sections in the world. All the land I have seen seems adapted to vines."

Of the forage crops, the foremost is alfalfa, which grows in prolific abundance, yielding from 5 to 6 tons per acre. Sown the previous fall, or in March or April, it usually yields the first summer crops that sell for enough to pay the entire expense of labor, plowing, ditching, sowing, water rent, irrigating and marketing, leaving enough for forage for team and cow. The field serves for winter pasturage. Thereafter, the stand having been secured, no sowing or plowing is necessary, and the crop gives an annual profit of from \$20 to \$30 per acre, if sold at \$3 per ton. For fattening purposes alfalfa has no superior, and by feeding to cattle and hogs an unlimited market may be relied on. Hogs, in particular, thrive upon it and need no other feed, except for hardening purposes towards the last.

Indian corn is also a fine crop. In most parts of the Valley it grows luxuriantly, yielding from 50 to 65 bushels per acre and often attaining a height of 12 to 13 feet. *Egyptian corn* is also an important forage crop. It is especially adapted to the soil and climate of the arid region. It is easy to raise and a sure crop, is relished by all stock,



and is an ideal grain for hardening hogs. *Sorghum* is likewise a prolific and an excellent forage crop, while the sugar beet makes a cheap and excellent stock feed.

It is safe to say that nowhere else in the United States, if indeed in the world, does the sugar beet attain greater perfection than in the Pecos Valley. The percentages of saccharine matter and purity run astonishingly high while the yields surpass belief. Fifteen to eighteen per cent. of saccharine matter, and a purity of 85 per cent., are by no means uncommon results; while as high as 59 tons of beets of proper size for sugar manufacture have been grown on a single acre. This was of course exceptional; but an average yield of from 25 to 30 tons per acre can be counted on with confidence. M. Alfred Musey, a French beet-sugar expert of wide experience both in Europe and America, recently visited the Pecos Valley, and gave this subject a thorough investigation. He was astonished at what he saw, and stated without hesitation that in his opinion beet sugar can be manufactured in the Pecos Valley with higher success than in any other part of the United States.

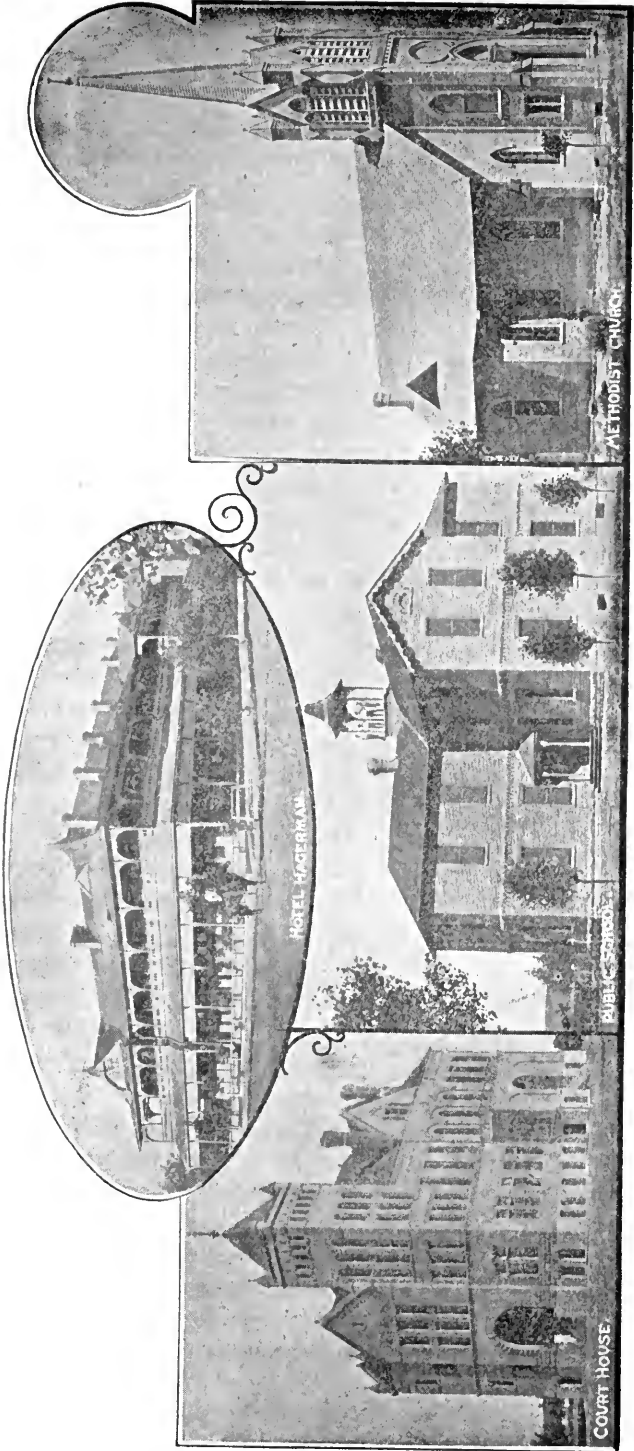
All the ordinary vegetables grow in abundance and find a ready sale. Onions, sweet and Irish potatoes and pumpkins are fine crops, onions being especially profitable. In melons, not even Georgia can surpass this section. Celery and asparagus grow in the greatest luxuriance, being specialties in which the Valley excels. Bee raising is likewise highly profitable, from the abundance of sweet alfalfa blossoms and the sunny climate. It needs only to be remembered that alfalfa is a species of clover, and that in the Pecos Valley it is in bloom during a considerable part of the year, to understand why the beekeepers of the Valley should derive a handsome revenue from the product of their hives. Alfalfa honey is very white and of exceptional flavor.

Last but not least, poultry raising pays, as all farm-wives know. Eggs always sell in New Mexico at from 25 cents to 35 cents per dozen. The cow is also a good helper, for butter sells at from 35 to 50 cents per pound all over the Southwest. Both products have an excellent home market.

The town of Carlsbad is the center of the vast irrigated district on the banks of the Pecos, and draws trade over a radius of 75 miles. It is a modern little city in every way, and enjoys advantages and distinctions especially its own. Its altitude is 3,100 feet. It has, since its first settlement twelve years ago, been known as Eddy, but the growing reputation of the great mineral spring near the town has attracted so many visitors and permanent residents to the place that the town was re-named Carlsbad, as being more suggestive and appropriate. Mrs. R. W. Tansill has had the honor of naming the city Eddy, and also the rechristening of it to Carlsbad.

Carlsbad is a growing, cosmopolitan, progressive city of twelve

THE IRRIGATION AGE.



nundred population, of an unusually high order. There are scarcely any Mexicans, and none who are property owners—a very unusual condition in New Mexico.

Thirty miles of handsome, thrifty shade trees, distributed in graceful lines on either side of all the streets of the town, and beautiful drives of La Huerta and Hagerman Heights— residence suburbs. Nearly 10,000 trees are necessary to make up this length of shade, giving it a feature not enjoyed elsewhere in the west.

Two substantial banking institutions and extensive business and commercial firms.

The Schlitz hotel, is a magnificent hotel of fifty rooms, under the management of Mr. Geo. H. Hutchins, a most genial landlord, one who sees that his guests are well fed and entertained while staying with him. The Schlitz House was formerly Hotel Hagerman.

A handsome court house and a number of substantial brick business blocks.

Schools that are the equal of those of any eastern section. Good school buildings, competent teachers and large attendance of pupils.

Churches of the most prominent religious denominations, able ministers and large congregations.

A city and territorial hospital with competent attendants.

A water works system which furnishes the finest pure, cold water.

Water power sufficient to give Carlsbad the foundation for a manufacturing center.

An electric light plant operated by water power, furnishing illumination to business and dwelling houses.

Mineral springs whose waters, quite varied in their composition, are as a rule exceedingly favorable to the cure of chronic stomach and kidney troubles.

A commercial and social club with a large membership of enterprising business men, who believe in Carlsbad, Eddy county and the Pecos Valley, and want others to know of their worth and have a share in their growth and prosperity.

A sugar factory, the only one in New Mexico and the southwest; provides an ample and certain cash market for all the beets farmers can raise. The reports of the United States Department of Agriculture show that Pecos Valley beets, for richness of sugar content and purity, are unexcelled, and a better price is paid for beets than in any other district.

A wool scouring plant erected in January, 1900, with a daily capacity of 10,000 pounds of wool, is now in operation. The sugar factory and wool scouring plant employ a large force of men and add very materially to the success and prosperity of the town and the farming country surrounding it.

The climate of Carlsbad and the Pecos Vally is the healthiest in the world, as it is free from excesses of heat, cold and moisture. It

makes a sanitarium of the valley for the relief of persons troubled with asthma, bronchitis, catarrh, consumption and all pulmonary complaints. There is no malaria and epidemic diseases are unknown. The temperature rarely falls below twenty degrees or rises above 100 degrees, and owing to the very dry atmosphere, is never oppressive. There is not an authentic case of sunstroke on record in New Mexico. It were useless to live in the richest country on earth without the blessing of good health.

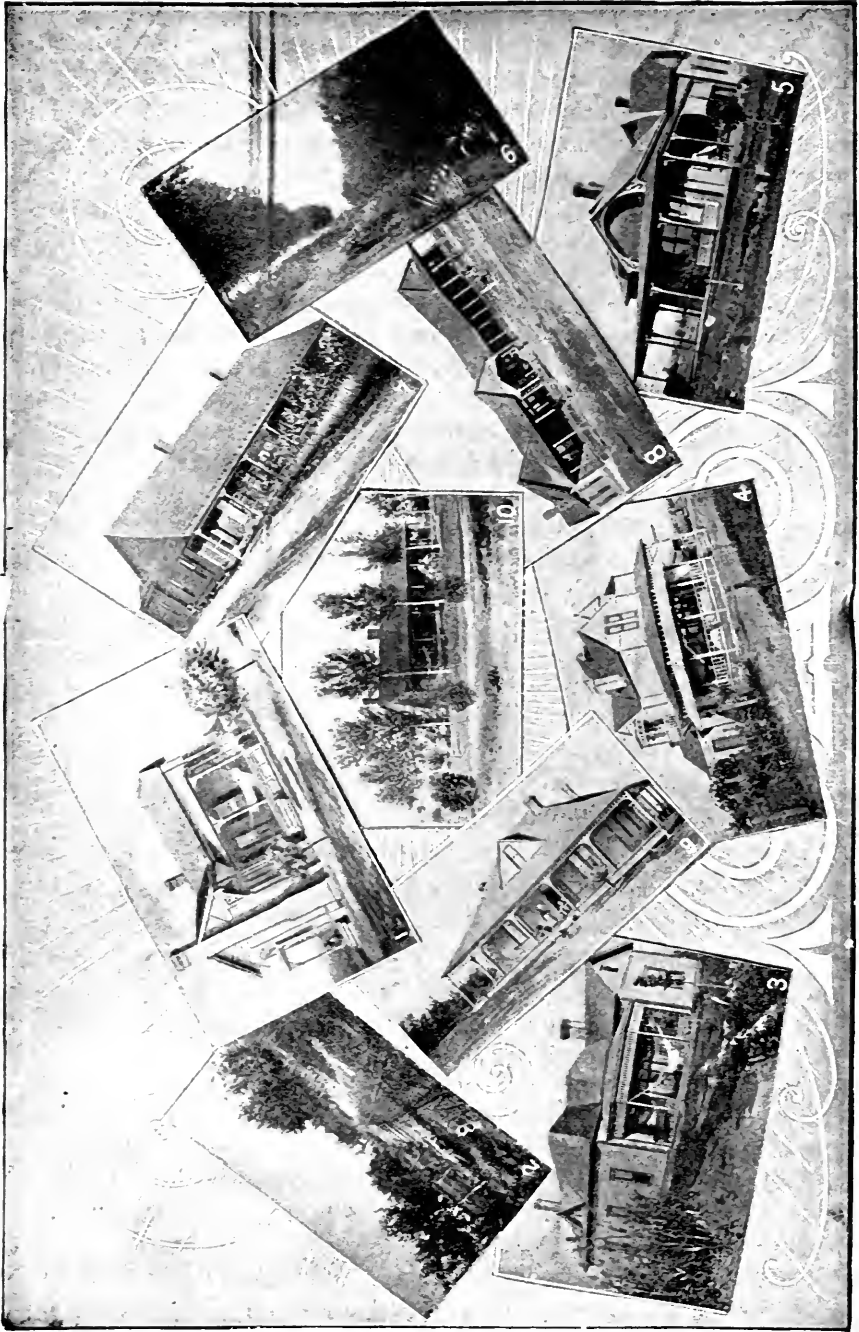
In the Pecos Valley you will find it, for hundreds of people who came here with tuberculosis are living witnesses of the efficacy of Pecos Valley climate.



FINE STOCK ON ALFALFA FARM, NEAR CARLSBAD, NEW MEXICO.

The vicinity of Carlsbad is Sportsmen's paradise. In close proximity are lakes and reservoirs well stocked with bass, perch and blue channel cat. During the fall and winter these lakes are covered with wild duck and geese. Quail abound, and antelope can be found with but little effort. In the mountains, only a short distance away, deer bear and turkeys are secured.

Carlsbad is situated in the center of the range industry of the west. Its cattle and sheep interests are large and constantly increasing. Feeding and fattening of stock on alfalfa, corn and beet pulp from the sugar factory, for the eastern markets, is a new industry full of promise. The Pecos Valley & Northeastern gives a direct line



to the large packing houses of Kansas City, Chicago, Omaha and St. Louis.

The irrigable lands are all properly ditched and prepared for cultivation; that is to say, water can be turned on any tract within 24 hours notice. The price quoted for lands under irrigation includes a perpetual water right which, like any other improvement, is part and parcel of the land. An annual charge of \$1.25 per acre, payable one-half after June 1st and one-half December 1st, is made to cover the cost of maintenance, repairs and expense of distribution.

Irrigable lands south of Carlsbad vary in price, according to location and improvements. A limited amount of good irrigable land can be purchased for \$15 to \$20 per acre, \$5 per acre cash, balance (if desired) two and four years at 6 per cent. Desirable tracts can be secured from private owners of large bodies of land. Lands can also be rented upon favorable terms. All the staple products of the United States are grown, and farming, as a rule, is more diversified than in localities which depend entirely on rainfall.

The yield, quality, flavor and color of the fruits grown in the Pecos Valley are unexcelled.

To sum it all up, Carlsbad is a flourishing and growing young city. The Pecos Valley is a country comparatively new and but recently opened to the farming world, but having already passed the experimental stage, is now building on the sure foundation of certainty and proved success.

The people here have a full knowledge and consciousness of all this, and are desirous that others shall know these facts.

ROSWELL, CHAVES COUNTY, N. M.

Is a town of 2,500 people, situated in the northern part of the agricultural and fruit-growing portion of the Pecos Valley, and is the division point of The Pecos Valley and Northeastern Railway, which connects with the Texas and Pacific Railway at Pecos, Texas, one hundred and sixty-five miles south of Roswell, and with the Fort Worth and Denver Railway at Amarillo, Texas, two hundred and eight miles northwest. The shops and general offices of The Pecos Valley and Northeastern Railway are located here. This road places the Pecos Valley in direct communication with important points north and east, and permits the shipment of live stock through to Kansas City under most favorable circumstances.

Roswell lies in the heart of the range industry of the west. Its cattle and sheep interests have been the foundation of its growth and prosperity, and will always be among its principal supports. During the six months ending with November 30, 1899, this railroad handled 7,000 cars of stock, or about 200,000 head.

Within the past two years the business of stocking fine alfalfa

farms with fine thoroughbred registered Herefords and Shorthorns has gained an astonishing impetus here. Large sums of money have been and are now being expended by a number of individuals and companies in bringing into the Valley some of the finest animals money can buy.

Among the principal breeders of Hereford Stock now located in the Valley are Col. C. C. Slaughter, The Littlefield Cattle Co., and the Milne—Bush Land and Cattle Company.

Since the fall of 1896 the sheep industry in the Valley and the adjacent territory has more than trebled in value and in the amount of income realized from it. The encouraging conditions have caused the investment of a large amount of capital in sheep, and the returns realized have placed the business in the list of most desirable for remunerative investment. A large number of fine rams have been purchased by flock owners for the purpose of improving either the mutton producing or wool bearing qualities of their flocks.

The sheep interests of the four counties of Chaves, Eddy, Lincoln and Gaudalupe have been centered here by the organization of The Southeastern New Mexico Sheep Breeders' Association. In sheep, as in cattle, a good manager cannot help but succeed.

In the arid region no town with an agricultural, fruit-growing and fine stock-raising population to support it is a possibility without a bountiful supply of good water with which to irrigate large bodies of land. In this respect Roswell has no peer in the Southwest. Five streams, each fed by immense springs, furnish an enormous quantity of water, by which some 20,000 acres of fine lands, lying close to the town, are irrigated, and the surplus flows into a canal 30 miles long, from which nearly as much more land is irrigated. In addition there are some 30,000 to 40,000 acres susceptible of irrigation, which will be brought into cultivation as fast as there is a demand for it, as it all lies under the irrigation system.

The lands close to town include a large number of old, well improved farms, with bearing orchards and vineyards, and hundreds of acres of alfalfa, on which graze as fine cattle, sheep, hogs, horses and mules as can be seen anywhere.

The supply of water referred to is supplemented by the development of artesian wells, of which there are some 100, flowing from 200 to 2,500 gallons each per minute. The water is excellent, and of a uniform temperature of about 60 degrees Fahrenheit. New wells are being rapidly bored, and the development of water by this means for both domestic and irrigating purposes has assumed proportions which demonstrate the fact that the supply of water obtainable from this source is practically inexhaustible, and that this development is in its infancy here. Artesian water can be had on government land, still subject to entry. Where artesian water cannot be had, water for do-

mestic and stock purposes can in most places be obtained by boring wells from 25 to 100 feet and using windmills.

It is difficult to do justice to the industry of Chaves County within the limits of this article.

All the fruits of the temperate zone are raised here to perfection, but the apples in particular are without rivals for size, beauty, flavor and soundness, and yet the yield is phenomenal. The acreage in old, bearing orchards, is comparatively small, but the young orchards, many of which are now commencing to bear, bring the total up to 1250 acres, and include one apple orchard of 500 acres. The acreage is being rapidly added to each year.

The entire absence of any of the orchard pests, which give so much trouble in nearly every other fruit region of the country, relieves the fruit-grower here of much of the arduous labor peculiar to other localities and makes the occupation of the orchardist much more satisfactory.

Exhibits of fruit from this Valley have taken first premium wherever allowed to compete, and have excited the wonder and admiration of people from every part of the United States.

The Celery raised in Chaves County is pronounced by those qualified to judge, superior to any raised anywhere else in the United States, and the fact that it leads all competition in every market it has reached, would seem to verify the assertion, particularly when it is known that it came in competition with the product of the most famous celery farms in the whole country. The soil of the Valley seems to possess to a marked degree the peculiar constituents which impart to this table delicacy the peculiar nutty flavor so much sought after by epicures.

Farming by irrigation is a science, and is often attended by failure when undertaken by persons who fail to inform themselves as to correct and successful methods, before beginning. The results attained in this Valley, as well as elsewhere, prove conclusively that, whenever intelligently managed, the irrigated farm surpasses every other agricultural proposition in producing power. A little capital, fair intelligence and plenty of energy, together with the ability to manage well, will rarely fail to crown the efforts of the practical farmer with success.

Roswell has good graded school, with two good brick school buildings, costing \$7,500; five church organizations, Methodist (South), Baptist, Christian, Episcopal and Presbyterian; a flourishing Commercial Club and Board of Trade, with elegant club rooms; one Bank \$50,000 capital and \$10,000 surplus; a U. S. Land Office; the New Mexico Military Institute, a fine building; an Agricultural Experiment-Sub-Station; a Masonic Lodge, Royal Arch Chapter and Commandery of Knights Templars, Knights of Pythias, a Woman's Club, a good Board of Health, an efficient Volunteer Fire Department, a \$30,000

Court House, two good Weekly Newspapers, a small Packing House, a Broom Factory, Steam Laundry, Telephone System, Electric Light Plant in course of construction, Ice Factory, three Hotels, one Flouring Mill, (water power), ten miles of graded streets, long rows of stately cottonwoods shading the principal streets.

The town never has had a boom, and has been built and developed entirely by private capital. The business men and leading citizens are conservative, but energetic and public spirited, and always work together for the public good.

No person who has been in the Pecos Valley long enough to know what its climatic conditions are, can fail to experience a feeling of regret when realizing the fact that if the actual truth could be known over the United States about this climate, the lives of hundreds of persons could be saved every year. The testimony of a prominent newspaper man, who is at this time in the Valley for the benefit of his health, will perhaps make the matter as plain as almost anything that can be said. In a recent letter written to his paper he says:

"It would be a great boon to the Pecos Valley to have a new railway connection with the East and North, since it would doubtless bring more people to enjoy the climate, which is one of the best, if not the best, in the United States. Sunshine and dryness are the cures for pulmonary and bronchial diseases, as nearly all can testify who have come to try them. * * * The blue skies of Italy and the Riviera are not so blue as the sky of the Pecos Valley, and every day the sick—women and children as well as men—can spend out of doors, walking, riding or driving. There are no sick here, in fact, except those who come for their health, and these are generally delighted and benefitted if any vitality remains in them on arriving. Certificates of cures in the persons of the cured are too numerous to leave a question as to the healing qualities of the atmosphere. If this air could be condensed into bricks and sold for what it is worth, the Pecos Valley would enjoy a greater boom than the Klondike Country. There is a cool, bracing breeze these days, but since Christmas there has not been a day when the most delicate 'lunger' could not be out in the sunshine from 8 in the morning until 5 in the evening, although ice has formed every night."

Cyclones are unknown in New Mexico, a fact of no small importance to those who have lived in localities where they have been subject to the dreadful fear of these awful engines of destruction.

North Spring River flows through the town of Roswell. Water clear and warm; bathing facilities unsurpassed the year round. Bass are very abundant, average from one to three pounds—as high as seven. In the fall and winter season ducks, including canvass backs, are very plentiful close to town. Antelope, quail, plover and teal are found close to town.

A large Hotel. A Sanitarium. A Canning factory.

Roswell lies in an open valley. No natural growth of timber exists, except along the streams, until the Capitan Mountains are reached, 60 miles west of town.

The thermometer, during the warm weather, sometimes reaches 100; the heat, however, is not so oppressive as 85 would be at a lower altitude, owing to the excessive dryness of the atmosphere. Altitude of Roswell is 3660 feet.

A MOTHER'S ROUND.

BY CARRIE EASTMAN MEDBERY.

'Tis a busy round, ah! me,
 From the dusk of early light,
 When the "fairy prince" bids slumber flee,
 To the welcome, bounteous night.
 For the "fairy prince" and all the rest
 Must be warmed, and fed, and taught and dressed,
 And the house kept fair for my lord to see—
 'Tis a busy round, ah! me.

'Tis a weary round, ah! me;
 The pitiless plough of care
 Is cleaving furrows sad to see,
 In the face that was once so fair,
 And often, alas! there comes a frown,
 When the baby pulls the dishes down
 And the "fairy prince" goes mad with glee,
 'Tis a weary round, ah! me.

'Tis a blessed round, ah! me,
 For the bloom of youth and health
 Is on each sweet mouth that kisses me,
 And their love is a mine of wealth.
 And the "fairy prince" and all the rest
 Are safe within home's sheltered nest,
 And sorrow moans not thro' the old roof-tree,
 'Tis a blessed round, ah! me.

THE DIVERSIFIED FARM.

DIVISION OF FORESTRY.

The appointment of Mr. Henry S. Graves as Professor of Forestry in the Yale Forest School, and of Professor J. W. Toumey, as his assistant, has recently deprived the Division of Forestry of the Department of Agriculture of two of its heads of sections. Mr. Graves has been Superintendent of Working Plans since his section was organized; and Prof. Toumey has been Superintendent of Tree Planting since his first connection with the Division. Under Mr. Graves' administration, the section of working plans has, in accordance with a policy of co-operating with lumbermen, state forest officers, farmers, and others who desire to manage their wood lots according to sound forest principles, furnished a larger portion of the rapid growth which has characterized the Division of Forestry in the last two years. Beginning with a comparatively small area, the applications for working plans have now extended to approximately 50,000,000 acres, including all the National Forest Reserves, the whole of the Forest Preserve of the State of New York in the Adirondacks and Catskills, and about 2,000,000 acres of private lands. Under Prof. Toumey's administration, the Section of Tree Planting, organized on a similar co-operative basis, has had marked success, and is now thoroughly established in a career of special usefulness.

So firmly have the organizations which these gentlemen have conducted been established under them, that the work which they have thus far carried on will suffer no interruption by their departure. Mr. Graves' place as Superintendent of Working Plans and Assistant Chief will be taken by Mr. Overton W. Price, of the

Division. Before entering the Division Mr. Price had an exceptionally thorough training as a forester. After graduating from the University of Virginia he studied at Biltmore, N. C., and thus was at the great advantage when he went abroad of having already had practical experience in this country. He spent nearly three years in Europe, chiefly in Switzerland and Germany. In Germany he worked under Sir Dietrich Brandis, formerly director of the British forest service in India, and also studied at Munich. He entered the Division of Forestry a year ago and since then has been chiefly engaged on working plans as a field expert. The position of Superintendent of Tree Planting is yet to be filled.

An investigation of forest fires and reforestation on burnt areas is now being pursued by the Division of Forestry of the Department of Agriculture through Prof. C. S. Crandall, lately of the Colorado Experiment Station at Fort Collins. This work, which Professor Crandall began some years ago as a collaborator of the Division, will be carried on chiefly in the northern part of the state, where the prevalence of Lodgepole Pine makes the conditions very different from those in the South. The investigation is an important one, for until the forester knows what to expect from fire and how to deal with burnt-over areas, he can do little in a region where burning has been as extensive and is still as common as in Colorado.

In this investigation the examination of the first stages of reforestation will be made on areas of which some were burned over thirteen years ago, and on which Prof. Crandall has already made surveys and recorded progress at different periods

since. In the case of the old fires of which there is no record, the date of burning can usually be determined by the age of the trees which came up after the fire, and the necessary surveys and measurements can then be made. Special attention will be paid to the causes which make the cones of the Lodgepole pine open and distribute their seed. These are not yet understood, and in view of the tree's habit of storing its seeds in the cone, often for many years, and setting them free when killed by fire, are very important.

Prof. Crandall will have four assistants and will begin his examination in the Medicine Bow Range. From there he will work down the Continental Divide to the neighborhood of Long's Peak.

The great number of applications for the position of student assistant under the Division of Forestry which have this year been made, shows how rapidly the interest in practical forestry is increasing. The pay, \$25 a month and expenses in the field, is not enough to be alluring to those who are not interested in the subject, and no attempt to advertise the opportunity has been made. Yet, although it was announced early in March that more candidates had already applied than there were places for, the number of applications kept steadily increasing, until finally 232 were received. This number is more than seven times as great as that of last year's, the first year's applications—35. In these applications it is noticeable that the majority come from in or near the large universities, where information regarding the opportunity, which had to spread chiefly by word of mouth, could circulate extensively. From Harvard and Yale alone 100 were received, while 77 more were scattered over different parts of the Atlantic states. Sixteen came from California, while several students from Berkeley and Stanford had appointments last summer. If this information could have been spread throughout the middle states as easily as it was in the neighborhood of these larger universities, the num-

ber of applications would probably have been still greater.

The position of student assistant was created for the double purpose of giving young men who are thinking of engaging in forestry as a profession, practical experience and assistance under the supervision of experts, and of securing intelligent assistance for the government at a slight cost. In all 61 applicants were appointed and they are now at work. They are divided up among the field experts who are making investigations and forest surveys as follows: In the state of Washington, 7, in California, 13; in the Black Hills, 9; in the Middle West, 5; in Arkansas, 10; in the Appalachian region, 2; in the Adirondacks, 15. Most of their time is spent in collecting the measurements of trees and in making the survey from which the foresters of the Division can next winter draw conclusions and results. To a young man of an observing and inquisitive turn of mind, the work affords an excellent opportunity for learning the nature of the problems with which a forester has to deal, and the ways in which he does part of his work.

THE HOP INDUSTRY.

The growing of hops for commercial use is a farm specialty, not so generally adopted as the market demands warrant. The principal hop districts are in New York, Wisconsin, California, Oregon and Washington. If soil and climatic conditions are favorable, hops yield from 1,000 to 2,000 pounds per acre. At present prices the income will range from \$150 to more than double that amount for an acre. As the vines require planting only once in many years, the crop is one of profit, and suited to our modern idea of intensive soil culture.

Hops need a well drained, sandy loam, rolling land being preferable. The plants are set six feet apart, either way, after the land has been carefully prepared and leveled, to prevent any low places for

water to stand and kill out the roots. Hops exhaust the potash elements of the soil quicker than any other substance, and necessitate the annual use of fertilizers containing a good percentage of potash. In ordinary fields the application of 1,000 pounds of fertilizers containing 10 per cent potash, 8 per cent phosphoric acid and 3 per cent nitrogen are necessary every spring to insure satisfactory results.

In the famous Yakima valley of central Washington, about 3,000 acres are planted to hop vines, and the income from this area this season will aggregate \$500,000 or more. The roots are planted in the spring and cultivated the same as corn. The first year there are no returns, but with care the yards continue producing for twenty years, without transplanting. The first season the vines must be trellised. This is done by setting poles, about two by four-inch scantlings ten feet long, in the ground every twelve feet. Wires are then stapled to the poles, six or seven feet above ground, and the vines trained up.

The aphid or louse is the chief hop enemy. This can be killed by spraying the blossoms with arsenical compounds similar to those used for orchards. If the season is dry the aphid seldom does harm, and if too much rain falls during the period from ripening to picking, the burrs are liable to mold or mildew. Picking is done by hand, an average picker gathering about 200 pounds per day. The green hops are taken to dryhouses, where they are spread out upon the floor or special drying cloths. The drying process requires twenty-four hours, when the hops are pressed into bales of 200 pounds each and placed on the market. As a general rule, hops lose three-fourths of their weight in drying.

Those who have been engaged in the hop industry for many years estimate that the original cost of a yard of ten acres, including plants, cultivation, dryhouse and complete equipment, is about \$200 an acre, and the annual maintenance expense reaches \$100 an acre. An established yard can be grown, harvested and marketed

for 8 cents a pound, and as the selling price this year averages 15 cents, the profits are good. Hops are used extensively throughout the world, for manufacturing and medicinal purposes, that the demand is constantly increasing, and the supply in the United States is limited.

American-grown hops sell readily in foreign markets, and are sought by experts because of superior qualities. The hop industry, when fully established in a locality, is an important money-producing business, as many people are employed in caring for and picking the crop. The 3,000 acres in Yakima valley this year furnished one month's work to 6,000 persons engaged as pickers, besides indirectly employing many others to supply these with food and clothing. There are many farming districts in the United States where hops could be introduced as a special crop, and the people made more independent by engaging in hop-growing.

Hop roots are grown by nurserymen, plant and bulb dealers, and most of the prominent seedsmen quote prices in their annual catalogues. An acre will require about 5,000 roots, which should be set deep in the ground, covering the crowns with about four inches of dirt. If the soil cannot be ploughed deep, it is well to run a subsoil plough to stir the surface as deep as possible. The roots may be set in furrows, marked out either way, the proper distances apart, or by making holes with the shovel, the same as in transplanting trees.

HOW TO GROW TURNIPS.

To grow turnips profitably the preparation of the soil should be commenced a year or more in advance. Green crops, say clover or cow peas, properly fertilized when seeded and turned under at maturity, will answer an excellent purpose. A fertilizer composed of the following ingredients may be used per acre: Acid phosphate 300 pounds and Kainit 400 pounds; broadcast and plow in shallow, preferably a few weeks before seeding; 100 pounds of muriate of

potash may be used in place of the kainit.

The ranker the green crop the greater the benefits to be derived, consequently it will pay well to apply double the above quantity of fertilizer. Crimson clover fertilized as above and turned under at maturity for a turnip crop next season would answer an excellent purpose. The clover (and the same of peas) should be turned under sufficiently early to at least partially decompose before the turnips are seeded.

When a fertilizer is applied to a green crop, as above, and turned under no further fertilizer for the turnips will be required.

The clover or peas as the case may be, will return to the soil the phosphoric acid and potash previously drawn from the acid phosphate and kainit that were applied direct. The vegetable matter while rotting will add humus and other valuable properties to the soil thus largely increasing the general fertility and productiveness of same.

In addition to this a heavy crop of clover or cow peas will draw from the atmosphere from 100 to 200 pounds of nitrogen per acre. The quantity will of course vary with conditions, but in order to be safe we will take the smaller quantity, 100 pounds.

The nitrogen in commercial fertilizers usually costs consumers from 20 to 28 cents a pound. Counting it at 20 cents there will be a clear gain of at least \$20 per acre, to say nothing of the other important advantages, from growing and turning either one of said legume crops. When the crop or clover or peas, as the case may be, is turned under the nitrogen, gathered as aforesaid, will also be returned to the soil where it will be available for the turnips, or any other crop that follow. Our farmers all know what saltpetre is. They can readily ascertain its active properties as a fertilizer by applying the scrapings from beneath old houses to the soil and noting the result. These scrapings are strongly impregnated with saltpetre. Touch a lump of the dirt to the tongue and note the pungent taste. Practically saltpetre, nitrogen and nitrate of soda may be regarded by the farmer as meaning the same thing, but

there are different degrees of strength in the several substances. One hundred pounds of nitrate of soda is equivalent to about 16½ pounds of nitrogen. Consequently if you can virtually grow 100 pounds of nitrogen per acre, as above described, it is equivalent to about 600 pounds of nitrate of soda. This fertilizer (nitrate of soda) is regarded as the most convenient form for supplying nitrogen direct to the soil.

It is mined in Chili, South America, being dug out of the ground and is known as Chili saltpetre. Owing to the great distance and to other causes not necessary to state, nitrogen produced from nitrate of soda, costs nearly three times as much per pound as phosphoric acid or potash. These three ingredients (nitrogen, phosphoric acid and potash) constitute a perfect fertilizer. The above plan of employing a legume crop will produce a heavy crop of turnips and the fertility of the soil will at the same time rapidly improve thereunder.

But, as a portion of at least two seasons will be necessary to prepare the soil the plan is impractical for present purposes, therefore in lieu of the foregoing construct low ridges from 2½ to 3 feet apart, and open and deposit a liberal amount of stable manure therein. A fertilizer composed of the following ingredients may also be applied in the drills with the stable manure at the rate of 500 pounds per acre; nitrogen 3 per cent, phosphoric acid 6 per cent and potash 8 per cent. Run a plow in the drills and mix the manure and fertilizer thoroughly with the soil. Then complete the ridges and seed the turnips in the usual way.

The plants in the drills should be properly thinned and thoroughly cultivated with a light narrow plow of suitable construction. Two boys can easily do the work, one holding, the other one pulling the plow. By having the drills a little wider apart a horse can be used in cultivation.

Owing to the convenience of cultivation sowing in drills will be found far more practical than broadcasting.

Bryan Tyson.

PULSE OF THE IRRIGATION INDUSTRY.

RESULTS IN PECOS VALLEY.

The Pecos Valley has made substantial progress this year, and is today as tangible a proof of what irrigation can accomplish in an arid waste as any irrigated district in America. Not only has the land been thoroughly reclaimed from its original state of barren desolation through the instrumentality of irrigation, but it has been made to give wonderful results and develop a fertility that cannot be excelled anywhere.

The enormous peach crop this year is proof of this. The yield was so large that not above one-half will be harvested. The fruit ripened in the big orchards faster than it could be handled and tons and tons have gone to waste. The size attained by some varieties seems almost incredible and many "Albertas" weighed a full pound and measured twelve inches around and possessed an unequalled flavor. A number of cars were shipped east, some as far north as St. Paul, Minn.

This immense crop of fine fruit will do the valley more good, spread broadcast over the country as this has been, than all the advertisements that could be given it.

Up to August 1st the Irrigation Co. supplied the farmers with about two acre feet of water on the average. This was distributed over 9,000 acres of land. Last year the number of acres irrigated was 8,881. Of the 9,000 acres irrigated this year, 4,000 are in alfalfa, 3,000 in forage crops, such as cane, Egyptian corn and grass, and 2,000 in orchards.

The two great lakes belonging to the Irrigation Co., Lake Avalon and Lake McMillan, are both at high water mark, and have been so all summer.

The alfalfa yield this season will be

fully up to that of any former year, about five tons to the acre and some of the fields will stand five cuttings.

The climate this summer has been very pleasant, the hot days being very few and far between and the mercury at night has not gone over 60° with an average of 55°. Last winter, that is between the 13th of December, '99 and the 13th of March, 1900 the daily average was just 55° above and for the nights the mercury seldom fell below 42°.

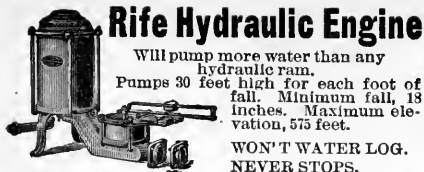
GEO. H. HUTCHINS.

IRRIGATED RICE FIELDS.

The most productive rice lands are always irrigated. Over a hundred thousand acres of rice are irrigated in Louisiana, and the method employed by the planters place them at the head of the world in rice culture. Their advantage lies in irrigating in such manner that they can cut their crops by machine instead of by the ordinary method of the hand sickle. Rice irrigation contemplates a complete flooding of the field and leaving the roots under water, rice being an aquatic plant. This being the case the only way left for harvesting is for the negroes to wade into the marsh and cut the grain by hand. The Louisiana planters, however, lay their fields off in plates and throw up furrows around them, forming little walls or levees.

Then at the proper time the water is turned in and rice grows. When the grain is just about matured, these miniature walls are broken down, and the water run off.

After several days the ground is dry and firm enough to allow horses and machines to go upon it and harvest it as they would wheat or other grains. This places the rice crop of Louisiana abreast of these other crops, whereas under the old method it is a hundred years to the rear. What would next year's wheat crop be if its harvest were dependent upon sickles? And yet with the exception of these Louisiana fields, the rice crop of the South is today irrigated and cut as it was a century before Brigham Young's followers laid out their first ditch in the wilds of Utah.



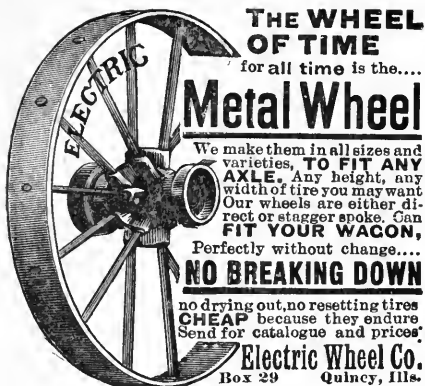
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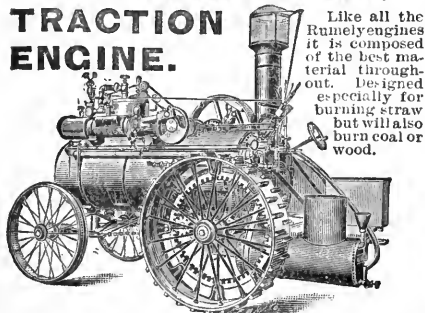
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