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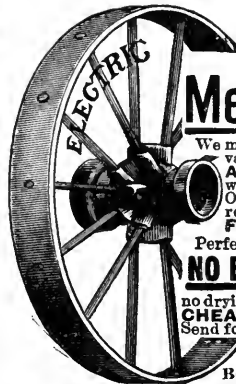


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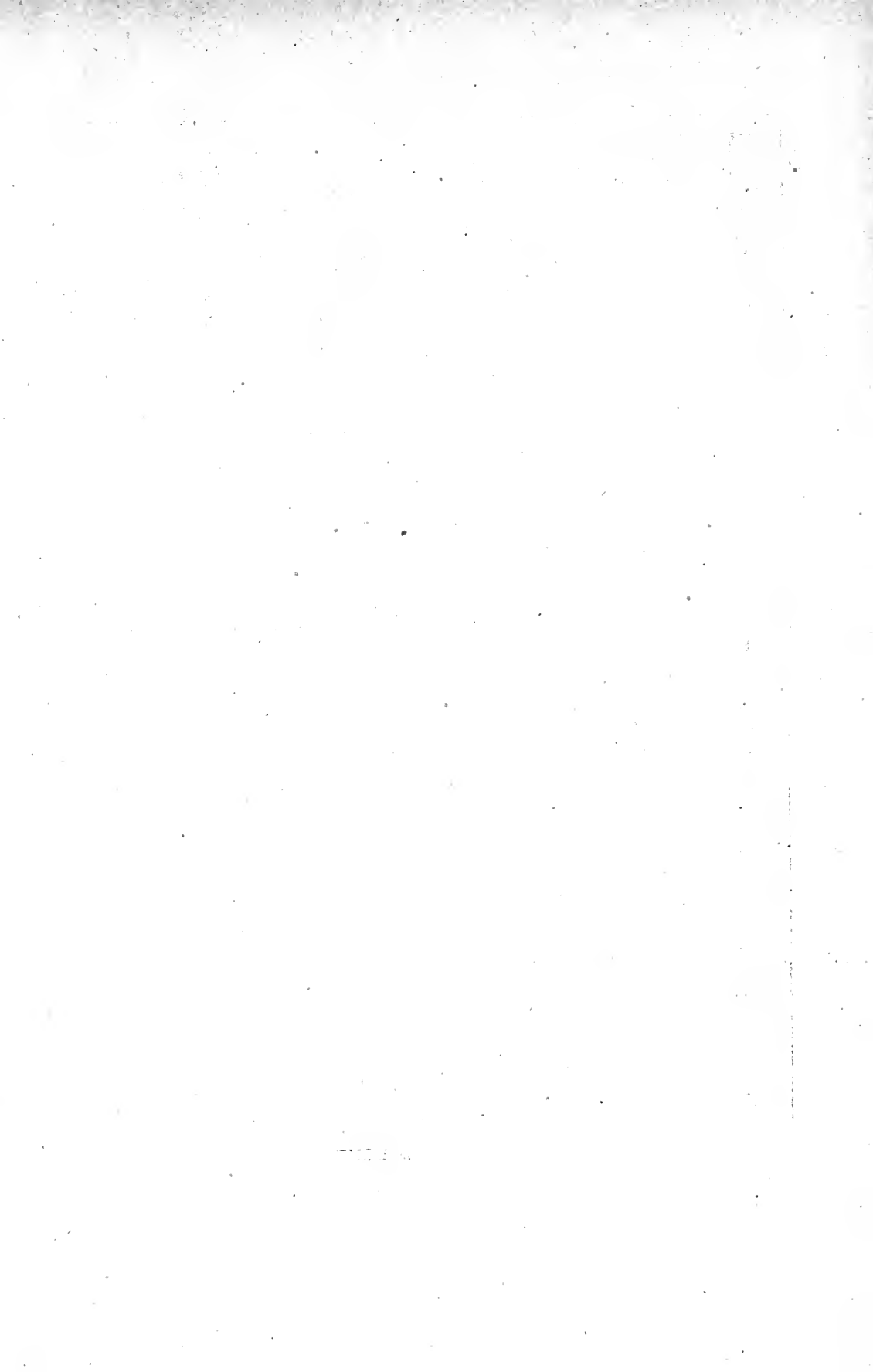
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OUR DEAD PRESIDENT.

THE IRRIGATION AGE.

VOL. XVI.

CHICAGO, OCTOBER, 1901.

NO. 1

William McKinley. Death makes mourners of us all. There is scarcely an American citizen but has at some period of time, when visiting the cemetery, shed a gentle tear upon the green mound raised over the graves of loved ones gone. Well do we remember when the electric flash brought the sad news that the "God-like" Webster slept beneath the shades at Marshfield; again when informed through the same instrumentality that the clarion voice of Clay was hushed and would no more be heard amid the councils of the nation, that the Great Harry of the West, the ablest Senator of them all, lay cold in death at Ashland; and again when red-handed treason stalked boldly forth in the land and strong hearts and able minds were needed to pilot the old Ship of State to safety, we were called to mourn the death of our own loved Douglas, who sleeps by the Lake, made classic by his own munificent hand, left to sing a fitting requiem to his memory as wafted by the gentle winds of heaven on, on to mid-ocean.

These were all great losses to our nation—there being no one left at the time to take their places—yet they were given in answer to

our heavenly Father's call; and while our loss was great, we could but say amen and go forward with bowed heads and bleeding hearts in the discharge of our duties, as if nothing of the kind had occurred—but not so in the present emergency. Multiply our grief a thousand—yes, a thousand times a thousand-fold over the loss of relatives, friends and statesmen, called in the regular way, and it will not compare with our loss over the assassination of the President of the United States. It is not at the loss of the man we grieve, though great and good he was, but it is the loss of the President of the United States—to strike a blow at him sends a thrill of pain to every true American heart. While this is not the first instance of the kind that has befallen us, yet, if possible, it is more painful to our people and far more dangerous in tendency toward the life of the nation. The assassination of President Lincoln and of General Garfield was the act of the individuals, Booth and Guiteau. There was no political party or body of people behind either of them; theirs was the work of a morbid, vitiated mind, maddened by drink, or a depraved na-

ture lost to all self control. Not so in this case. Czolgosz, the terrible wretch that he is, was only an instrument in the hands of a political organization of people in this country, who have by their actions forfeited all right or claim to citizenship and should be expatriated at the earliest day possible and placed in captivity on some lonely island far removed from all the rest of the world and left there to work or starve and enjoy only the company of themselves.

The fathers in framing the Constitution of the United States made ample provisions for the country in emergencies like the present. At the death of Presidents Lincoln and Garfield, Vice Presidents Johnson and Arthur took the oath of office as President and entered upon the duties of the high office just as Vice Presidents Tyler and Fillmore had done at the death of Presidents Harrison and Taylor. There was no shock to the business or political interests of the country then, and there should be none now. While this occasion calls for prompt, rigid, vigorous legislation to prevent its recurrence, fortunately for our common country we have a president in the person of Theodore Roosevelt who has the ability, courage and firmness to rise to the occasion and who will use all the power at his command to see that adequate laws are enacted by congress to enable him to crush out Anarchism in the United States, and clothed with that power, he will discharge his duty to the letter and spirit of the

law; and in the performance of that duty he will be sustained by all true American citizens regardless of party ties, creeds, or religions.

If beauty can come from such a terrible crime as we have just witnessed, it is in the fact of the unanimity of sentiment of love for our President on the part of the people of the civilized world. From the far off countries of the Old World, as well as at home, the South, the North, the East, the West, the Jew and the Gentile, the Catholic and the Protestant, comes the universal cry, as if with one voice saying, God save the President! God have mercy upon the American people!

William McKinley was the obedient son, the true friend, the good husband, the brave soldier, the able statesman, "the noblest work of God, an honest man," respected and honored by his own political party when living, loved and mourned by all when dead.

Sugar Beets.

The growing belief that the United States will shortly be able to produce from beets the \$100,000,000 worth of sugar which her people now annually import seems to be shared by British Consul Wyrldham, who has given the subject close attention and reported upon it to his government. The following is an extract from his report which has just reached the Treasury Bureau of Statistics.

"The production of beet sugar in the United States is rapidly increasing, and in the Chicago Consular district there are four factories in the State of Illinois, three in Nebraska, and three in Colorado; those in Nebraska and Colorado belong to the

American Beet Sugar Company, and are at Grand Junction, Rocky Ford and Sugar City, and when fully completed will employ thousands of hands.

“Statistics indicate that the United States consumes more sugar than any other nation or approximately one-quarter of the whole of the world’s product. The conditions of soil, climate, and other advantages are quite as good in the United States, and especially in Colorado, Nebraska and Illinois for the development of the beet as in any of the country of Europe or Asia. The world’s production and consumption of sugar is now about 8,250,000 tons per annum, two-thirds of which is produced from beet and only one-third from cane, whilst the normal consumption is estimated as increasing at the rate of 250 000 tons yearly.

“The success attending the cultivation of sugar beet in this district has proved that it may be made a profitable and successful investment. A large factory has been built at Rocky Ford, Colo., which cost \$200,000 to build and equip. It is proposed to have it ready for the crop of the coming season. To supply it the farmers in the vicinity have contracted to grow 8,000 acres of beets a year for five years. From tests made, they estimate their beets will yield 15 to 18 per cent of sugar. The factory, when running at its full capacity, will consume daily 1,000 tons of beets, which it will convert into about 100 tons of refined sugar of the highest purity. The beets reach maturity with a high percentage and seldom go below 15 per cent, 12 per cent is taken as the basis of buying beets at the factory.

“The beets are grown by the farmers under contract with the factory, and paid for according to the saccharine contents determined by chemical tests made of samples taken from the wagons at the time of delivery. In addition, the factory controls about 5,000 acres of land. Most of the land will be farmed by tenants, but

only a portion of each farm is devoted to beets each year. Growers sell their beets based upon the sugar contents. The tests somewhat resemble the assaying of ore from the mines. Selling upon this basis encourages better farming and the raising of better beets. It is the only fair way, both to the raiser and the manufacturer.

“At Sugar City on a farm of 12,000 acres a factory has been built with a capacity of 500 tons every 24 hours. On the farm 1,000 men and women have been employed during the summer, and this season’s crop will be converted into sugar. The establishment of the sugar factory at this point built the town, which a few years ago consisted of a hut or two and thousands of prairie dogs. Next year fully 4,000 acres of beets will be in cultivation. The output will be increased as rapidly as possible, and every day the demand for workmen is increasing.

“A general estimate of the cost of construction, cost of operation, and general results to be counted upon, of beet sugar factories in this district, as taken from the Rocky Ford plant places the general average of sugar in the beets at 12 per cent. So far as the Arkansas Valley in Colorado is concerned, this percentage is being largely exceeded; the minimum percentage of sugar being about 14 per cent, while the maximum has reached 23 per cent, with a coefficient of purity ranging from 89 to 95 per cent. In stating these results, reference is especially made to the factory at Rocky Ford, built and worked by the American Beet Sugar Company, a New York corporation, which works two factories in California and three in Nebraska, the one at Rocky Ford being their fifth. The experts in charge of this last factory all express surprise at the results of this first campaign, and they have become thoroughly convinced that this valley (Arkansas Valley, Col.) is the ideal sugar-producer, thanks to its equable climate, ample supply of water for irriga-

tion, cheap fuel and limestone, and an unlimited extent of available land for beet culture. It is expected that the same company will erect one or more factories in addition to the one at Rocky Ford, one to be built further east and the other west of Rocky Ford.

"As an example of the quality of the sugar beets produced upon this land, it may be mentioned that so far six car-loads of beets from one field have been tested with results as follows: one car-load, 16.3-10 per cent; three car-loads, 18.8-10 per cent; and two car-loads, 20.4-10 per cent.

Exports and Imports to Porto Rico. Exports of American products to Porto Rico in the fiscal year just ended were, according to the figures of the treasury bureau of statistics, more than three times as great as they averaged when Porto Rico was under the Spanish flag and more than 50 per cent in excess of those prior to the enactment of the Porto Rican law which went into effect May 1, 1900. The total domestic exports from the United States to Porto Rico in the fiscal year 1897, which entirely preceded the beginning of hostilities with Spain, were \$1,964,850. In the fiscal year 1900, ten months of which preceded the date at which the Porto Rican tariff went into effect, our domestic exports to Porto Rico were \$4,260,892. In the fiscal year ending June 30, 1901, all of which was under the Porto Rican act which levied 15 per cent of the regular Dingley law rates on goods passing into that island from this country, the total domestic exports from the United States to Porto Rico were \$6,861,917. These figures include only exports of domestic merchandise and do not include foreign merchandise brought into the United States and re-exported to Porto Rico, which probably amounted to about a half million dollars, since the Porto Rican statement of imports from the United

States for the fiscal year ending June 30, 1901, shows the grand total including domestic and foreign to be \$7,414,502.

Porto Rico imported in the fiscal year ending June 30, 1901, goods amounting to \$9,367,230 in value, and of this \$7,414,502 came from the United States, the total from other countries being \$1,953,728. Of this, \$1,952,728 imported from other countries other than the United States, the value of \$808,441 was from Spain; \$374,837 from the United Kingdom; \$294,067 from Canada; \$166,823 from France; \$152,201 from Germany, and \$61,838 from the Netherlands.

The Date Palm in America. It is known by very few even of our well posted fruit growers that the Date Palm is an established success in the United States. For centuries past there has been an occasional tree growing in some of the warmer parts of the country, especially in southern California, Arizona and Florida, but these trees have all been seedlings which have mostly come up by accident or were planted by some of the mission fathers who emigrated for Spain, and many of them have never borne any fruit to this day. It is also known only by a few that the date palm is a dioecious tree; that is, the flowers of the two sexes being on separate trees, it is absolutely necessary that a female or bearing tree should have a staminate tree growing near, or that male flowers when in a proper condition should be carried to the female trees and placed where their pollen will fall upon the stigmas of the bearing tree in order that fruit should be produced. This fact has been known for thousands of years by the inhabitants of the arid regions in other parts of the world where the date has been grown very largely, and male trees are kept purposely that their flowers may be used in this way. This is a common practice among the Arabs and Budouins. They also take advantage of this peculiar

ilarity of the date tree in their wars. One tribe or band making a raid upon another, if successful is almost sure to burn the male date trees in order that no pollen may be obtainable for the fructification of flowers of the bearing trees, and by this means the fruit supply is cut off and starvation, or at least the material reduction of their food supply is certain. But in order to prevent such a calamity, those who are foresighted enough to do so, take the male flowers when in proper condition, wrap them up carefully in cloth or other material which will protect them and bury them in some secret place where they can be dug up, dampened and used in case of necessity. The pollen thus kept in the flowers retains its vitality for several years, and it seems to us a remarkable fact that the Arabs, whom we have often considered unscientific people, have long been able to take advantage of this.

There are regions in Southern California and Arizona where the date can be grown perhaps as well as anywhere in Europe, Asia or Africa, and steps are being taken to undertake its culture on an extensive scale. Some twelve years ago when in the government service in Washington City I imported plants which were taken up as suckers from some of the best bearing trees in Algeria, Arabia and Egypt, and had them planted near Phoenix, Arizona, and in several places in California, where they are now in bearing condition. This is the only way in which the date can be properly propagated, because to grow seedlings would be very uncertain as to which sex would be produced, and the varieties would not likely be of much value, as is the case with seedlings of other kinds of fruits. But when suckers or slips are

taken from the base of bearing trees they are sure to bear fruit of exactly the same character as that grown upon the original trees. This is the method always followed in date growing regions. The United States Department of Agriculture, under its present able management by Secretary Wilson and his assistants, is following up this idea by importing thousands of small plants from the regions just mentioned and plantations are being established in the arid regions of Arizona and California. The soil and climate best suited to date trees are just such as are found in the hottest parts of those states, where rain rarely falls and where the soil is quite sandy, with abundant opportunity to irrigate. The Arab saying that "the date tree needs fire at the head and water at the feet," which means that the climate should be very hot and dry, but the soil should be moist.

Although a little fruit has been produced on trees in various parts of the sections mentioned, yet there has never been any of it dried and packed until last year at the Agricultural Experiment Station at Phoenix, Arizona, where a number of varieties were thus treated. There is a case of this fruit now on exhibition in the horticultural building at the Pan American Exposition, on the Arizona space, where it may be seen. This marks a notable event in date culture in the Western Hemisphere. There is no good reason why we should not produce in this country all the dates which our people need, and it is a matter of great satisfaction to those who are interested in this line of work to note the progress which is being made.—
H. E. Van Deman.

IRRIGATION IN INDIA AND AMERICA.

BY. E. H. PARGITER, OF THE IRRIGATION BRANCH, PUBLIC WORKS DEPARTMENT, PANJAB. INDIA.

(Continued from last month.)

It would be unwise to give to these small tenants in India, proprietary rights in their land, as the Indian agriculturist is one of the most improvident of men and many would soon run into debt, and mortgage or sell their estates to capitalists or money lenders, the very men whose ownership of such estates has been shown to be not for the general interest. Hence while seeking to give tenants every inducement to improve their holdings, and every opportunity of benefitting themselves thereby, it was advisable to safeguard them against their own extravagance or negligence; and therefore no means are given them of disposing of their rights in their land, and of putting themselves in the power of other landlords. Speculation in land also is thus guarded against; all the profits arising from the increase in the value of the land belong to the government which has in fact done all the speculation itself, in constructing at great expense a new canal in a barren land.

As soon as the construction of the Chanab Canal approached completion, work was started on another, the Jhelam Canal, from the river Jhelam, in 1898. This is to irrigate the land between the rivers Chanab and Jhelam; it is expected to take five or six years in construction. The rate of progress on the construction of these canals is governed by the amount of the capital money grant allotted to the province each year by the government of India. For many years past, the sum given to the Panjab annually, has been between \$1,300,000 and \$1,400,000. During the past two years, however, since Lord Curzon has been governor general of India, considerably more has been allotted, he having quickly recognized the immense advantages to the country that these canals prove, and shown thus his desire to hasten their construction. From one-third to two-thirds of the annual grant in the Panjab, is usually spent each year on the large perennial canal under construction at the time, and the remainder on small canals and on extensions and improvements of the existing large canals.

The condition of the land in the doab to be irrigated by the Jhelam Canal is similar to that for which the Chanab Canal was made. Nearly all is waste land, but the upper half has more population than

there was on the Chanab Canal tract. This is due to the fact of its being nearer to the Himalaya Mountains, and so receiving more rain; of which enough falls to render culturable the lower lying portions and basins which receive the drainage from the higher surrounding lands. Also as the width of the doab is not great, being about forty miles, the depth below ground surface of the subsoil water is not more than 90 feet where deepest in the center of the doab, and decreases to about fifty feet towards the edges of the higher land bordering the river valley bottom lands. There are a good many wells therefore in use, chiefly to supply drinking water to the people and their cattle and flocks; but these are also brought into use to irrigate a little vegetable and grain crops when rain is deficient. The rainfall is usually sufficient to produce a plentiful crop of natural grasses, on which large herds of cattle and camels are supported, and their owners derive a handsome profit from the sale of the clarified butter ("Chee" in Hindustani) obtained from the milk.

Nearly half of the land irrigable by the Jhelam Canal is included within village boundaries, and belongs to the population there, though most of it is waste land, has never been cultivated for centuries, and is more than necessary to supply with grass the cattle kept by the people. This arrangement was effected many years ago at the time of the settlement of the country, soon after annexation, when there was absolutely no prospect of the land ever acquiring a high value through the construction of an irrigation canal. The villagers were then allowed to claim as their own, all the land for which they were willing to pay the merely nominal grazing land assessment, fixed by government for waste lands. The people are now gaining a large unearned increment by the great rise in the value of their land caused by the approaching certainty of assured irrigation. Owing to the three years' drought that has caused the recent famine in India, these people have been very hard hit, and brought into great straits, for neither crops nor grass could be grown. Many of them were obliged to sell some of their land in order to be able to pay their way, and this they were encouraged to do by seeing their land to have now becoming valuable. Whereas its value was only about \$1 or \$2 per acre before there was any hope for irrigation for it, it has already attained a value of \$6 or \$7 per acre, though three or four years must yet elapse before irrigation can be commenced. Their need has been an opportunity for capitalists and speculators to buy up land, and many have done so, anticipating a further rise in value when the canal is opened for irrigation. Under these circumstances of there being plenty of privately owned lands available for purchase, it is not likely that government will sell any of its land; but guided by the experience gained on the Chanab Canal, will probably keep the ownership of it

itself, and give the tenant farmers occupancy rights where they are satisfactory tenants.

During the construction of a large canal like this, that takes several years to complete, the accumulated interest charges on the capital cost will amount to a large sum, before any revenue can be expected. But to prevent any loss of revenue that could be obtained, when once the canal is completed, it is desirable that all the land that can then be irrigated, be already colonized, and prepared for cultivation, so that the canal may start working with a fair demand for water. Now government has it in its own power to thus colonize all its own land, and has a perfectly free hand to settle the new colonists when and where, exactly as it requires, and finds best; arranging different tribes, castes, and classes, in separate villages or townships; so that those may not interfere with each other's ways and quarrels or disputes among neighbors be avoided. But with regard to privately owned lands, government has no guarantee that proper arrangements will be made to ensure early and extensive irrigation. Speculation in land may only hold back their land to sell it again at a good profit afterwards; owners may be unable to obtain sufficient tenants or laborers at once to take up all their land; while the old inhabitants of the district are mostly very loth to change their long established patriarchal mode of life, that of keeping large flocks and herds on the waste land, and instead take up irrigation farming. Their favorite recreations also hitherto have been cattle lifting and thieving, a profession easily carried on, and difficult to check in the extensive and uninhabited jungles of the district; but they would have to take to more honest ways with the advent of a large population, and the transformation of the jungle wastes and hiding places, into villages, farms and open fields. So that if the government had to depend on the irrigation of villages and privately owned lands alone for revenue, it might be many years before the canal became remunerative; and meanwhile, annual interest charges would be accumulating as a debit against the account of the canal. In fact it would not pay the government to construct a canal for such land in such circumstances, and it needs to have full powers for colonizing the land to be irrigated. In the case of the Jhelam Canal, it does own more than half of the land commanded, and this is sufficient to commence with as a revenue producing area.

After the completion of the Jhelam Canal, the next most feasible large project to be undertaken, is the construction of one or more large canals from the left or east bank of the river Indus: to irrigate the doab lying between this river on the west, and the river Jhelam and lower down the river Chanab on the east side. This will be a very large work, and detailed survey of the country have yet to be

made for it. If a single large canal be considered most advisable instead of two or more canals, this canal will be, by far, the largest irrigation canal in the world. At present, the Chanab Canal holds this position.

But here, much more than in the case of the Jhelam Canal, the question of the ownership of the land to be irrigated, comes in, and forms the *crux* of the project. A very large proportion of it belongs to the village inhabitants of the country, made over to them many years ago at the settlement of the country, in the same manner as the land of the Jhelam Canal tract. As already explained, a canal is not likely to be remunerative in such tracts, which need colonizing, unless the ownership of most of the land is in the hands of the government; and it has lately been notified to the people that no canal will be begun until most of the waste land, now useless to them, is given back to the government. This track receives hardly any rain; the land produces but little grass for cattle, and is practically valueless to the people, except in patches here and there of lower depressions, and where there is a well, in some cases. The government therefore, a few years ago, endeavored to persuade them to relinquish their ownership in most of the land, as being far more in area than they had any need for, or could utilize; but without success, as they got wind of the proposals to make a canal in their district, and therefore naturally wished to hold on to land, which would become valuable when irrigation was made available. They believed that government would ultimately construct the canal for the land, in any case, and therefore of course refused to part with any of their land. So government has had to put its foot down firmly, and has clearly notified to the people, that it will not think of constructing any canal at all until the land asked for has been given up. There is no injustice or real hardship to the people, involved in this procedure; they will be allowed to keep as much land as they now need for the purposes of their present cultivation, and pasture; as well as a certain proportion of the waste land. Probably about one quarter of the whole area will be left to them, and about three quarters become the property of government, who will then be put in a position to undertake the construction of a canal or canals with a reasonable prospect of its expenditure being remunerative, and the irrigation project a success commercially. The village owners also will be largely benefited by the great rise in the value of the land that will still belong to them; and by the change for the better in their prospects, from their present precarious state, with an uncertain and scanty rainfall, to one of assured prosperity and the certainty of irrigation. It now remains to be seen if they will respond to the invitation, and accept the terms offered; for until they do, nothing can or will be done to give irrigation to their land. To

bring the waste labor of congested districts on to the waste land, by a profitable employment of its capital, is the main object of the government; not to risk its money on a costly undertaking, which might not for long, if ever, prove remunerative, and the profits of which would even then mainly go, as an unearned increment, to those who have in no way deserved them.

The construction of one of these canals for the irrigation of waste lands, includes the laying and marking out of every farm and holding, in squares of about twenty-six acres each, and the completion of a watercourse leading to each holding. Each village or township is arranged to contain from about thirty to sixty of these holdings or squares, which are not grouped together according to any geometrical plan or pattern, but entirely in accordance with the watersheds and drainage lines of the country, so as to allow of irrigation by flow or gravity being carried out in the simplest and readiest manner. Consequently no two villages are similar in size and shape. To do this, of course, requires a complete detailed surveying and contouring of the whole track, with plans showing every holding and contours for each foot in level. These preliminary works are laborious, expensive, and take time to complete, but when done, they permit of ideal arrangements being made, so that no subsequent alterations are required.

One of the squares is set apart as a village site, and roads are made from it to the neighboring villages, and past every holding. As soon as the watercourses of a village are ready, and canal water is available, the village is colonized. The new settlers clear sufficient land, each in his own holding, to grow what crops they require for their first years' support; and they construct their houses on the village site. These first houses would be made very rapidly and cheaply of adobe walls, and roofed with jungle wood cleared from off the land, with a covering of a few inches of earth. For the first two years of irrigation no water rates are assessed on the crops grown, as the people require all they can grow and earn, to support themselves while preparing their farms and buildings. During the third year, half rates only would be assessed; and then by that time, they should be fully at home, with plenty of land under cultivation; so that in the fourth year they could easily pay the full water rates fixed for the various crops grown. One square of 28 acres is sufficient to support one man with a family, and is large enough to occupy his whole time. Where the family contained grown up sons, they would be given other squares, as many as they could keep fully cultivated.

While the government of India can, is prepared to, and usually does, wait several years after the opening of one of its large canals, before the canal proves remunerative, it cannot afford to do so for an

indefinite or prolonged period, (unless the canal is maintained as a protective work against famine in times of different rainfall in well population districts). In all projects for canals designed expressly as remunerative or reproductive works, careful forecasts are drawn out showing the anticipated revenue and expenditure for twenty or more years after completion. These show the growth of the irrigated area, and revenue therefrom, year by year, the gradual paying off of the accumulated interest on the capital cost by the net revenue, (total receipts minus all working expenses) until, after a certain number of years which may be ten, fifteen or twenty, the annual net revenue forms a handsome interest on the capital cost. A less rate of interest than 4 per cent would not be considered sufficient to render the work remunerative; and on the canals of North India, a rate of 8 or 10 per cent or even more, is realized frequently. Without a satisfactory assurance that a canal would be, in this way, remunerative, the government would not be prepared to construct it. Ordinarily, when a canal of this kind is constructed in any country, by private capitalists or a company as a remunerative undertaking, the owners would expect a much quicker return of profits on their expenditure, and therefore would be less likely to undertake a single large canal carrying as much as 8,000 cubic feet per second, (as the largest canals in North India do) and which could not be expected to be remunerative for several years after commencement. The state ownership of rivers and canals has this advantage, that the government can afford to wait several years, and can spend money more freely on so constructing a work as to be permanent, without renewals being acquired. Efficiency and permanent success are better ensued in the case of large and costly undertakings by the government carrying out their design and construction by a competent staff of trained and reliable engineer. In the early days of a country such a staff is not usually available, and in order to have its first railways constructed, the government of India was obliged to have recourse to the system of inviting their construction by guaranteeing a regular rate of interest on the capital expenditure from their very commencement. But for many years past, with an efficient staff of engineers in its own railway branch of the Public Works Department, government has been able to do its own construction work, and keep all profits for itself. In the development of irrigation no such urgency was called for, and irrigation works have been uniformly carried out by government agency, the department being increased as more engineers were required.

All these perennial canals are designed to flow continuously throughout the year. The works on them are constructed, once for all, solidly of concrete, iron, brick and stone, with a view to permanently withstanding the heaviest strain ever likely to be brought on

them, and to requiring the minimum of periodical repairs. While it is usual for each canal to be closed entirely at its head, for a few weeks, at some time in each year, to enable ordinary repairs and clearances of the bed to be carried out, yet it may happen any year through a failure of the rains, that the canal has to be kept in full flow at that time to save the crops dependent on it. In such a case, the usual annual repairs must be postponed, perhaps for many months; and the canal should be able to do its duty efficiently without them. Deep and solid foundations are therefore given to all works where any scour in the bed close by, is possible from any cause.

In the southwest regions of the Panjab, and throughout the province of Sindh the annual rainfall is so slight, averaging less than six inches, that without irrigation no crops can be grown. Along the strips of bottom land bordering the great rivers, the spring level is sufficiently near the ground surface to allow of water being profitably lifted from wells by bullock power. Close to the river the amount of lift may not be more than ten or fifteen feet, but it rapidly increases with the distance from the river, and would usually exceed thirty feet at a distance of three miles, the land being fairly level along a line at right angles to the river throughout the width of the bottom land of the river valley. With a greater lift than forty feet but little irrigation can be done during the intense dry heat of the hot weather in the plains of North India. These plains are less than 1,000 feet above the sea level; and in the arid regions now alluded to, only strips of land a few miles wide bordering the great rivers, can be cultivated without canal irrigation. For the tracts further distant, numerous small inundation canals take out from the rivers Indus, Jhelam, Chanab, Ravi and Satlaj. The largest are about fifty or sixty miles in length, have bed widths up to eighty feet, can carry a full supply depth of from eight to ten feet, with a discharge up to about 2,000 cubic feet per second. Some are quite small, with a length of only about ten miles, and a bed width of eight or ten feet. Many of these were made and were in use by the people long before the commencement of British rule. They were usually very badly aligned, and crossed drainages or low ground with weak embankments which often breached, so that they gave great trouble. Ever since the annexation of the country the engineers in charge have been busy in improving and extending these; amalgamating two or more small adjacent ones by giving them a common head channel. None at first had any head regulator, or any head works; they were simply open ditches fed from the river, and their supply fluctuated with it. But by this time most have been provided with head regulators to control the discharges and keep out excessive flood supplies which were always a source of danger. These regulators cannot be built at the very commencement of a canal, as they would be destroyed before long by river erosion, which may cut away from a quarter to a half of a mile in width of land along a river bank in one year. They have to be built at some distance off, so as to be always safe from river erosion.

(Continued next month.)

TWO WINDMILLS IN ONE LOT.

BY HEZEKIAH BUTTERWORTH, IN *Farm and Fireside*.

The time of protected crops is at hand, and the "glass gardens" of New England and the irrigating windmills of Dakota but follow the suggestion of the most productive crop-raising abroad. The dike and windmill made Holland a garden, and one of the most beautiful of all garden lands of the world. Nowhere do flowers bloom brighter; nowhere do small plants yield more vegetables.

A Holland story is told of a man who acquired an estate with two mills on one lot. He caused one of them to be taken down, because there might not be wind enough for two windmills in one field.

"Out West" there is wind enough for two windmills in a single field, and an irrigated garden even in the short season of the Dakotas will support a family. Thousands of toilers in the Northwest have gone into debt, mortgaged their farms, into which they had put their hard-earned money, and lost all they had. Their crops failed for the want of water. "I could have succeeded had I had the means of irrigation," has been said thousands of times by the hapless, half-starved wheat farmer, as he turned back to some city to live in a few rooms of an apartment house, and to work for small wages, a slave to circumstances. A modern hydraulic machine or a simple patented windmill for raising water would have saved his crops, turned his fields into gold, made him a home in the pure airs of Nebraska or the Dakotas, and surrounded that home with cotton-trees, shrubs, vines, etc. But he had no means of securing such hydraulic power.

Farmers rushed into the Dakotas and the Middle Northwest and raised a single crop of wonderful proportions. They saw a clear fortune for them in a few years in their mind's eye. They thought they saw how much money they could borrow on next year's crop. The East lent them money. The next year brought a drought; the "next" year a crop almost ready to harvest, but which suddenly shrank and withered for want of water. They must live; their families must be supported.

How they struggled and toiled, and wrote to their friends in the East for help, or perhaps to relatives in Europe! Their friends helped them for a time, and then inconsiderately lost faith. How those poor wives toiled and prayed and wept alone! How true these sufferings and disappointments made the whole family to each other! All that was needed was water—or the money to procure it. The needed water was running in streams just below the earth.

Certain farmers in Nebraska who could not get away or purchase expensive hydraulic power, turned their attention to home-made

windmills, such as would cost less than ten dollars, so at least to save the garden. They made little windmills of old machinery, with anything for fans that would turn the wind into service. One man favorably situated made the wings of his little mill of coffee sacks, and irrigated five acres for five dollars. Some used barrel-staves with fence wire; others turned roofing-tin to this service. A few years served to show the value of these home-made windmills in many arid localities. The idea spread, the mills enlarged, when, presto, change, those who experimented with the little home-made mills had gardens, while those who did not had withered acres! Now a book has appeared on the subject. The traveler may see green gardens in many places over which curious windmills of home production are turning.

The agricultural experiment station in Nebraska sent out an observer among those windmill gardens. His published report is most interesting to young farmers in the Middle West. The home-made windmills offer new opportunity in garden farming. It is one of the new suggestions that will help to bring a new order of farming to the true-hearted industrious young farmers of the Middle West.

There is room for "two windmills" in most of the fields of honest industry. Costa Rica protects her coffee; the United States of Columbia her cocoabeans, and Florida is developing protected orange groves which will yield golden fortunes. Glass gardens are filling New England.

Wendell Philips used to say that there were two kinds of people in the world—one kind "went ahead and did something; the other showed how it should have been done in some other way." There are a multitude of people that reason that there will not be room for two windmills in the same field. There is room. "He can who thinks he can," and a purpose of success will make a way anywhere.

The writer spends his life in writing narratives of travel, and has traveled considerably, and one of the things that has greatly interested him is how people are protecting their crops in our own and other countries. The example of brave little Holland is being followed the world over, and the people who have the idea that two windmills cannot be run in one lot are disappearing. Let me give some examples of crop protection which I have seen by the way, beginning at New England.

Some years ago there arose in Arlington, Mass., a glass garden. It was for the raising of cucumbers. It was remarkably successful. It grew and spread, and became almost a farm. It was imitated. One may see such gardens glittering along the old family roads around Boston; and near Fall River, on what is called Gardener's Neck, and near it one may see wonderful developments of New England farming under glass. There is a farm in Connecticut that has ten acres under

glass. With what result? The protecting farmer will get a larger profit from an acre under glass than his grandfather did from a hundred acres.

Let us turn from the North to frost-smitten Florida. The protected orange groves are filling the state. Some of this protection is done by sheds with movable roofs, some by glass, and much by cloth tents, after the manner of protecting hay-cocks in a New England hay field. In Marion County, Florida, lives a man by the name of Dolittle, whose name belies his occupation and enterprise. He saw the frost cut down hundreds of beautiful orange groves, and out of his northern blood he resolved that his delightful trees should not be destroyed. He made frames for his trees, and in the winter filled them with dried pine needles. This did not prove wholly satisfactory. He then tried cloth tent covers. His orange trees now are the pride of the town.

The returns from choice orange groves will pay for protection. I have seen a grape fruit tree near Belleview, Fla., that has borne fifteen hundred grape fruits in a single year. These grape fruits at ten cents apiece would have brought the owner one hundred and fifty dollars. A hundred protected grape fruit trees would yield an income of a thousand dollars or more, and support a man and his family in Florida, a place where one may live more cheaply than anywhere else in the world, as the sun furnishes him largely fuel and clothing, and one's gardens may be made to produce sweet potatoes, cabbages, strawberries, cumquats and figs and grapes nearly all the year. Like Holland from the dikes, so Florida is to rise again and in golden glory by protected trees. The rich are protecting acres of orange and grape fruit trees in this way. A poor man may protect enough to support his family.

There is a quality of the Florida orange that will always give it a distinct place in the markets of the world. The Florida orange can never be driven from the market.

The great use of grape fruit in the Northern cities would alone secure Florida fruit growers from failure. The fruit is reported to contain quinine, and to be a very good tonic and vitalizing. However this may be, banquets that used to begin with soups now start with halved grape fruit which have stood soaked with sugar for half a day or more, awaiting the festal hour. In some places the grape fruit pulp is frozen, and served like sherbet.

The hardy bush orange of China, or cumquat orange, is likely to be grown extensively in Florida. It finds an immediate market. The *Citrus Deliciosa*, or China Mandarin orange, is also likely to come into use more largely than before, as it can be easily protected.

A few years ago I was in Costa Rica. I went from Port Lemon to Costa Rica's beautiful city, San Jose. Passing through lofty

groves of cocoanut palms to what seemed to be an ocean of banana fields, I was surprised to find cart loads of ripening bananas heaped up along the way—bananas enough, it would seem, to feed all New England. I turned to a friend sitting beside me and looking out of the car windows.

“Why does the country pile up bananas by the roadsides to rot?”

“That the leaves may grow stronger and last longer.”

“But the people do not grow banana leaves.”

“Oh, yes, they do.”

“Why?”

“To protect their coffee plants. Those are not banana fields. They are coffee fields. Coffee has to be protected from the sun.”

It is so everywhere. Holland protects her glistening gardens from the sea; New England makes her short season long by gardens under glass. The Dakotas protect their crops from drought, and by canned fruit and vegetables secure for the winter the products of long season crops. They are doing what the hardy people of northern Europe so well have done. Florida is protecting her oranges, and Costa Rica her coffee. The agricultural and horticultural world is finding out the value of the agricultural college; two windmills may be placed in a single field; both of them will go. What is worth growing is worth protecting. Thrift finds a way; creative genius is money. One may conquer the soil.

FEDERAL AID TO IRRIGATORS.

With only 3,000,000 people at present occupying the Pacific slope of the United States west of the Rocky Mountains, President James J. Hill, of the Great Northern Railway system, say that when that slope shall have 20,000,000 people Chicago ought to be the largest city in the world. He bases this interesting possibility upon the fact that 76,000,000 people in the country are supported more or less directly by trade with Europe and Africa, with their 400,000,000 population.

“On the other hand,” he says, “there are a thousand million people off our Western coast with whom we should trade, and yet we have only 3,000,000 population to reach out for it.”

He confesses to the handicap of the present coast country, but he is sanguine of the good time coming when the United States shall dominate the trade of Asia. Mr. Hill insists that the building up of such a trade will depend in great measure upon the development of the agricultural resources of the Pacific slope. To develop this he says that government aid in building irrigating canals will be necessary.

“Except for manufactured stuffs and cotton, these far Eastern exports will be grain and flour,” said Mr. Hill in a Chicago interview, “and these agricultural products must be grown on the Pacific coast. For this purpose we have a territory 1,000 miles square, which, through centuries of aridity, have become vast beds of fertility, needing only water to make them the most productive spots in the world. There is water enough for the purpose melling from the mountain snows; all that is needed is the canal system.

“The execution of this irrigation work is the one thing needed to give to the United States the domination of the Pacific Ocean commerce and the supremacy of the world’s trade. Without it progress will be slow, because, unless there is an abundant supply of food products always available at shipping ports, it will be impossible to insure full cargoes and quick dispatch to the vessels of large capacity, which alone can be profitably employed in the trade. Every business interest which hopes to benefit by participation in the trade of the Pacific Ocean must be in favor of the reclamation of the great mountain valleys for the occupation of agricultural workers. If successful in the advocacy of this public improvement full rewards will come in the shape of new markets in the orient, and it will be found, additionally, that the settlement of the Western mountain region has developed a local market richer in natural resources than any other portion of the earth’s surface.

“There, where the soil under irrigation will grow the best quality and greatest quantity of all the grains, except corn, all the grasses and fruits, the ground is seamed with deposits of gold, silver, copper, lead, iron and coal. There the largest supply of standing timber, and petroleum and natural gas abound. Under the influence of the dry atmosphere and constant sunshine, good health prevails, and the melted snow in falling to the sea level creates a water power available for electric heat, light, and motor service, equivalent in energy to the combustion of 300,000,000 tons of coal per annum.

“People regard with amazement the present rapid growth of wealth in the United States, but this will be comparative poverty when with twenty million people on the Pacific slope engaged in raising grain and manufacturing flour for the orient, we can dispatch large freighters daily from each of the Pacific ports loaded with the manufactured goods of the Eastern factories, the cotton of the South, and the food products of the mountain valleys. Then a river of wealth will be turned into the United States, which will put to shame the visions of the wildest dreamers.

“If Congress at its next session will appropriate \$100,000,000 in 2 per cent bonds to be used in canal and reservoir construction, the money will be returned directly many times in the increased value of the public land. Indirectly, in trade results, the benefits will be permanent and incalculable. As a matter of political policy, the party which will take up and boldly advocate an immediate and liberal appropriation will receive the support of millions of people now homeless and discontented who desire homes and the opportunity to make a living by honest labor.

“The agricultural products of the Pacific slope cannot come into competition with the farmers of the middle West. On the contrary, the section will open a large market for corn and hog products not producible here. The storage of the water in mountain reservoirs will reduce the flood level of the lower rivers and measurably relieve the cotton and sugar estates from the dangers of overflow.

“A policy of arid land reclamation to be effective must be conducted on a large scale. An entire appropriation of only \$1,000,000 would be childish. Two hundred and fifty million dollars was voted without discussion for the Spanish war. This was for waste. In these days of large undertakings an expenditure of \$100,000,000 for a permanent improvement which will benefit millions of people should not cause hesitation. Such an amount, properly used, would add three billion dollars to the national wealth. While it would make homes for a multitude of settlers, the greatest benefits would come to the manufacturers of the Eastern and middle Western states and their employes, and to the cotton raisers and spinners of the South.”—*California Cultivator*.

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

PAN-AMERICAN LETTER.

(Written by Herbert Shearer.)

The lion's share of space in the Horticulture Building was assigned to the State of California. The State government deserves no credit because they failed to make an appropriation, and it became necessary for the fruit and business men of California to come to the front with both money and material or allow the state to go unrepresented at this important exposition.

In the exhibit made by the business men of Fresno County, that of raisins is one of the most important, the extent of which already covers a territory of 55,000 acres; three-fourths being in Fresno County. Until recent years we imported all our raisins from foreign countries, and it was the exception to get a product that was satisfactory, as the methods employed in packing were not only slovenly but in many instances downright dishonest.

The California product, on the other hand, is systematically handled, packed and shipped in a thoroughly straightforward business-like manner. Besides the different brands of selected raisins, ranging from Imperial Clusters down to Two-crown London Layers, I wish to call especial attention to the seeded raisins that are now being put up in such quantities, as well as the manner in which this branch of the industry is being conducted.

There are two grapes known as "raisin grapes"—the Muscatel and the Muscat of Alexandria. The time of picking is determined by the use of the sacharometer in the following manner: About a peck of grapes are picked promiscuously from a

great many different vines and the whole lot pressed to extract the juice. Sufficient juice to float the sacharometer is placed in a glass tube and the record taken, which in order to be right must be about 25 per cent. sugar.

Picking begins about the first of September. The grapes are picked and placed on wooden trays about 24 by 36 inches and left exposed to the sun's rays for a week or ten days according to the condition of the atmosphere. They are then turned over by placing an empty tray over the full one and inverting the two, which empties the first tray, and this in turn is used to hold the grapes that the second tray contains, and so on down the row; two men—one on either side of the row—accomplish this turning very rapidly. After the grapes have been turned and exposed to the heat until about dry—a condition that requires some skill and judgment to determine—the trays are all taken up and put in piles where they remain a few days until they "equalize." They are then sorted out and divided into "Clusters," "Layers" and "Loose," when they are placed in the "Sweat Boxes."

As the loose grade is what we are especially interested in, we will not follow the other and more extensive grades. The cleanly, mechanical handling of the loose California raisin grape marks an era of progress in machine-manipulated edibles in a very typical manner.

As all grapes and raisins are more or less dusty from exposure to the atmosphere during the growing period, they are passed through a machine that brushes the dust free and blows it out with an air

blast, thereby starting the packing operation with a thoroughly clean product.

The loose dried raisins are next run through a recent invention—a large machine called a “stemmer” or “grader” that is the evolution of a great deal of work and mechanical ingenuity. This machine stems and grades into four different classes, from 30 to 40 tons of raisins per day. It is the two grades—the Two-crowned Loose and the Three-crowned Loose, as they come from this machine—that are seeded and have become such an important factor in the raisin business.

The seeding is done by another machine that is a wonder in the mechanical line. In this piece of mechanism the raisins are passed between a steel roller and a soft rubber band. The steel roller is provided with needle points about one-sixteenth of an inch apart. These needle points pierce the raisins and push the seeds through into the soft rubber, from which they are removed by a scraper, and the raisins pass out and are packed into pasteboard boxes, without having been touched by hand from the beginning to the end of the process.

The benefits of organization are illustrated in this business by the California Raisin Growers Association. This association is controlled by officers who transact all the business, sell the product or make any necessary arrangements with the packers and return the amount of money due the grower. The result is a good paying and an even product that is satisfactory to the trade, the grower and the consumer.

By way of advertising the association is distributing 250,000 sample boxes to visitors at the Exposition. This will doubtless do a great deal to acquaint the general public with the quality of the product, as a great many people are eating these raisins, who are unfamiliar with this new American industry. I am indebted to Mr. Chas. F. Wyer, who has charge of

the exhibit in the Horticulture Building, for much of the information contained in this letter.

THE MODEL DAIRY.

The Model Dairy has been in operation long enough to establish the importance of the undertaking, and the results as published from time to time have produced more enthusiasm throughout the country in regard to the different breeds of milch cows than has ever before been made manifest. It is not to be supposed that these cows have done their best under the trying circumstances and disadvantages under which they have been placed, though conditions, with very few exceptions are as fair for one as for the other. Removing cows from their natural surroundings to be housed in an exposition building for six months under conditions that are more or less detrimental is not calculated to assist in producing the best results. To appreciate this feature of the Exposition, it is necessary to carefully inspect each herd and to take into consideration a great many details and side issues which it is impossible to give out in an ordinary report.

While the old-time favorites still retain the apparent advantage there are other breeds that have shown astonishing sustaining qualities that have won them fame. One of the least known, perhaps, is the French Canadian, a herd of five little cows, whose record has far exceeded their looks or previous recommendations. In fact, a study of this model dairy will reveal more surprises than the ordinary stockman is aware of.

A very important livestock side issue is a large assortment of forage plants that are now growing in a section of the grounds near the livestock buildings. This exhibit should be carefully studied by every stockman in the country. It is under the supervision of Prof. Lameon Scribner, Agrostologist of the Agricultural Department at Washington. This

consists of native grasses, roots, millets, different kinds of peas, beans and other plants of a similar nature. Some of the details of this work will be given in my communications later.

In addition to other features of the stock exhibit, visitors to the Exposition will have an opportunity to see the filling process of a modern silo. A large silo is now being erected on the grounds and suitable machinery is being installed to cut the green feed and carry it to the silo in the most approved manner. The latest and best machinery for this purpose is being used which no doubt will be of great advantage to many farmers who are contemplating work of this nature.

A series of international live stock meetings will be held in the New York State marble building on the grounds. At these meetings the best talent in the United States, Canada and the Latin Americas will be present and deliver addresses on subjects pertinent to the occasion. Amongst these is the International Association of Farmers' Institute Workers, which will bring together the different lecturers throughout the United States and Canada. It has come to be recognized that no more potent factor in the interest of farmers and dairymen exists than these farmers' institute meetings when properly conducted. Men of wide experience will be present on this occasion, and the meetings cannot fail to be of great interest and benefit.

Many details in connection with the business, that are calculated to save labor or as being beneficial in some other way, still will be on exhibition during the two weeks that are especially devoted to the cattle interest. Among these may be mentioned various kinds of cattle ties, watering devices, milking conveniences, feeding attachments, and a great many other similar exhibits.

MODERN STABLE CONSTRUCTION.

The proper housing of domestic animals, is receiving careful systematic consideration as never before. Investigations are being conducted by means of careful, practical experiments by men who are thoroughly conversant with the subject from a practical as well as scientific stand-point.

Mr. F. A. Converse, who has charge of the live stock and dairy departments at the Pan-American Exposition is a pioneer in this important field. He is demonstrating to the multitude at the Exposition by actual working models, how it is possible to build a really good stable for a very reasonable amount of money.

In our northern climate, warmer stables have for years occupied the attention of our best farmers and stock-men and bank barns have been the outgrowth of the desire to provide comfortable stables that were both warmer and better. The convenience of having all stock under one roof tucked carefully away from the cold with plenty of feed over head, ready at all times to find its way to mangers and food racks by gravity, proved very alluring to ambitious farmers all over the country. Animals housed in these expensive dungeons were not happy and showed their discomfort in watery eyes, lusterless hair, hot noses and hot feverish breath with fretful quarrelsome actions together with their inability to grow or fatten. Too frequently cattle thus housed were attacked by bovine disease germs which were materially assisted in their work of destruction by conditions so expensively though unintentionally provided. Stock-men thought the trouble was caused by too great a change in temperature by allowing the cattle to go out for an airing or for water each day; to remedy this, water buckets were added to the stable outfit and the stock confined in an abominable atmosphere for weeks at a time.

Atmospheric conditions affect animals

differently. The heavy breeds of beef cattle are usually phlegmatic in disposition, paying but little attention to ordinary disturbances; these suffered less in consequence, though it was noticed that they did not benefit from the quantity of feed as they should. Milch cows of a highly nervous organization are more susceptible to incipient diseases caused by objectionable surroundings than any other domestic animal. Not until progressive scientific men spent much time and money in investigations and experiments was the trouble traced to its true source.

Analyzing stable atmosphere led to the detection of harmful bacteria in incredulous numbers. Scientists engaged in the work were slow to give out the result of their first investigations, thinking that the conditions under which they were working might be abnormal. Prospecting further and while endeavoring to learn the cause they found conditions in these cellar stables particularly favorable to the propagation of stockmen's worst enemy. Harmful bacteria delight in a dusty atmosphere especially when it is impregnated with moisture, when a share of the dampness comes from the moisture laden breath of animals that are obliged to breathe the same air over and over again, bacteria conditions are complete.

Bank barns are always damp and always dusty; owing to their construction they never admit sunlight in quantities, sufficient to be any use. Sunlight is destructive to all forms of harmful bacteria therefore a stable properly constructed should admit the direct rays of sun to every stall if possible.

Great progress has been made during recent years in stable construction, looking to the complete elimination of the troubles as set forth along these lines.

A model stable on the Exposition grounds, in which is confined, a number of different breeds of the best dairy cattle in America, will demonstrate to the mil-

lions of Pan-American visitors, how a really good stable may be constructed at a low cost, that is warm in winter, cool in summer, and sanitary and hygienic at all times.

Public opinion backed by government milk inspection has resolved into a strict censure of dirty, antiquated methods. City milk supply is now traced to its source, the cows examined for condition and health, and the stable for cleanliness. If incompetency or indifference has led the dairyman to disobey the state sanitary requirements, he is not permitted to ship his milk until he satisfies the inspector that he has mended his ways. This course was made necessary by the rapidly increasing volume of business which is conducted by such a cosmopolitan class of people, comprising as it does, all grades of producers from the most progressive farmer down the line of small dairymen to the ignorant huckster. Cleanliness is required by inspectors first, last and all the time; thus, making the right start for cleanliness, leads to many virtues. A man who is particular about all utensils, his wagon, stable, cattle and himself, will not tolerate a poor stable or an unhealthy cow. He may not understand the science of ferments or disease germs, but his milk supply will be good and wholesome, because he robs harmful bacteria of the dirt upon which they thrive.

The proper location for a dairy stable is one of the most important considerations in the construction of the most important adjunct to the dairy business. To be able to start right it is necessary to consider the subject from different standpoints. Fresh air and a plentiful supply of pure water, good drainage, protection from cold winds, plenty of sunshine and convenience in regard to feeding arrangements, are the essential features to be considered.

Fresh air and drainage may be provided by selecting an elevation. Protection

from cold winds is secured by planting a tree belt along the northern exposure, but it is not always easy to combine with a location of this nature the proper water supply which is a very essential feature. Generally speaking the elevation also assists in providing a water supply as the pumping should be done by wind power, a rise of ground naturally gives an uninterrupted wind approach as the derrick may be high enough to lift the wind above the tree wind break. In no case should the water supply be poor, limited or inconvenient.

In addition to the tree belt a high board fence should enclose a breathing space; this fence should be well constructed and the joints between the boards battened tight. If, in addition to this, a shed roof is provided opening to the south, winter yard conditions will be about as good as they can be made, provided, of course, that the ground is supplied with proper drainage. The filthy, miry condition of so many barn yards is sufficient excuse for laying so much stress on the importance of this feature. The abomination that is permitted to exist year after year in connection with farm barns and stables is little short of criminal. Ideas in this respect, however, are fast changing, domestic animals are recognized as possessing certain inalienable natural rights that owners are bound to respect. The old fashion notion that any kind of an old shed planted in any sort of a mud hole, in any haphazard location, is good enough for cattle has given way before recent scientific investigations. This is particularly true in the older states of the East and Middle West, as well as throughout the better dairy sections of Canada.

Boards of Health and State Boards of Agriculture have inaugurated a system of inspection that has exerted a salutary influence especially in milk shipping districts. Humane considerations have had a good deal to do in bettering conditions

in this respect, but mercenary interests and the general health of humanity have combined to bring the subject home to many interested people in a very forceful manner. The fact is now recognized that it pays to take good intelligent care of domestic animals, which is simply producing at all times natural favorable conditions which are always the most economical in the end. Dairy cows return dividends, the ratio of which increases in direct proportion to the care and intelligent consideration bestowed upon them.

So little attention is now being paid to pasture that the fence and long lanes leading from the stable to the fields, which were formerly such an all-impotent adjunct to a well regulated farm, does not enter into the consideration. Pasturing is too expensive in these days of keen competition.

North of parallel forty-two there is an average of only six weeks of good pasturage. Summer droughts sandwiched in between late spring and early fall rains are responsible for this condition. A runway consisting of about one-fourth of an acre per cow is a better and more satisfactory arrangement. It should be enclosed with a good movable fence and shifted occasionally for the benefit of the land; this, however, is largely a matter of personal opinion as well as convenience. A permanent pasture that has never felt the plow offers advantages that no artificial production can equal. Where a running stream of good water exists within a reasonable distance of the stable the question of a pasture run will settle itself. On the great majority of farms, artificial water supply must be depended on; a condition that should be met by a never failing well with a windmill sufficiently powerful to carry the water not only to the stable but to the pasture lot. A drinking trough should be placed in a shady spot and water conducted to it by pipes placed under ground sufficiently deep to be cool in

summer and beyond the reach of the frost in winter.

Too much stress cannot be placed on the importance of plenty of pure water provided conveniently for dairy cows. Fever conditions which affect the condition of the milk are too often produced by cows going too far to water.

Tainted milk, or the fevered conditions of the cow that leads to tainted milk, is produced in this way; too often it is aggregated by the presence of a dog when the udders are so full as to render every step painful.

Silage crops are so thoroughly distributed over the farm that the location of the stable makes very little difference in the work of filling the silo through easy grades and a good hard track will materially assist the aggregate amount of forage hauled with a given number of loads.

Mr. Frank A. Converse, manager of the agricultural departments of the Pan-American Exposition is illustrating many of these essentials to modern dairying on the grounds. The intention is to interest farmers in improving methods of conducting the business of the farm.

After deciding on the proper location for the stable a great deal of future work may be saved by selecting the exact spot according to grade that will give the most advantages. Here again the farmer must be guided by conditions. If it is possible to provide sufficient fall to get a wagon track about four feet below the level of the stable floor it will facilitate removing the manure, an item of no small moment, as it is a daily occurrence that follows up year after year; however, this is overcome in a measure by the manure cages that have a hand elevator attachment.

After deciding on the size and dimensions of the stable, it will pay to stake it out on the ground several days or weeks before the time set to commence operation; this will probably save the remark that we so often hear, "If I had to do it

over again I would do it differently." Remember that you are laying out work for yourself for years to come; a little foresight is worth a tremendous lot of regret.

It is a good plan to take a trip about the country and look over half a dozen different stables that are known to be correct in principle. A good many men go ahead with this kind of work without taking this precaution with the result that after the work is completed, or so far along that it cannot be changed, mistakes are apparent. A case in point occurred only last week. A farmer in the eastern section of the country was about to build a bank barn at considerable expense. Hearing about the work at the Pan-American, he decided to investigate before completing his arrangements. The result is that he has abandoned his original intention entirely, and is now building a complete modern stable on thoroughly scientific principles, as mapped out by Mr. Converse at the Exposition.

When the location is finally decided upon, a trench for the wall should be dug deep enough to go below frost. The trench should be the exact width of the wall, say twelve inches, and a tile scoop used to hollow out a space around the outside of the trench at the bottom for a two and one-half or three inch drain tile. Lay the tile flush with the outside wall of the trench and true up with earth so mortar will not squeeze out over the tile. This drain tile is very important as it answers the double purpose of providing a dry foundation for the wall and prevents rats from working under. Rats will burrow down next to the wall to find the bottom but when they meet with an obstruction they will follow it sometimes for a long distance along the wall, but never think of working away from the wall to get around it.

Material for the wall must depend upon local conditions, price of stone, labor, etc.; in some localities stone is plentiful, in others it is necessary to substitute grout

construction. With a trench like the one described, a skilled mason is not required to build the wall as it is only necessary to fill in the trench with stone and thin grout mortar or to mix the grout and pour it in the ditch until it is full. Where it is necessary to build the wall higher than the ground, boards or planks are held temporarily in position by stakes to carry the wall to the desired height. Of course there is no objection to building a stone wall in the usual manner if the extra expense is no object, but the construction described is just as good and often better, while the expense is considerably less.

The wall should extend but an inch or so above the floor, and the top of the wall carefully leveled to form a proper bed for the sill. The reason why the wall should not extend higher will be fully explained in another chapter that explains every detail in the construction of the stable above the floor. Inside of the wall the ground must be carefully graded in conformity with the ground plan. Jogs, gutters, mangers, inclines and track runs should be laid out with great care to correspond with a carefully drawn plan and profile.

Earth that has been loosened up by handling should be wet down when necessary to make it solid. Small grade stakes should be driven along gutters as well as at regular intervals over the graded bottom, these stakes should be driven just deep enough so that the top of the stake will be level with the top surface of the first layer of cement, they should be removed while the cement is soft and the holes filled, although this is not absolutely necessary.

In order to set these stakes properly, what is called an A level is required; this is made with three strips of board seven-eighths by three inches, nailed together in the shape of a letter "A." A plumb bob is hung from the top and a mark made on the cross piece where the line crosses when the feet are level. To find this level drive two stakes and set one foot on each

stake; by reversing the feet and repeatedly driving down the higher stake until the line touches the same point, when the "A" is placed in either position the exact level may be obtained. With one of these simple instruments a few stakes and a maul, two men may walk all over a hillside and mark out a perfectly level course.

When the ground is finished ready for the cement, mortar boards should be placed conveniently that is plenty large enough to be used without sides. Mix thoroughly by measure dry, one part best Portland cement with six or seven parts of coarse sand; a good liberal sprinkling of broken stone is an improvement. When thoroughly mixed, wet to mortar consistency which is just wet enough to be pressed into a ball by hand spread directly on the ground in a layer two and one-half inches thick and tramp down solid. Gutter sides and all jogs should be an inch thicker to prevent breaking. Corners at these places should be beveled for the same reason. The top or putty coat should be mixed and laid on the stall floor with a rough board trowel; this coat should consist of one part cement to two parts sand that has been sifted. It should not be troweled down smooth on the standing floor but it should be left rough in order to furnish a hold for bedding; the mangers and feed ways may be polished to the queen's taste. This coat may be from one inch to one and one-half inches thick and it must be laid when the bottom coat is fresh and damp or the two will not properly unite; for this reason it is better to lay a large floor in sections, though if dryness cannot be avoided, sprinkling will help to restore adhesiveness. In large stables where a driveway is provided it is necessary to make creases in the cement when soft, otherwise the hard smooth floor will furnish no foothold for horses, this may be done by embedding a rake handle at frequent intervals in the cement while it is soft. Stable floors made in

this manner are permanent, sanitary and comfortable for stock, when all the necessary conditions are complied with, which includes proper care in building and the necessary subsequent cleanliness.

Cementing directly on the ground in this manner, is all right provided the ground is hard and dry. Judgment is required in this as well as in all other transactions pertaining to the farm; if the soil is a hard clay the cement may be much thinner than for a soil of a loamy or looser nature. On the other hand, if the soil is sandy a thin layer of broken stone or coarse gravel may be necessary. Where gravel is used on sand, some kind of a binder is sometimes required. This may be a mixture of clay and ashes, or loam and ashes or clay alone, but whatever method is employed, condition must be carefully studied to obtain the best results. Even cisterns may be plastered directly on the earth with satisfactory results, if the nature of the ground is hard and dry and the cistern covered sufficiently to keep out the frost.

As a silo is a necessary adjunct to the stable and should be built in connection, the silo foundation should be built at the same time that the stable foundation is laid. The same rules will apply and the same construction may be followed in all except the design of the wall which will of course, depend on the size and dimensions of the silo. This will be taken up in a separate article and treated at length in the near future.

In stable construction the question of sanitation is comparatively new. Advanced stockmen have for years recognized the value to animals of plenty of fresh air without knowing exactly why.

In this series of articles, describing the experiments of Mr. F. A. Converse and his illustration of good dairy work at the Pan-American Exposition, it is my intention to explain this, and to show how a cheap, effective, sanitary stable may be

built. In former articles I described the proper location for a sanitary stable and the manner of constructing a foundation and floor for the same. This article will describe the proper construction of a stable from the wall up.

We have built a wall from below frost to the upper surface of the cement floor. We do not wish to carry it higher because a difference in temperature between the inside and outside of the wall causes dampness to collect on the inner surface. This may be seen in the form of white frost is almost any cellar or root house during the winter season. It is also noticeable in stables under bank barns and this is one of the great objections to this class of stable.

The stable should be built entirely separate from the barn although it may be connected therewith at one end for convenience in feeding. It may be connected with a silo for the same reason.

The stable building should be of light construction, only one story in height, and in no case should storage be provided overhead. The building should be constructed practically air tight, but fresh air should by no means be shut out.

Commencing with the top wall, a sill, six inches square should be embedded in fresh cement mortar. Studding, 2"x6"x8 ft long are placed thereon, three feet apart to be nailed into the sill with a 2" x 6" plate, spiked on top; the studding carefully placed and plumbed, especially where the doors and windows come.

Building paper must be used both inside and outside of studding, thus making a six-inch dead air space, which is the most satisfactory non conductor of heat or cold. This paper may be protected with cheap or expensive boarding at the option of the builder. If the paper be carefully put on it will provide the necessary air space without respect to the quality of the lumber used. Salvage should be left on the paper at all openings, sufficient to reach

the window and door frames, which should be made just wide enough to fill the space between the flush sides of the inner and outer boarding; the paper nailed to the frame edges, an extra strip of paper put over this which is in turn covered with the casing and all nailed down tight. The same care should be taken wherever joints are made around air flues, at the plates and sills, and especially where the wall paper joins the ceiling paper. Careless workmen will need watching at such places. It is the numberless little details that determine the value of the stable when finished.

To secure proper warmth and ventilation a ceiling is provided 8½ feet above the floor. As a stable should in no case provide for storage overhead the ceiling may be very light. Joists 2"x6" placed 3 feet apart will be heavy enough for almost any stable no matter what the size may be, as it is supported by the gas pipe uprights that hold the cow chains and the wire partitions in place.

The ceiling joists are spiked to the plates and rafters thus forming ties to strengthen the building. Building paper is tacked to the under side of the joists, and matched, ceiling nailed on below the paper. This ceiling may be of ¾" stuff or thinner. Care should be taken to lap the ceiling paper with the paper from the side walls to leave no space for the admission of air. All inside wood work should be dressed and free from any heading or projection so far as possible; this is to prevent the lodgements of dust, which is one of the main things to be carefully guarded against.

Window stools should be made so narrow that they will not become the receptacle for curry combs, brushes, old bottles, and other trash that are so instrumental in collecting dust and other dirt.

Equal care should be taken with the doors. Door frames are made and fitted the same as the window frames with the

exception of the sill. This is made narrow and rounded so that the door will shut tight against it without a jog or jam for the accumulation of dirt. There is no objection to having the sill eight inches high as the cows easily step over it and the manure carrier is suspended from the ceiling.

The roof should be comparatively steep, as anything less than one-third pitch is too short lived if covered with shingles. The size of rafters will depend on the size of building, though generally speaking 2"x4" placed two feet apart for a rafter, up to twelve feet in length is strong enough for one-third pitch or steeper.

The matter of windows requires careful consideration. They should be large enough and numerous enough to admit plenty of light and sunshine when required, but not sufficiently large to produce by radiation too great changes in temperature. If possible, sunshine should be admitted into every corner of the stable. For this purpose and to prevent unnecessary radiation of heat at night and during cold weather, it is better to have the necessary windows so far as possible on the south or southerly side of the building.

A window should be provided in each gable end. These windows should work in grooves to slide easily up or down as required with rope attachments that may be opened or closed as required.

For a double stable, if long, the 2"x6" plate should be doubled, through a single two-inch plate properly supported by the boarding, both inside and out, makes a very strong building, so solid in fact, that the plate may be but away to make room for the ventilators without any appreciable weakening of the structure.

With a building put up in this manner and furnished with fly screens, dark blinds, double doors and double windows, with all properly and carefully fitted, we have a stable which may be shut up practically air tight, and one that would be a very unhealthy place for animals unless provided with a good system of ventilation,

PULSE OF IRRIGATION.

SOLUTION OF THE DROUGHT PROBLEM.

The following editorial in the *Drovers' Journal* is a fair sample of the awakening to the benefit of irrigation all over the country after a year of universal drought:

"The anxiety caused by the recent drought and the attendant loss should awaken this ingenious nation to the necessity of providing in the future the moisture that nature fails to supply. Not only the vast territory affected by drought, but the whole of the United States have been sufferers. It is not so much in the amount of rain that may fall as it is to have it fall at the right season of the year. One-half of the total rainfall would suffice if it were distributed in proportions tantamount to the needs of the crop.

"The demand the west has been making for national assistance in reclaiming the arid and semi-arid sections will be strengthened by the drought of this summer. There are many clubs forming for the purpose of bringing this matter before congress at its next session, but as the movement is in an incipient state it would be difficult at this time to forecast the result. There is not the slightest doubt of the need of irrigation both in the large neighborhoods of the west and in the small farming communities in the agricultural section, and even though we fail to secure the co-operation of the national government, we should not remain idle and wait for a repetition of the drought which has just been broken.

"In California, Colorado, Arizona, Utah, Wyoming, Texas and New Mexico evidences of the benefits of irrigation are seen on every hand. In many instances

barren desert wastes have been converted into fertile fields yielding abundant crops of everything indigenous to each locality. and in some sections the productive capacity of really good lands has been greatly increased through the aid of irrigation. In New Mexico the bounteous crops of alfalfa, Kaffir corn, milo-maize, apples, pears, peaches, sugar beets and several cereal crops are the result of irrigation. In Colorado, Utah, Wyoming and California the prosperity of the farmer, the stockman, and the fruit-grower is the result of the water from the mountain streams. In Texas the immense rice plantations and truck farms are irrigated by pumping the water from rivers and artesian wells. These are all large communities, and while some are aided by state appropriations, the majority of the irrigating plants are operated by private individuals and corporations. In the rice belt there are numbers of plantations adjoining which aggregate fifty to one hundred thousand acres, all watered from the same stream.

"The great value of artesian-well irrigation is just beginning to be appreciated. Not only the rice-growers are sinking wells, but truck farmers and orchardists have fallen into line and are sinking wells, which supply their lands with the much-needed moisture. A *Drovers' Journal* representative visited one of these improved truck gardens during the annual meeting of the Texas Cattle Raisers' association in San Antonio last March. This farm consists of one hundred and forty acres. At the time this land was purchased it was almost barren—nothing but thorny mesquite bushes would grow upon it. This land was bought at fifty dollars

per acre, cleared and grubbed thoroughly, and a twelve-inch well sunk. At a depth of less than a thousand feet a flow of over 24,000 barrels or over one million gallons per day was struck. The farm is divided into twelve tracts, with a small cottage on each, and is rented to gardeners who pay an average annual rental of \$22.50 per acre. These gardeners raise vegetables for market, and their average net profit per acre is more than \$100. This well supplies sufficient water to irrigate a tract many times larger than it is required to do. This wonder is in a portion of Texas where it seldom rains, and the owner has refused \$100,000 for his property.

"The farmers in Illinois, Iowa, Kansas, Nebraska and other states affected by the recent drought, might study with profit the irrigation methods now in vogue. Flowing artesian water at a depth of six hundred to one thousand feet is possible on any land that will produce crops. If a flowing well, the water could be held in check by a cap until needed, and then distributed over the land by means of ditches in quantities to suit the farmer. He would not bother about rain, and with water at his command would be enabled to mature his crops at an earlier date.

"The first cost of a well or series of wells may seem great, but when the ultimate benefits are considered is insignificant. It would be a good idea for farmers in the more populous agricultural sections to form irrigation clubs and sink wells at some convenient place where each could receive the benefit of the water. In the west where farms are larger than they are in the east, running streams could be utilized in connection with the wells. Where water from the creeks and rivers is used, a pumping plant on some high point would flood the farms surrounding, and the benefits would be incalculable.

"This is a subject worthy the earnest consideration of farmers everywhere. Irrigation is not an experiment, but is prac-

ticed with great success in all the states where the annual rainfall is light. If it will benefit the arid sections it will also benefit the middle states who were sufferers in the recent drought."

IRRIGATION WORKS IN SIBERIA.

The Russian government contemplates undertaking large irrigation works in Western Siberia, which will extend over a tract of land along the western section of the Trans-Siberian railway for more than 275 miles. In the districts of Tomsk and Omsk alone no less than 833 artesian wells have been bored during the last three years. The expenditure for the construction of these wells amounted to \$300,000. Furthermore there have been constructed in the government of Tomsk, in the different districts, altogether 276 miles of canals, while 85 miles of river beds were cleaned from mud. It is reported that the administration of the Siberian railway has recommended to the Russian government a scheme to undertake extensive drainage works in the marshy Baraba steppe, for which works a credit of about 3,000,000 rubles has been asked.

BIG IRRIGATING PROJECT.

One of the big irrigation enterprises of northern Montana that is now under construction and is rapidly nearing completion has as one of its promoters a Helena man, Jacob Switzer. Associated with him are Lawyer T. E. Brady of Great Falls, and D. W. Bateman, also of that city. The plant is located at Ashville, between Malta and Saco, along the line of the Great Northern railway, in Valley county. The work on the canal was started nearly two years ago, and since that time work has been pushed vigorously. Within the next month it is expected that the main canal will be completed.

A large lake known as Bowdoin lake, which is some 20 miles in circumference,

is being used as a part of the reservoir, to which has been added as reservoir site fully as much ground. The reservoir has a contour or circumference of 43 miles and covers 8,600 acres of land. For the reservoir a canal 23 feet wide and three feet deep is taken down upon and over lands lying in the valley of Beaver creek and lying east of the reservoir, for a distance of about 12 miles. The canal commences its work of irrigating within two miles of the head gate and runs through the lands which are to be irrigated from it the full distance.

The reservoir has a capacity of irrigating 26,250 acres of land, which acreage can be increased if necessary to double that amount by lowering the canal at its intake. In perfecting the reservoir an earth dam 4,900 feet long, four feet high, 10 feet in width at the top and 30 feet in width at the bottom, was constructed last fall across the outlet of this immense natural basin, and a ditch 20 feet wide and three and a half feet deep was excavated for a distance of 5,650 feet between the large lake first mentioned and what is known as the lower lake, connecting the two and allowing the water from the large lake to be drawn down to the lower lake.

The reservoir has within its confines two islands, aside from a couple in the big lake. One of these islands contains an area of about 800 acres and the other of about 100 acres. This reservoir is fed and filled annually by the waters of Beaver creek, which takes its source in the Little Rocky mountains, and flows for a distance of 100 miles before discharging into the lake after draining an immense territory of mountainous country and bench lands, and after receiving the waters of a large number of smaller streams.

It is the intention of the promoters to establish upon this irrigated land a large hay and cattle ranch. The proximity of the Great Northern station at Ashville will enable them to ship hay at a small ex-

pense to Great Falls and Butte, and the summer range for stock cattle in that neighborhood being very extensive they will be enabled to carry a large band of cattle on their lands and properly care for them in winter.

The lands subject to irrigation from this canal are wonderfully productive and within the next two or three years this locality, which has for so many years been merely a grazing land for roaming cattle, will be one of the handsomest and most productive fields in the state.

GOVERNMENT TO CONTROL ALL IRRIGATION IN INDIA.

Lord Curzon has telegraphed to London that the monsoon rains in India this summer are very unequally distributed. The rice districts, which need large water supplies for irrigation, being deficient in rain, while excessive rains in the northern and central regions have damaged the millet crops. He does not intimate that as yet there are serious prospects of another period of food scarcity. There is no other part of the world where the distribution and quality of the annual precipitation is watched with such intense anxiety as in India. In that overcrowded region the land is so minutely subdivided that each holding scarcely provided more than a bare subsistence for one family. If the vagaries of the monsoon rains deprive any districts of the usual quantity of moisture so that the crops are below the average the direst poverty and sometimes the horrors of famine ensue.

For several years private and state irrigation works have been established in India and for the last few years they have been augmented to such an extent, and their work has been so profitable that there is now a scheme on hand for the India government to exercise direct control over all of them, with the idea of increasing their usefulness. A commission will shortly be appointed, to be presided over

by Sir Colin Scott-Moncrieff, "to lay down rules for the interlacing, encouragement and control of irrigation work in India."

According to the Annual Review of Irrigation, published last month, twenty-two irrigating works in India realized in the fiscal year of 1900-1901 a net revenue

amounting to 9.52 per cent on the capital invested, while thirteen others yielded only 6.52 per cent, reducing the average return to 7 per cent. The total area of the crops irrigated or protected exceeded 18,500,000 acres, being an increase of over 750,000 during the year.

AT THE CLOSE OF SUMMER.

By S. Raymond Jocelyn.

Russet clad, yet sports the plaintive thrush,
 Beside great meadows, green with aftermath;
 And eloquent amidst the Sabbath hush
 The wood dove's notes fall on the orchard path.
 The lichen whitens and the plump peach falls,
 The sunflower now its rightful crown assumes;
 Proud covey-sultan on yon headland calls,
 Where dusky wild grapes scent the willow plumes.
 Beneath the dandelion's faded gold;
 Through thistles' silvered hair its pale strands peep;
 The sumach's vivid fruit hangs flaunting bold
 Where spider threads float quivering o'er the steep!

CITY LIFE.

(A parody on Alexander Selkirk, by Wm. Cowper.)

By H. L. K.

I own nothing of all I survey,
 My right here all seem to dispute;
 From the Harlem clear down to the bay,
 There's not room for a fowl or a shoot.
 O, city life, where are the charms
 That millions can see in thy face?
 Better dwell in the poorest of barns
 Than live in this horrible place.
 I am right in humanity's reach,
 Not a foot can I journey alone,
 Never hear the sweet music of speech,
 (For a week I have not heard my own),
 The people that rush through the streets
 My form with indifference see;
 The girls jostle wherever we meet,
 Their boldness is shocking to me.

Fresh butter, fresh eggs and sweet cream,
 Divinely bestowed upon man,
 Oh, had I a flying machine,
 How soon would I taste you again!
 My hunger I then might assuage
 With food that was healthy to eat,
 And not starve at a table d'hote
 Down here on Twentieth street.

Religion, of treasures untold,—
 The Bowery would scarce know the word;
 All they want here is silver and gold,
 And all that this earth can afford.
 The sound of the church-going bell,
 The crowds of this place never hear;
 They would rather go to famed Coney Isle
 Or South Beach by ferry so near.

Ye sharpers, that made me your sport,
 Let me go from this horrible shore;
 Give me money to buy a transport,
 From a place I shall visit no more.
 Friends said they would now and then send
 A bill or a check after me;
 My last bill I was coaxed up to lend,
 And a check I am never to see.

How swiftly the automobile spins!
 To rival the speed it attains
 The swift little errand boy runs,
 And the hospital ambulance strains.
 When I think of my own native land,
 With its feather beds not stuffed with hair
 And its great herds of cattle not canned,
 In a moment I seem to be there.

But the cable-car's gone to her nest,
 The policeman's lain down in his lair;
 Even here is a season of rest,
 And I to my lodgings repair.
 There is mercy in every place,
 And mercy (encouraging thought)
 Gives even the city a grace
 And reconciles me to New York.

ODDS AND ENDS.

JACKY'S SUPERSTITIONS.

By D. F. Randolph, Ph. D., U. S. N.

In our fourteen thousand mile cruise from New York to San Francisco, I made it a point to mingle constantly with the men of the Iowa for the purpose of learning something of their superstitions. In early days, we are told, superstition was as much a part of a ship as the water in which she floated; for it entered into the wood, scarfed into her keel; it controlled her name, her crew and her cargoes; it summoned for her ill fortune and evoked portents for her prosperity. Certain objects, certain signs and certain persons inspire Jacky with an idea of the supernatural. The German seaman, the British tar, the Chinese waterman, the Italian fisherman, the Nile boatman, all share in common with the Yankee blue-jacket, the fears that have been handed down from their respective marine ancestors for generations. Amongst the animals which Jack considers as omens of good or ill luck are cats, rats, hares and sea-hogs.

You would be surprised to see how tender-hearted Jack is and how fond he is of animals. The Iowa's goat was brought on board by a coxswain transferred from the Dolphin, and though the captain of that vessel sent for the animal on two different occasions, the goat

still remains the pride of the ship and the chief source of amusement of the crew. So well behaved is he that none of the officers can complain. He has recently become thoroughly sailorized, going to quarters mustering on deck and otherwise observing the routine of the day; he is very fond of tobacco and prefers to take it from the bowl of the pipe. Of all pets none seems better suited for navy life than this wily animal.

A few years ago English sailors' wives kept black cats to insure the safety of their husbands at sea. Many sailors object to having cats on board. Time was when a black cat was supposed to carry a gale in her tail, and a storm was sure to follow any display of playfulness on her part; also a firm notion existed among the seamen that the throwing of a cat overboard would bring on a storm. A dead hare on board a ship was considered a sign of an approaching hurricane. Cornish fishermen used to declare that a white hare seen about the quays at night indicated that there would be rough weather.

Dennis is the common name of sea-going pigs, at one time accustomed to have their baths at daylight and be washed and brushed. The Japanese sailor, you know, hesitates to go to sea on any day when he has encountered a pig

early in the morning. This animal is an object of aversion to all seamen; there is scarcely an article on the superstitions of the sea that I have read that does not allude to his Jonah-like propensities.

Our blue-jackets object to meeting a priest previous to setting out upon a cruise. Clergymen, lawyers and women were ever looked on with disfavor on sailing ships as sure to bring ill luck. The first named are unlucky, probably on account of their black gowns and their duty of consoling the sick and burying the dead; lawyers, from the antipathy of sailors to the class; women, because a ship is the last place for them, and because of the dread of witches who are supposed to live by selling contrary winds and wrecked vessels. In these days we are apt to look upon the sea as an electric railway, to think that the romance of ocean has passed away, and with the Atlantic "greyhounds" the last glamour of mystery has faded from the pages of marine history. The sailors form part of the poetry of ocean; they are the heroes that shine from its terrible pages; they must be brave, or nature brands them as cowards.

In making the passage of the Straits of Magellan, sea-gulls hovered constantly about the ship. Indeed, bad weather may always be looked for whenever these birds leave the open sea and hover near the shore. The sea legends that have to do with birds are of very ancient date. The stormy petrel presages bad weather. Of the

kingfisher it used to be said that while this bird was hatching her eggs, the sea remained so calm that the period became known as the halcyon days. The Russian Finns are considered wizards of high degree. Hurricanes blow, calms beset, gales roar as they will. If they wish to drive rats out of a vessel, they shove the point of a snickersnee into the deck, and every rat is supposed to run for the blade and perform harakiri. The proverbial desertion of sinking ships by rats is founded on reason, for rats like to prowl about dry footed. A ship rat on the other hand is not usually a cherished object of affection. Its chief value to its owner is to keep his stateroom clear of all winged insects and make a riot among the ants and roaches of the wardroom. During its stay, the cat is not allowed aft. The great auk never wanders beyond soundings; and thus, taking their clue from him, the Jackies know that land is not far off.

NOTHING BUT NUTS.

Mr. McClure, the well-known American publisher, was once crossing the Atlantic with his seven-year-old boy, when the following amusing and suggestive incident took place.

The boy was given his choice of the vast, varied menu of the *White Star*. The boy, bewildered by the variety, hid his face in his father's side, and whispered, "Nuts!" Not another thing would he have for dinner; and nuts he had, and nothing else.

Later in the evening, as they paced the deck together, McClure told the writer of

his intention to have his boy taught everything a human being could learn. He should go both to Oxford and to Cambridge, and to two foreign universities as well, so that he should be thoroughly versed in every branch of knowledge.

His friend said, "Suppose, when you try to stuff four universities full of miscellaneous learning down his throat, he flatly refuses to swallow anything but nuts?"

McClure stopped in his walk and put his hand on the speaker's arm. "I never thought of that."

WHAT HE WANTED, AFTER ALL.

"Kind hearts are more than coronets." The visit of the Duke and Duchess of York to Australia has furnished a touching incident, an account of which we find in *The Presbyterian*.

The Duchess called at Sydney Hospital incognito, and went through the wards. On one of the beds lay a little boy. The Duchess halted there and asked the patient what was wrong. The reply came, "I've broke my leg." Her royal highness wished to know how the accident came about. It was all very simple and boylike. "I fell off a fence trying to see the Duchess, and I never saw her, after all!"

A pretty little situation truly! The Duchess of York immediately told the boy who she was, and said, "You can see me now all to yourself." That boy wasn't sorry he fell off the fence."

WHY HELEN KELLER IS HAPPY.

Who tires of reading about Helen Keller? This wonderful girl—deaf, blind and dumb—or at least dumb until recently—is perhaps the best known and best loved young woman in all the land. We have followed her from those early days when the indomitable perseverance and marvellous skill of her teachers pierced through the shell in which a sad fortune had enclosed her beautiful soul. We have

watched her progress, step by step, as the world has unfolded itself before her delighted appreciation. Of recent months we have seen her entering Radcliffe College, and taking honorable rank there. Unending effort has even given her the faculty of speech, though she can hear no syllable that she utters. When chosen vice-president of her class, she rose at the freshman luncheon, and said distinctly: "Classmates, it is a great pleasure, and I esteem it a great honor, to be present here and speak to you. I am glad to have an opportunity to thank the class for their kindness in electing me their vice-president, and I hope that I may become acquainted with many of you. Though I cannot see you, I will soon know you by touching your hands."

"Miss Keller," said one of her teachers, the other day, "is really the happiest person I know of. And why? Because of the great obstacles she has overcome."

PAST AND PRESENT IN A GUBAN TOWN.

When we compare the present with the past in Cuba, we quickly see what progress has been made. Fairest of all the isles dotting these sunny seas, horror-haunted and terrorized for decades of years, surely the martyr nation of the nineteenth century is at length coming to its own. Peace, tranquility and prosperity have returned to these beautiful shores.

The thrifty city of San Antonio de los Banos, not far away, was the scene of many stirring events during the last war, and has of late witnessed marvellous and striking changes. Begirt with royal palms and plantain groves, it has always been a popular resort with the Havanese. Here is the Ariguanabo,—a river which risen from unknown depths two leagues to the north, and, after traversing the city with its swift crystal current, spanned by four bridges, plunges mysteriously into a cave, to be seen no more, though the thirsty

fields below call for its waters, emblem of a wasted life.

It was in 1897, when patriot blood flowed like water, the sun was low in the western sky, and the shadows of the palms grew long, as a band of Spanish guerillas, armed to the teeth, spied a Cuban farmer at work in his field near San Antonia. His wife, near by in the palm-thatched hut, prepared the evening meal as she waited for his coming. Both were arrested, and, suspected of being patriots, were driven like dumb cattle to the public prison, with threats, abuse, and deadly blows. They reached it as the stars came out, more dead than alive, the husband dying before morning from the effects of the cruel blows. His poor widow was turned loose to care for herself, their little home having been burned.

Three years pass. The strong hand of the United States has aided the weak arm of the Cuban patriots. The yoke of the oppressor is lifted. His vast armies have sailed away from shores they had desolated.

We visit the same city. Lo, what a change! The river flows to its plunge into the dark cave, the air in midwinter is fragrant with roses and orange blossoms, but the people are free. Patriots rule; no more reconcentration of the weak, no midnight assassination of defenseless youth. The arms of Spain are stripped from over the prison door. A Cuban keeper is in charge of the jail where men languished until death curtained their staring eyes.

The lone star flag waves over the spacious barracks where pitiless Spanish warriors drilled under the red-and-yellow flag. The rural guard, mounted and armed, shout "Viva Cuba Libre!" as they gallop through the streets. The very birds seem to sing song of liberty.

Convinced are we that these changes are to go on until the history of San Antonio has been repeated in all of the cities and villages of Cuba, land of beauty and of promise, "Gem of the Western Seas."—
Rev. E. P. Herrick.

AN ORDINARY LIFE.

By SARAH E. FISHER.

An ordinary woman,
An ordinary wife,
An ordinary mother,
An ordinary life.

Ordinary methods for things both great
and small,

Why should such a woman be ever missed
at all?

An ordinary husband,
An ordinary home,
Ordinary children,

Yet she never cared to roam
From all the petty duties of the plain and
common day,

In living out a common life in the ordinary
way.

Ordinary longings,
Ordinary fears,
Ordinary heartbreaks,
Ordinary tears;

Ordinary wrinkles and the thin hair
touched with snow,

Showed the ordinary troubles of the form
now bending low.

An ordinary illness,
Death's ordinary call;
The ordinary mourners,
And the ordinary pall.

The ordinary grieving o'er the mother's
vacant place,
And the ordinary longing for her ordinary
face.

An ordinary story
On this ordinary earth,
But the ordinary spirit
Heard in its celestial birth,

As the heavenly portals opened, the wel-
come of the Son:

"Dear ordinary mortal, thy work has been
well done!"

A SPELL OF REST.

My wife she's been a-urgin' me t' take a
month o' rest,

T' leave my work behind me, an' the troubles that infest,
 T' visit all my kinfolks,—for of late we've prospered well,
 An' I've worked so hard she figures I should have a breathin' spell.
 But seemingly there's somethin' alfers doing on a farm.
 An' if I ain't here t' do it, things might somehow come t' harm.
 So I tell her 'long in April: "Well, I guess I'll cut an' run
 An' leave all care behind me when I get the plantin' done!"
 The plan appears t' suit her, so I labor like a Turk,
 Through May an' June, kept busy by the season's rush o' work.
 By that time wheat's t' harvest an' my early corn's in silk.
 There's calves that need attention and there's four fresh cows t' milk.
 An' then there's lots o' tiukerin' 'fore summer work begins;
 The wheat crop's extra heavy an' I'll have t' have more bins.
 Somebody has t' plan things, an' it seems like I'm the one,
 So I say: "I'll have that visit when I get the threshin' done!"
 July slips into August and September runs its race,
 An' still my time is occupied a-fixin' up the place,
 A-mendin' fences maybe, pickin' apples, makin' hay,
 An' pretty soon October an' November's slipped away.
 Then 'fore one knows it, winter holds us in his frosty vise.
 The stock needs more attention, an' I have t' put up ice.
 An' I haven't time t' take that promised visit now, 'tis plain,

For before I'd get half ready, 'twould be plantin' time again!

—*Orange Judd Farmer.*

FROM THE "AMEN" CORNER.

You say the hymns is dogg'rel—that they ain't refined enough;
 That all the time we've sung 'em they've been nothin' else but stuff;
 You say they need revisin'—we must make 'em more polite;
 "On Jordan's Stormy Banks I Stand" is not constructed right;
 But, just the same, Perfessor Triggs, you'd better let 'em be—
 The Lord—he understands 'em—so they're good enough for me.
 I s'pose there's nothin' finer than that good old "Beulah Land,"
 And when our Lizzie sings it you can see the glories grand;
 When "Rock of Ages" rings out from the hallelujah shore,
 I tell you this old sinner ain't a-goin to drift no more;
 And when they strike "Amazin' Grace," each feller singin' free—
 The Lord—he understands it, so it's good enough for me.
 It isn't what you're singin'—why, I oftentimes forget
 And praise the Lord to music with the good old alphabet,
 Until I strike the words again, and I don't think it's wrong—
 It isn't what is in it, but the soul behind the song.
 So, I tell you, Perfessor Triggs, you'd better let 'em be—
 The Lord—he understands 'em, so they're good enough for me.
 —*Josh Wink in Baltimore American.*

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By HERBERT MYRICK

Editor of American Agriculturist of New York, Orange Judd Farmer of Chicago. Treasurer American Sugar Growers' Society, Etc.

FROM THE AUTHOR'S PREFACE

In January, 1897, appeared the author's first book on this subject, entitled "Sugar, a New and Profitable Industry in the United States, for Agriculture, Capital and Labor, to supply the Home Market with \$100,000,000 of Its Product." That book was received with favor, not only among farmers and capitalists and by the press, but especially in the Congress of the United States and by American Statesmen at home and abroad.

National legislation favorable to the development of our domestic sugar-producing industry was enacted by Congress during the summer of 1897. This was followed by a phenomenal interest in America's domestic sugar industry, which, however, gave way to uncertainty with the advent of the Spanish war and the problems raised thereby. Provided those problems are now solved with due regard for American interests, it only needs proper direction and right management to secure for the United States large and permanent good from a vast development of its domestic sugar-producing industry.

Many of those best capable of judging have been kind enough to partly attribute the promising outlook for this new industry, at the outbreak of the Spanish war, to the book referred to, to the American Sugar Growers' Society organized by the author, and to the agricultural journals under his editorial direction. This would seem to impose upon the author a moral obligation to do whatever lies in his power to help the industry through its new politico-economic crisis.

It also seems incumbent upon the author to present the important scientific, practical and financial results of the seasons of 1897 and 1898, in addition to the fruits of all prior experience. Thus, unfortunate and costly mistakes in this new industry may be avoided, and uniform success attained by both farmer and capitalist.

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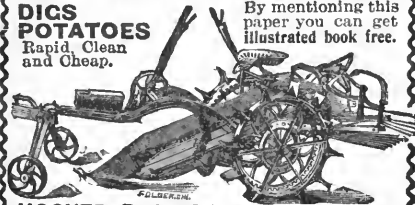
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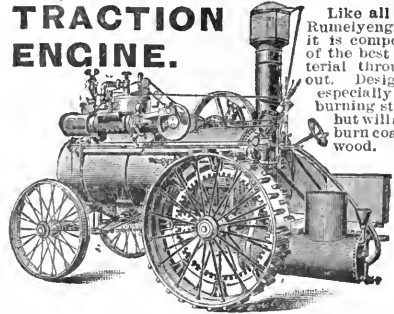
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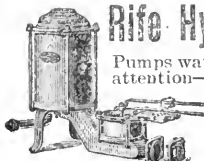
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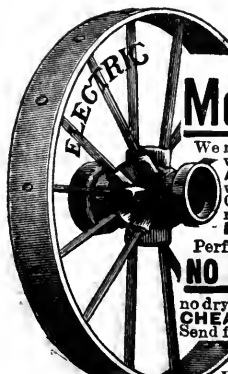
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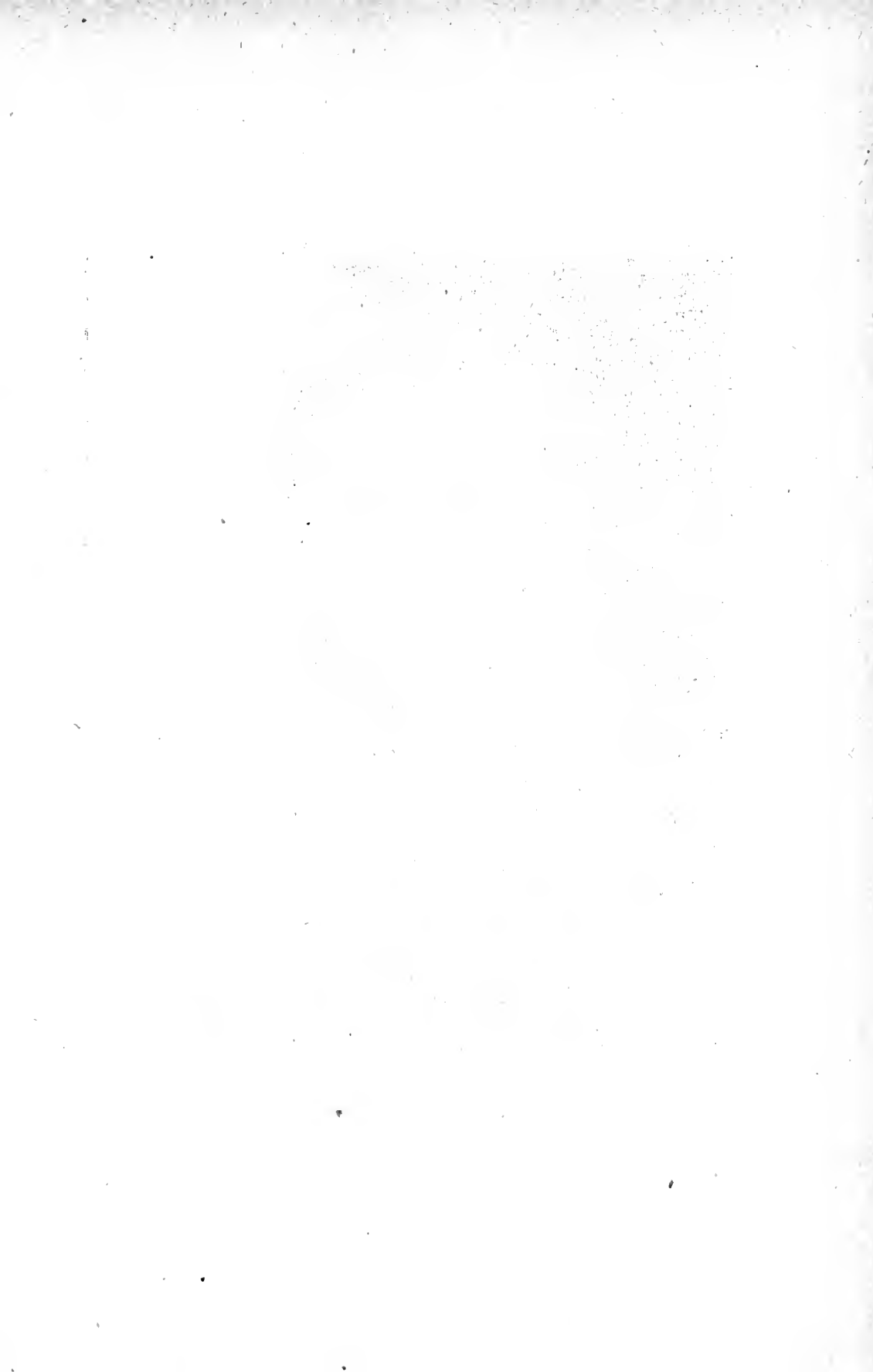
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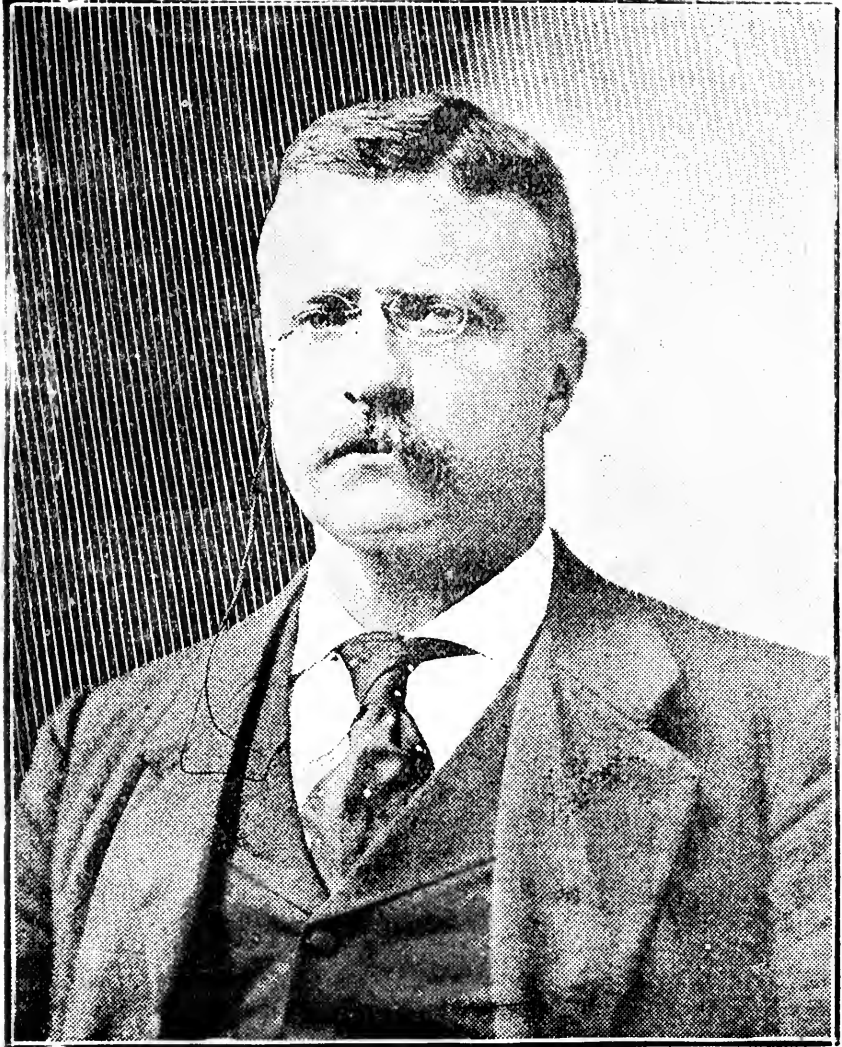
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OUR NEW PRESIDENT.
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THE IRRIGATION AGE.

VOL. XVI.

CHICAGO, NOVEMBER, 1901.

NO. 2

Theodore Roosevelt. For the third time in this generation has the assassin's bullet caused the nation to mourn, and with unmeasured sorrow has it buried its dead; with hope it now turns to the living.

President Roosevelt, so suddenly and unexpectedly elevated to the head of this great nation, has doubtless had the most remarkable career of any man now living in this country. This is due somewhat to unusual opportunities, but chiefly to the man himself with his uncommon faculty for creating his own opportunities and for making the most of those which other people would not even see.

Although descended from a long line of distinguished ancestors and born into the most aristocratic social circles of New York City, no man was ever more thoroughly democratic or more heartily despised every form of snobbishness and superciliousness than our present president. This has often been demonstrated, most noticeably perhaps in his relations with the cowboys on his Dakota ranch.

Always possessed of a keen fondness for study, he has had every opportunity to gratify it, which his health would permit. He grad-

uated at Harvard in 1880 and has pursued graduate study at Columbia. He has written a number of popular books, all in a racy, imaginative, original style, and showing great observation and other deep research. Some of the most important are: "Ranch Life and the Hunting Trail," "The Winning of the West," "A History of New York City," "Essays on Practical Politics," "Hero Tales from American History," and "The Naval War of 1812."

His political career began in 1881, when at the age of twenty-three he became a member of the legislature at Albany from his own district in New York City. To accomplish this, he fought and defeated the Republican party machine there; and the most remarkable thing about his career from that day to this, is that his rise has been always in spite of and often opposition to party machines. Consequently no one has ever come to the presidency more absolutely untrammelled by party dictation or by political promises. During his three years at Albany he advocated and pushed through the legislature the state civil service act and the act regulating primary elections,

two of the most important reform measures of recent years.

In 1884 he made his first appearance before the nation, going as a delegate to the National Republican Convention of that year. For the next five years he was principally occupied as ranchman and author. As a ranchman he lost money but gained the magnificent health which he has ever since possessed, the material for some of his most interesting books, and a reputation for boldness and courage, second to none in the country.

In 1889 he was appointed national civil service commissioner. He took the civil service laws as he found them and enforced them most vigorously. He made the spoilsmen of both parties hate him; but he won the unbounded admiration of the whole country by his courage, honesty and ability.

From Washington he returned to New York where he was appointed police commissioner under the reform administration of Mayor Strong. The hitherto corrupt police force was purified and made efficient as it never was before or since, to the astonishment and gratification of all right-minded persons. An amusing anecdote is told of the way he reformed one policeman whom he found on his beat half-intoxicated. Determined to teach him a lesson he could never forget, Mr. Roosevelt stirred him up a little and got himself arrested and taken to the station house. The officer's feelings when he discovered the personality of his prisoner, may be better imagined

than described.

In President McKinley's first term came the appointment as assistant secretary of the navy. He was largely instrumental in preparing the navy for the conflict with Spain and very influential in getting Dewey sent to Hong Kong and Manila. Then, finding that there would really be a war, he resigned his position in the navy. Then, there occurred the following conversation, very characteristic of the man. A lady friend said to him: "Mr. Roosevelt, you have a wife and five children depending upon you for support. You have no right to resign such a position to enter upon service in the field, where you are in danger of losing your life any moment."

"It is true," replied Mr. Roosevelt quietly but earnestly, "that I have a wife and five children depending upon me for support. It is equally true that no one has been more earnest in trying to bring on this war for the sake of our national honor than myself. Therefore it is my duty as well as my great pleasure to help prosecute it to a successful termination to the fullest extent of my ability, thereby helping to make this the greatest and best nation on the face of the earth, which my children can enjoy after I am gone."

Accordingly he proceeded to organize the First Cavalry Volunteers, familiarly known as the Rough Riders, of which he was at first lieutenant colonel, and then colonel before the end of the war. The history of this regiment in-

cludes the history of the most important field operations of the Spanish-American War and needs no repetition here. His indomitable energy was well exhibited in the way he ignored and over-rode the yards of red tape in the War Department, which anyone else would have felt obliged to unwind with due ceremony. It was due entirely to the leader himself that the most useful and successful of all the regiments sent to Cuba arrived in time for action. At the time of the battle of Manilla, knowing that the supply of ammunition had necessarily been greatly reduced, Mr. Roosevelt was acting Secretary of the Navy and at once without further notice ordered a full supply of ammunition sent from California to Dewey's command.

Immediately after his return, he was elected governor of New York and filled that office with conspicuous ability. He gave up his own desire to run for this office again in obedience to the universal demand of the Republican party that he should become their candidate for vice president. This action of Roosevelt's in sacrificing his own preferences for the good of his party is quite similar to that of President Lincoln in 1856. When he was within six votes of election to the United States senatorship, Lincoln gave up his claim on it to Judge Trumbull, who was supported by only six votes, because these six would not yield and vote for himself, in order that the Republican party might be successful in the election. This generous ac-

tion on Lincoln's part secured him the unanimous support of his party against Douglas for United States senator in 1858. While Mr. Lincoln was not successful in that campaign, the great ability shown in joint debates with Judge Douglas secured for him the nomination and election to the presidency in 1860. So in giving up the really preferable governorship in order to add his personal strength to the national ticket, Roosevelt has unexpectedly attained the same high office.

During the campaign he displayed his present wonderful powers of physical endurance by traveling over 21,000 miles throughout the country, making speeches everywhere and still farther increasing his popularity with the masses of the people. During the few months that he was allowed to remain vice president, he presided with conspicuous ability over one extra session of the senate and made several trips through the country attending public functions and making speeches.

Now for the fifth time in our history, the necessity of having a very able man as vice president has been forced upon us by the death of our chief executive. Roosevelt is the youngest president we ever had; yet nothing demonstrates the wisdom of our political institutions more than the fact that he is older and more experienced than most of the present rulers of Europe. He is forty-three the 27th of this month, while the Emperor of Germany is forty-two, the King of Portugal thirty-eight,

the Czar of Russia thirty-three, the King of Italy thirty-two, the Queen of Holland twenty-one, and the King of Spain fifteen.

In conclusion, Roosevelt may be said to combine in his own person the most prominent qualities of our most conspicuous presidents, the purity of character of George

Washington, the scholarly attainments of John Adams, the iron will of Andrew Jackson, the intense patriotism of Abraham Lincoln, the persistency of purpose of U. S. Grant, the "bull-dog" tenacity of Grover Cleveland, and the wide popularity of William McKinley.

IRRIGATION IN INDIA AND AMERICA.

BY. E. H. PARGITER, OF THE IRRIGATION BRANCH, PUBLIC WORKS DEPARTMENT, PANJAB. INDIA.

(Continued from last month.)

During the flood season the river water is heavily laden with silt or sediment, mostly sand. This, entering a canal with the water, is soon deposited on the bed in the first few miles, as the velocity in the canal is very much less than that in the river. Wherever there has been a heavy erosion of its bank by the river, upstream of a canal head, as much as six feet of sand may be deposited on the bed of the canal channel at the head, in one season of three months, decreasing perhaps to one foot some five or six miles down. But where the head is in a good position, with no erosion near, and especially when it is in a long creek or small side channel of the river, there may be not more than two feet of silt at the head; and nothing at all three miles down. As the river falls after the end of the rainy season, a canal whose bed is heavily silted will of course run dry much sooner than one with little silt in it. The level of the canal bed is usually fixed at the lowest cold weather level of the river water surface at its head, so that the silt clearance goes down to the spring level there; it is not easy to dig deeper, for the annual silt clearances are heavy enough usually with the bed at this level. The bed is graded at a slope or grade of from one in 10,000 to one in 2,000, according to the size of the canal, and the natural grade of the country traversed by it. As soon as the river begins to rise, water can flow down the canal, but in practice it is not usual to open a canal with less than two feet depth of water, as a mere dribble is of no use, and deposits its silt very soon. These canals are opened in March, April or May as required, and flow until September, October or November. Occasionally it happens that a canal flows throughout the cold weather months, it being free from silt, and the bed level having been scoured out deeper than usual; but this does not often occur. For these large inundation canals, a bed grading of one in 5,000 is given wherever the natural slope of the country will allow of it; but in some places a flatter grading has to be adopted in order to bring the level of the water surface in the canal more speedily above the level of the ground, and so allow of land being irrigated near the head of the canal.

During the cold weather months, when these canals are dry, they are cleared of all silt deposits, banks are strengthened, bridges or other works repaired, and new ones constructed where necessary.

While the foundations of such works are usually built of concrete or brickwork, yet timber is often used in the superstructure, both for economy and rapidity of construction. Though repairs and renewals are required from time to time, still these are easily carried out each year during the months the canals are dry, and there is no danger to be apprehended from any long continued running of an inundation canal being required.

The construction of the canals and ditches in the western states of America correspond more closely with that of these inundation canals, than with that of the large perennial canals of North India. For both the canals of America and these Indian inundation canals are constructed with a view to economy in first construction, and to being quickly brought into use, leaving renewals and repairs to be done from time to time, when the canals are not in flow.

Labor is extremely cheap in India, while it is more costly in America. For instance earthwork can be done in India for one-eighth of its cost in America. A job for which twelve cents per cubic yard would be paid in America, would cost only about $1\frac{1}{2}$ cents in North India (taking the Indian Anna as equal to two cents, at the present value of the rupee which is about one-third of a dollar.) Earthwork in excavation in India is done entirely by human labor, machinery or teams of horses, or yokes of bullocks not being used, except in very special cases of large works, or embankments which require to be trodden down and consolidated during construction. Digging out the earth is done by a man with a broad-bladed mattock, with which also he fills the earth into baskets, and these are carried away on their heads by men, women and children, who throw down the earth where required. The final dressing to correct shape of the finished channel or embankment would be done by these mattocks also. In digging, the mattock is wielded by the arms, and brought down with a blow on the ground; the Indian laborer does not use his feet to press it into the ground for the reason that his feet are bare, or have on only light shoes like slipper; it requires a strong boot or shoe to press a spade into the ground. The daily wage of a laborer on earthwork would be only six or eighth cents (three or four Annas).

In consequence of earthwork being thus so inexpensive while the massive stone or brick structures required as falls, drops or rapids, are comparatively costly in material, it is usual to design the channels of large canals in India with longer reaches between falls, and with banks higher above ground level, than would be done in America. The bed of a canal (in a country where the grading or slope of the bed was less steep than that of the country) would be allowed to run on to, or nearly on to, the natural surface of the ground, before a fall would be put in. With a depth of seven feet of water, the canal banks

would be ten feet above ground with a top width of at least ten feet. Below the fall the canal would be in deep digging of ten feet or more. Falls of eight or ten feet are very common, necessitating deep foundations. Whereas in America where timber is so cheap and labor so expensive, the falls or drops would be designed nearer each other, and deep channels and high banks be avoided as involving great expenditure on labor.

There are two distinct crop seasons in North India. There is really no winter in the great plains; it is never cold enough for snow, and but rarely does a slight frost occur in the more northerly parts. The cold weather is the pleasant season of the year, when white people can be out in the sun all day with safety and comfort. It is the great working and touring season. The hot weather, on the other hand is decidedly unpleasant to white people, who must avoid the sun as much as possible throughout the day for fear of sunstroke; if their duty compels them to be exposed to its heat, their health and safety require them to carefully protect their heads and backs from its rays, and to keep under shade of some kind if possible. The associations and ideas connected with the terms "summer" and "winter" to dwellers in temperate climates, do not apply at all to the corresponding seasons in India, which are more like those seasons in the southern states of the United States of America, where the same crops are grown as in the hot weather in India. The terms "hot weather" and "cold weather" are usually employed in India, rather than the terms "summer" and "winter;" and the native language also employ the same terms, so that their literal meanings in English come naturally into use. There being then no "winter," there is no sleep of nature, or stoppage of vegetable growth, but the crops, fruit and vegetables of temperate climates grow readily throughout the cold weather, and produce their harvest at the end of it when the sun's heat begins to be powerful. During the hot weather the crops, fruit and vegetables of torrid climates grow in profusion and produce their harvest at the end of it. A few kinds of produce interlap between the two seasons, and some take almost the whole year from sowing to harvest, as for instance, sugar cane, which is sown in March and cut in January usually, and the orange which flowers in March and April, and ripens its fruits in the middle or end of the cold weather, from December to February; again cotton is sown from March to June, and is mature for picking from October to January. The regular cold weather crops in the Panjab are wheat and barley, sown from October to December, and reaped in April and May; turnips, sown from August to November, as a fodder crop for cattle throughout the cold weather; field peas of various kinds, one of which is the chief grain given to horses, for oats are not grown by the people for their uses; and several varieties

of rape and mustard for making oil from; these being sown from September to November and reaped in March and April. The regular hot weather crops, beside cotton and sugar cane are sown from May to July, and reaped from August to November; such as maize, the millets and fodder crops like kaffir corn; and rice where water is to be had in abundance; again in some parts, indigo is grown, sown from March to May, and cut in August and September. The sesame or gingelly oil seed is a somewhat later crop, often sown as a last resource when the season for the other crops has gone by.

The the perennial canals the irrigation is continuous throughout the year; water is not taken for land on which cold weather crops are to be sown, until the time of sowing approaches, and when it is no longer required for the hot weather crops, which by that time have matured. But on the inundation canals the system is different. Here a supply of water cannot be depended on after the middle of September, and what there is, is small and daily diminishing, and would be quite insufficient to do much irrigation. Hence the people utilize the superfluous water received in times of high flood in the river, to irrigate the lands destined for their cold weather crops. The regular ordinary full supply in a canal, having a depth of five or six feet of water is all required for the hot weather crops; but whenever the supply rises above this amount, as it continually does during the rainy season, this additional water is not required for the existing crops, and therefore is turned out on to the lands kept for the cold weather crops; a heavy flooding is given in order to thoroughly saturate the ground, and allow water to sink down in the soil, so that the subsoil may remain moist for a long time. This land is then thoroughly ploughed up to prevent weeds and grass from growing, and the moisture below considered by a careful smoothing of the top soil; what is called in America "cultivation." One good watering in August is usually sufficient in clayey soils to keep the subsoil moist until October or November when the seed is sown; though two or three are commonly given where water is plentiful; the soil is ploughed up and "cultivated" after each watering. The earlier and oftener that the ground can be thus watered and ploughed, the better will be the subsequent wheat or barley or pea crop.

As the inundation canals are dry during the cold weather, the further irrigation for the maturing of the crops, chiefly wheat, is carried on from wells by bullock power. One well, with a lift of about twenty feet, worked day and night by four to six pairs of bullocks, will supply sufficient water to mature sixty or seventy acres of crops, sown on canal irrigated land; while it would only be able to supply sufficient water for the ploughing and sowing of twenty to twenty-five acres where no canal irrigation was available.

Inundation canal irrigation is thus expected to be supplemented by irrigation from wells; and it is more suitable for the bottom lands of river valleys than perennial canal irrigation would be; for the continuous sinking into the soil of water, in the latter system, tends in the course of a few years to raise the level of the subsoil water to the ground surface; whereas in the former system the total cessation for half the year of irrigation, with its pouring on to the land of water from outside, gives time for the subsoil water to flow away, and for its level to fall to its normal depth below the ground. The working also of numerous wells at the same time, helps the process so that no permanent injury is done in the way of saturating the soil, which is kept wholesome and fit for use.

As a matter of fact, too profuse perennial irrigation has been allowed in some places in the past years, with the result of saturating the soil too much, so that drainage channels in addition have had to be constructed to relieve the land and prevent further injury. But the matter now receives full and proper attention in time. Careful measurements are made, twice a year, in all canal irrigated tracts, of the depth below ground surface, of the spring level or subsoil water; and wherever it is found that this water is rising too rapidly and approaching the ground surface, means are carried out to check further saturation of the soil. These means, ordinarily, will be to stop all irrigation during the cold weather; and so to compel the people to depend on the rain, or on wells, for their crops then; thus carrying out the practice necessitated on inundation canals. Hitherto this excessive rise of the subsoil has only occurred in those tracts near the Himalaya Mountains, where there is a fair rain fall and where much irrigation from wells used to be effected, before canal water was made available. So the remedial means enforced, only make the land revert to its former agricultural condition, a condition under which good crops can be satisfactorily grown.

Another means, tried in some places, was to raise the water rates assessed on the richer crops taking much water, to such an extent as to induce the irrigators to give up canal water, and revert to well irrigation as more profitable to them, or to depend on the rain where the rainfall was sufficient for the ordinary grain and fodder crops in average years. This plan, in itself, would answer admirably, but it had the disadvantage of requiring great alterations in the assessment of land revenue, and in the relations between landlords and tenants, so it was not always suitable.

The above description of the conditions under which irrigation in North India is effected, and has now reached such a degree of success, politically and financially, will enable American readers who know the condition in the western states of America to compare the condi-

tions and results in the two countries. In India everything has been done under absolute and entire government control; while in America private enterprise and speculation have largely had the whole field to themselves. In India the progress has been slow and sure with every precaution against a new project injuring the prospects of an established work. In America the progress has been very rapid, but results have often failed to come up to what was expected, with numerous conflicting interests, and heavy litigation, to hamper and obstruct the smooth and due working of many projects. It seems advisable now that government control should be increased in America in order to conserve existing rights, and allow of future projects being designed with a full prospect of permanent success. The great thing to bear in mind is, that in arid countries, natural sources of water belong to the whole land, and are the property of the state, and not of riparian owners only. The state can then make use of and distribute the water, to the greatest good of the greatest number of its people. In America the state means the people, and hence the majority of the people should be able to derive the fullest possible benefit from the natural resources of their state.

(TO BE CONTINUED.)

THE IMPERIAL SETTLEMENTS---A WONDERFUL DEVELOPMENT.

(From The *California Cultivator*.)

Southern California is just developing the most extensive and important irrigation system to be found in arid America. The location of this enterprise is on the Colorado Delta, and the water for the reclamation of that country is taken from Colorado river, where the supply is more than abundant.

In extent, the land to be reclaimed under this system includes about 500,000 acres in San Diego County, California, and about 300,000 acres across the line in Lower California.

The California Development Company has charge of this work, which is generally known as the Imperial Canal System.

In April, 1900, Mr. George Chaffey, founder of Etiwanda and Ontario, in San Bernardino County, and Mildura and Renmark, in Australia, concluded arrangements with the California Development Co. whereby he was to take absolute control of the enterprise and manage it to a conclusion. In this work he has been ably supported by other members of the company. Work was immediately commenced, and the progress made during the past year and a half has been most remarkable,—nothing like it being of record in the irrigation history of this country. A few of the advance steps may be noted as follows:

First.—The public domain in that country has been resurveyed, as most of the old stakes and land marks of the government survey had been obliterated.

Second.—The Imperial canal has been constructed so that water has been introduced into the Imperial Settlements from the Colorado river in quantities in excess of the demand made by the men who have taken over 100,000 acres of land from the government.

Third.—The work of constructing the distributing systems of canals and ditches is progressing rapidly and will be completed as rapidly as they may be needed for distributing water to the land owners who may need it.

Fourth.—Although water for irrigation purposes did not reach the Imperial Settlements until the middle of June of this year, over two sections of land have been planted to crops—mostly sorghum and millet for feed,—and these crops have grown beyond the most sanguine expectations of all parties interested, some of the sorghum having been already harvested and yielding ten tons of cured feed to the acre.

Fifth.—A school district has been established, and a school is now in operation with a competent teacher, and over twenty scholars under a temporary brush shade supported by nine posts. This temporary structure was made because the law required the school to be opened by a certain date, and there was not time to build a school house.

Sixth.—A large number of families are now moving into the settlements, taking in teams to work on the canal system for a while, afterwards to be used in putting in crops and improving the lands of the settlers.

Seventh.—A railroad is the next program. Already the Los Angeles, Imperial and Arizona Railway Company is being incorporated to build a standard gauge railroad from Yuma through the Imperial Settlements in a northwesterly direction to Los Angeles, or to a connection with some other line of railroad that will give entrance to Los Angeles under favorable conditions. On this line of railroad are located the towns of Imperial, Paringa and Calexico. This company also proposes to construct a branch line from the town of Imperial in a northerly direction through the town of Ranchita to a connection with the Southern Pacific; also a branch line from the town of Ranchita down through the Eastside Settlement on the east side of Carter river, through the towns of Eastside and Ganges, to a connection with the main line at Imperial, or some point on the main line south of that town. Work of grading the line from the Southern Pacific in a southerly direction throughout the towns of Ranchita, Imperial and Paringa to Calexico will be commenced in a few days, and this portion of the road will be pushed to completion as soon as possible.

Eighth.—From the best information obtainable, there will be 50,000 acres of land under the Imperial Canal system put under cultivation during the coming season.

Ninth.—The towns of Calexico and Imperial are already platted and the lots in these towns are now on the market. The towns of Ranchita and Paringa will soon be platted, and building operations therein commenced. Another season will probably see Eastside and Ganges commenced.

This is a summary of work thus far done in reclaiming the Colorado Delta and in developing the largest, and what promises to be the most flourishing irrigation settlement for general farming and stock raising to be found in the United States.

What of the products? It is definitely known that alfalfa, barley, and wheat will do as well here as anywhere; that more alfalfa can be grown to the acre here than in any other known section; that as a cattle and hog country, no section will produce more feed for convert-

ing cattle and hogs into beef and pork. This will be the first staple industry.

As to fruit, those fruits grown will be early. Canteloupes and watermelons are being successfully and profitable grown at Indio and Yuma. These crops have netted the growers \$100 an acre or more the past season, and the markets for these products are fast being developed. It is believed that apricots, peaches, pears and grapes will do well in this country. All such fruits will be from four to six weeks earlier than similar fruits grown in the coast valleys of Southern California. It is believed that the finest layer raisins in the world will be produced in the Imperial Settlements, for they will be cured by placing them on trays and not exposing them to the sun at any time before being perfectly cured.

All indications point to a rapid settlement and a rapid development of the resources of this country, and hence, there must be a rapid advance in prices, not only of ranch property, but of town property also.

One-fifth of the land that can be irrigated on the United States side of the line is already in the hands of the settlers, and the other four-fifths is being taken as rapidly as the irrigation system can be extended.

Prices of water stock were started at \$8.75 per share or acre, with liberal concessions to those who purchased the first 50,000 shares. The price was then advanced to \$11.25, and on the first of October, 1901, the price advanced to \$15, and by the first of January next the price will go to \$20 a share. This will be cheap for the price of such land, with such a good water right, and so cheap water will not stop until it reaches \$50, \$75 or \$100 an acre, and the advance under present conditions must be very rapid. The price of the land will still remain the same—\$1.25 per acre. The price of the water stock will be advanced so that it will keep pace with the price of land and water combined. The speculation is not in the land, but in the water.

IRRIGATION IN THE NORTHWEST

Prof. F. H. Newell, of the Geological Survey, refers to a recent report prepared under his direction, in which he discusses very briefly the water supply of the public lands in the several western states, and calls particular attention to the references to the states of Oregon, Washington and Idaho. In his report Prof. Newell says:

“In Oregon the great bulk of the land to the east of the Cascade Range still belongs to the National Government, together with a considerable area of forest along the coast and among the high mountains. The aggregate area of vacant public lands is estimated to be 55,887 square miles, or 35,767, 680 acres, this being a trifle less than three-fifths of the area of the state. The principal tracts disposed of to individuals lie in the valley of the Willamette and in the smaller valleys to the south and west. In the extreme eastern portion are also numerous entries, in the valleys among the Blue Mountains, where water can be obtained. Next to Washington, this state is one of the best timbered in the West, the estimated area in forest being over 20,000,000 acres, and in woodland 17,000,000 acres. Part of this has, however, been burned or cut over, and the present knowledge of the condition of the timber is somewhat meager, so that these figures may be above the actual facts. The largest forest reserve in the United States, that of the Cascade Range, lies within this state. It includes nearly 4,500,000 acres. Besides this there are smaller reservations of relatively insignificant size.

“The greater part of the vacant public land is within the great interior basin, the streams of which do not have sufficient volume to cut their way to the ocean. They flow for a short distance from their sources among the mountains, and gradually dry up, or flow into some lake or marsh from which the water is evaporated. The supply is very small in comparison with the land to be supplied, and it will be necessary to use storage reservoirs and well water, wherever it can be obtained, in order to utilize the land.

“Washington, lying in the northwestern corner of the country, is probably the most humid of those west of the Mississippi Valley. Along the seacoast the precipitation is excessively heavy, and the mountains are clothed with dense forests extending inland north of the Columbia. The vacant public land aggregates nearly one-half of the area of the state, and in addition to this over one-tenth of the land surface has been reserved for the Indians and for forestry purposes. The state is crossed by the broad land grants of the Northern Pacific Railroad Company, these covering much of the best farming land.

The main body of vacant land is within the Cascade Range and directly west of the vast foreign region to the north of the Columbia, and lies also out upon the broad, dry plains of the central part of the state. In the eastern end the humidity is such that wheat is raised by dry farming, the productiveness of this area being well known.

“Within the tree-covered regions the water supply is large and well distributed, being often in excess of the needs of the relatively small areas of the arable land. Out upon the plains of the Columbia, however, the question of obtaining sufficient water is still unsettled. Attempts at drilling deep wells have been prevented by the great thickness of the lava underlying these plains and the expense necessarily involved. The Columbia itself, although one of the largest rivers of the country, and having an estimated low-flow of 60,000 cubic feet per second, cannot be employed in irrigation, as it is bounded by bluffs and cliffs hundreds or even one thousand feet in height. The valleys west of the Columbia and immediately east of the Cascade Range, although having a very slight rainfall, are well watered by the numerous streams rising among the lofty, snow-crowned summits. The principal stream of this area is in the Yakima, whose waters are employed to a small extent in irrigation. The storage facilities are exceptionally fine in the glacial lakes at the headwaters of these streams, and great quantities of water can be held at small expense for use upon the fertile lands stretching out to the Columbia. One of the most favorable opportunities for development is in this part of the state.

“Idaho is considered one of the best wooded states of the arid region, its narrow northern end being covered to a large extent with forests and woodlands. The broad southern part, however, extends over the lava plains bordering on Snake River, and is destitute of the larger vegetation, the most conspicuous plant being the so-called sage brush, which grows on this rich soil often to extraordinary size. The water supply of the state is large, but, unfortunately, only a part can be utilized to advantage, as the most important river—the Snake—soon after leaving the mountains, cuts for itself a deep canyon in the lava, and by cascades and rapids falls to a depth of hundreds or thousands of feet below the plains.

“The vacant land of the state—over 75,000 square miles—forms nearly nine-tenths of the total area. The great mass of it, untouched by settlement, lies in the almost unexplored mountain passes of the central and northeastern parts of the state. On the great laval plains of the Snake, also, are many miles of vacant land, the soil, though fertile, being too dry to attract the pioneer. Along the northwestern edge, adjacent to Eastern Washington, the cultivation of cereals by dry farming is successful; and in the valley of the Weiser, Payette

and Boise many irrigating systems have been constructed carrying water to farms on the benches and lowlands. There is still a surplus of supply, and the area thus cultivated can be extended, although it is probable that the lands now in private ownership will demand all the water easily obtainable.

“Considerable areas of vacant public land can probably be watered by large canals heading on the Snake River near or below Idaho Falls, and small tracts can doubtless be made valuable by the construction of storage reservoirs upon or near the edge of the lava plains. Several such reservoirs, as, for example, in the vicinity of Mountain Home, have been built and are in successful operation, the relatively low altitude and genial climate rendering possible the production of prunes and similar fruits.”

THE WATER QUESTION.

REPORT OF A MEMBER OF THE HYDROGRAPHIC SURVEY.

The following article on the work of the hydrographic surveys was written by George B. Hollister, resident hydrographer U. S. survey, Rutherford, N. J.:

Prof. Israel C. Russell of the U. S. geological survey is at present examining the great lava covered plain of Southern Idaho, through which Snake Run has cut its deep canyon. Many creeks and rivers rising in the mountains on both sides lose their waters as they enter upon the pervious surface. These percolate under ground to finally reappear in great springs far down the canyon walls. Some of the streams from these springs are literally large enough to float a steamboat. It is the object of the geological survey to locate the course of these underground waters beneath the drouth stricken region and to indicate where, by deep wells, water may be had for the cattle or sheep which for lack of water are unable to graze over the broad area. There are many tracts of fertile land embracing thousands of acres which by use of the waters now flowing to waste, might be made into productive farms and orchards. This investigation is part of the general study of the water resources of the country, and the maps prepared will add to the series exhibiting the probable depth and character of the waters beneath the surface.

The United States geological survey is conducting a series of investigations in the vicinity of Greeley, Colo., the results of which are expected to be of importance. The work, which is in the hands of Mr. Geo. I. Adams, will consist in an examination of the geological

formations of this section with special reference to the location of underground waters which may be made available by well borings. Greeley is situated in the arid eastern part of Colorado and was founded through the efforts of Horace Greeley, who was one of the early enthusiasts of the possibilities of irrigation. In Colorado as in all the arid states where most of the streams run low in the summer season, a reliable supply of well water is of great importance, often being equivalent to the difference between profit and loss in the management of the farm. This is especially true of the smaller farms where wells are used to assist in irrigation. An attempt will be made to locate the underground waters of the Greeley district and to secure all the information possible regarding their depth, volume and reliability.

The serious character of the recent July drouths which so jeopardised the western crops gives an unusual interest to the investigations of the United States geological survey which are being conducted in the Big Horn Mountains of Northern Wyoming. It is to this section that the porous, water bearing rock formations come to the surface which are known to underlie the whole of the great plains region to the eastward, and from which are derived the very considerable artesian water supply which means so much to the industrial and agricultural development of the section. Along the slopes of the Big Horn Mountains, the Black Hills and other localities numerous mountain streams flow across the upturned faces of these rock layers and furnish water which slowly works its way along them under the plains to the eastward. In these mountain regions it is possible to measure their thickness, study the character of the rock lying beneath them, and obtain other information of value in throwing added light on the important question of the water resources of the great plains. The work is being conducted by Mr. N. H. Darton, who has spent several seasons in similar investigations.

As the part of the general plan of the United States geological survey for a comprehensive investigation of the underground water resources of the great plains region, Prof. Charles M. Hall of the Agricultural College at Fargo, N. D., will spend a portion of the summer in the study of the artesian waters of the upper Red River valley and of the southeastern part of North Dakota. The wells of this region, which is an important agricultural center, have proved to be a growing factor in increasing the possibilities of its further development. The results of Prof. Hall's investigations will be published in the series of interesting water supply papers issued by the government.

DEEP WELLS FOR IRRIGATION.

BY JOEL MOODY.

The deep well system for irrigation is no longer problematical in Vermilion parish. Hence it has passed from the experimental into the practical realm of agricultural industry. At least twenty-five good successful wells are in operation in the northwestern part of this parish, and when dug deep enough give entire satisfaction.

These wells are not artesian, neither are they in any sense an overflow. The water never flows forth like a fountain with great pressures from below like the artesian wells in Nebraska and South Dakota, which are from one to two thousand feet deep. But these wells which are sunk about two hundred feet seem to have tapped a subterranean sea in which the water supply, like the artesian, is practically inexhaustable. The water rises to within a few feet of the top and has to be pumped.

Recently it was my pleasure to visit and inspect the irrigation plant of Simms & Wathen, located ten miles west and two miles southward from Abbeville. These gentlemen, who own a large tract of land there, have put down four eight-inch wells to a depth of one hundred and eighty feet. A less depth in this location does not often reach this great body of clear water and never gives entire satisfaction. Often two hundred and twenty feet is still better.

These four wells, which are within twenty feet of each other, are pumped by a 12-inch submerged rotary, driven by about a fifty-horse power boiler and engine. This is too light a power to come anywhere near testing the capacity of the wells, yet it pumps over three million gallons in twenty-four hours. We witnessed this volume of water, clear as crystal, sparkling and cool, flowing in a large stream from the flume, and drank bountifully of it as it came forth from its subterranean sea.

Since the 8th day of June the pump has run only eighteen days and six hundred acres of the finest stand of rice we have seen in the parish was thoroughly watered. Much of this rice is now three feet high and all of it is very clean and in splendid condition.

With this power, which is not half sufficient to test the capacity of these wells, it is safely estimated it is sufficient to water one thousand acres. With the motive power doubled or quadrupled a far better estimate of the value of deep wells could be had, but it is already sufficient to take the question far beyond any doubt in regard to it.

It has been objected to the theory of deep wells that the water is too cold for growing rice. This theory has been exploded by the fact

that the best and largest rice of the six hundred acres is at the very door of the wells and got the water first and all the time.

The wells settle the fact of salt on rice. There is no salt in this water. There is no earthy or mineral substance to stick to the stalk and injure it. It is the best water that can be had for all purposes on the farm, and is as soft as rain water. Dead crawfish, however, are found along the sides of the trenches, but none among the rice, living or dead; the water seems to be too pure and clean for such filthy animals.

Within a radius of twelve miles from the Simms & Wathen plant are twenty-two wells in successful operation, some of them deeper, some not so deep. Those that are deeper give no trouble, those that are of a less depth are not so satisfactory. It is safe to say that the deep well is the coming and satisfactory source of success to the agricultural industry of this part of our state. Not rice alone will be watered, but corn, cane, cotton, the kitchen garden, in fact, all the agricultural products will grow and flourish by the waters beneath the earth instead of from the clouds above. If it rains sufficiently the pump may rest, if not, the waters from beneath will make the farmer happy because he controls the situation.—*Gulf Coast Farmer.*

A FRIEND OF NATIONAL IRRIGATION.

There is little doubt that, among other things, the question of national irrigation of the arid lands will be well taken care of under the administration of President Roosevelt. He has lived for a long time in the West, and is fully able to appreciate the importance of this question. Since becoming president, as well as before, he has pointedly expressed himself in favor of the national irrigation of the public lands of the arid West.

A dispatch from Washington states that Senator Hansbrough of North Dakota, who is a prominent advocate of national irrigation, recently called upon the president, and after the interview expressed the belief that the president favors the required Congressional appropriation for the reclamation of the arid lands. He added:

“Congress is going to be liberal with the West in dealing with irrigation questions, and I believe that President Roosevelt will also be most liberally disposed. I believe that the government should give the proceeds of the sale of public lands to irrigation purposes. This would amount to about \$2,000,000 each year, and it could be expended under the direction of the Secretary of the Interior in making surveys and in the construction of reservoirs and canals. After the government has done its part the private land owners will do a great deal. They stand ready to spend millions also.”

As *The Times* has previously observed, the application of the proceeds of the sales of arid lands to the building of reservoirs would be all right, as far as it goes, but of itself it would be far from sufficient to produce any adequate results, commensurate with the vast importance of the problem. Such money would probably be divided among the states, in proportion to the amount received from each, and this would not go far in the building of reservoirs.

There is every reason to hope that the coming Congress will deal liberally with the arid West in the matter of an appropriation for irrigation purposes. The campaign of education on this subject that has been carried on during the past couple of years has been productive of good results.—*Los Angeles (Cal.) Saturday Times*.

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

FALL SEEDING OF ALFALFA.

Alfalfa may be sown from August 15 to September 15, and if the season is favorable, will make a vigorous growth through the fall and go through the winter in good condition. August sowing is preferable, as it gives the alfalfa a longer time in which to grow before the ground freezes.

PREPARATION OF THE GROUND.

The ground for alfalfa should be thoroughly pulverized and deeply plowed, but it must be well settled before seeding and only the surface loose. Alfalfa will usually fail if seeded in the fall on freshly plowed ground. If it is necessary to plow the ground before seeding, plow as early as possible, harrow thoroughly, making a good seed-bed, and then wait until a good rain has settled the soil before seeding.

A well cultivated corn-field, with the stalks cut and drawn off, will give ideal conditions for seeding alfalfa. Such a field should not be plowed, but harrowed before seeding. Wheat, oat, flax and millet stubble-ground plowed, harrowed thoroughly, and allowed to settle before seeding, furnishes good conditions for alfalfa. If such ground is mellow plowing may not be necessary, and the land will need only to be disked and cross-disked.

A careful farmer and a careless renter a few years ago put in alfalfa in adjoining fields in northwestern Kansas. The farmer plowed the land deeply and pulverized it until it was like a garden bed. He immediately sowed alfalfa, secured a thick stand, and in a few months the alfalfa entirely died out. The renter thought it would not pay to spend much time on another man's land. His field had been in corn

the previous year. He broke the stalks with a pole, sowed the seed broadcast, and lightly covered it with a harrow. He secured a good stand that was permanent. Usually a good stand cannot be secured with so little preparation, but a deep, mellow seed-bed at seeding time generally insures a failure. The more thoroughly the seed-bed is prepared the better, if it is allowed to settle before seeding.

The ground must be deeply pulverized, well settled, with a good mulch on the surface, and saturated with moisture, so as to bring up the seed quickly and force the fall growth. If either of these conditions is lacking do not sow.

HOW TO SOW.

The best way to sow alfalfa is with a press-drill, using twenty pounds of seed per acre. Mix the seed with equal parts by measure of coarse corn-chop or bran, drill and cross-drill, sowing half the seed each way. If either a hoe or disk drill is used, care must be taken not to get the seed too deep; about twelve times the diameter of the seed is the proper depth, if this places the seed in moist soil. If necessary to sow broadcast, use twenty-five to thirty pounds seed per acre, cover with a harrow, and roll, unless there is danger from blowing. It is much better to seed with a drill.

Alfalfa should be sown alone. It does not want a nurse crop.

WHERE FALL SEEDING IS PROFITABLE.

In general, it may be said that fall seeding is advisable wherever the proper conditions of seed-bed in regard to moisture and mechanical condition can be secured in August or early September. In some

years, in some sections of Kansas, the conditions for fall sowing may be secured but grasshoppers will destroy the young plants.

From the east line of Kansas westward for 120 miles, spring seeding of alfalfa fails more often than it succeeds. Last year, in Wabaunsee county, a farmer secured a heavy stand of alfalfa from fall seeding on a field where he had tried spring seeding for four years in succession and failed. Alfalfa seeded in September, 1900, yielded its first crop of hay in May, 1901.

West of a line 120 miles west of the eastern line of the state, fall seeding of alfalfa is not so certain. If conditions are right it will pay; otherwise spring seeding is best. Judging from our correspondence and investigation, fall seeding is usually best in states east of Kansas.

ADVANCING OF FALL SEEDING.

Alfalfa may be seeded in the fall after another crop has been taken off. The next year it will yield full crops of hay, and no time is lost. Alfalfa seeded in the spring usually yields no hay until the following year, and requires mowing several times during the first summer to keep the weeds down. Alfalfa sown in the fall under proper conditions requires no attention whatever until the following spring, when a crop of hay is ready to be harvested.

It must be remembered, though, that conditions must be right or fall seeding will fail, as a vigorous growth must be secured in order to carry the alfalfa through the winter.

Alfalfa, when sold, will probably return a greater cash income year by year than any other feed crop raised in Kansas. When fed on the farm where raised it ranks among the most profitable crops.

At this Station, pigs are pastured through the summer on alfalfa with a light feeding of corn. After deducting the probable gain from the corn, the gain

per acre from the alfalfa pasture was 776 pounds of pork. One lot of fattening hogs were fed all the grain they would eat; another lot all the grain and dry alfalfa hay they would eat. The lot having the hay made a gain of 868 pounds of pork per ton of alfalfa hay. Alfalfa should form part of the daily ration of every growing pig and of all stock hogs.

With scrub cows fed alfalfa hay and Kafir-corn grain, at ordinary prices for feed, butter-fat was produced at a cost for feed of seven cents per pound. On the College farm young cattle are wintered on alfalfa hay and corn, Kafir-corn or sorghum fodder, and make through the winter a good growth without grain.

A stockman in Rice county, Kansas, made a gain of five pounds per day per head on steers for forty-seven days with alfalfa hay and corn. In ordinary feeding, 1000 pounds of grain are required to put 100 pounds of gain on a fattening steer. With alfalfa hay and corn-meal, at this Station, fattening steers made 100 pounds gain for each 718 pounds of grain.

Alfalfa makes a good pasturage for horses. Horsemen report a gain of six pounds a day per head on horses pastured on alfalfa and given a light ration of corn or Kafir-corn.

Alfalfa hay is one of the best feed for sheep that is grown, and both green and dry alfalfa are valuable feeds for poultry.

On account of the effect on the skin and hair, alfalfa is one of the best feeds for cattle being fitted for the show ring.

At the Wyoming Experiment Station, part of a field was seeded to alfalfa and part planted to a variety of field crops. At the end of five years, the alfalfa was plowed up and planted to the same crops as the other part of the field. Wheat, on the part kept for five years in alfalfa, yielded thirty bushels per acre; on the other part, eighteen bushels. Oats on the alfalfa land yielded seventy-eight bushels per acre; on the other land, thirty-seven bushels. Alf-

alfa increases the fertility of the land and improves its physical condition, making stiff soils mellow and binding loose soils. Kansas farmers need alfalfa for increasing the yield of their other crops.

Alfalfa is adapted to a wide range of soils and climate. It will make the greatest growth on rich, well-drained bottom land, where the subsoil, while not sand or gravel, is porous. It has been grown for years on the farm of the Kansas State Agricultural College on high upland, where the subsoil is stiff hard pan, and where it is 180 feet to water. The yield on this land averages more than three tons per acre per year. On better land the yield is four to six tons per acre per year.

Alfalfa will not grow in wet land, nor on land subject to overflow. On the College farm, a part of one field has only four feet of soil and then solid rock. In ordinary years fair crops are raised on this part of the field. In drought the yield is light, but the alfalfa lives, ready to grow with vigor as soon as rain comes.

Many farmers in eastern Kansas have tried to grow alfalfa and have failed, and the general impression is that alfalfa is not a suitable crop for that section of the state. The failures are due to improper methods of seeding or to wrong treatment after seeding. Secretary Coburn, in his recently published book on Alfalfa, shows that alfalfa is a profitable crop in thirty-one states and territories. It grows successfully in such widely different soils and climates as that of California and Washington, and Delaware and New Jersey; Idaho and Montana, and Louisiana and Georgia. Secretary Coburn shows that the annual yield per acre in New Jersey has a feed value equal to six tons of bran; that in Montana fields sixteen years old are now yielding good crops, and that in Louisiana six cuttings are made annually.

With this showing, farmers in eastern Kansas should not be afraid of alfalfa not succeeding with them. We have found a

yield of six tons per acre in a single season in Jackson county, where the best farmers believed it could not grow. From careful investigations made during the past five years, we are convinced that ninety per cent. of the tillable land of eastern Kansas is adapted to growing alfalfa. It does not live long on sandy soils, and should not be sown on any soil that is not in good condition.

On most farms in eastern Kansas fall-sown alfalfa, seeded on well drained land, will grow well and will yield profitable crops. It is a profitable crop for both bottom and upland.—*Experiment Station Bulletin, Kansas State Agricultural College.*

THE PRODUCTION AND DELIVERY OF MILK IN CITIES.

BY A. W. BITTING, D. V., M. D.

Of all the food materials in general use none are more wholesome than milk. It is palatable, easily digestible, and highly nutritious. This is partially recognized by physicians in that they prescribe it freely as the best article of diet for the weak and sick patients suffering from almost all forms of disease. While milk can not be made an exclusive food for the adult as for the child, its real value is little appreciated by the well. Its use is largely that of a condiment for seasoning tea and coffee, for berries or fruit, and as an adjunct to the cooking. Very few use it as a staple article of food as bread or meat. In cities it is generally regarded as being too expensive to be used freely. When a family of four or five have a milk bill for more than a quart a day they consider that they are somewhat extravagant. The facts in the case are, that a quart of milk contains essentially the same amount of nutrient material as three-fourths of a pound of steak. The milk has the further advantage in that it is practically wholly digestible, while the steak is rendered less digestible by the process of cooking. Upon

the basis of steak being worth from 12 to 16 cents per pound, milk would be worth from 9 to 12 cents per quart. Its ordinary retail price is of often as low as 4½ cents per quart, and seldom exceeds 6 cents. The practical tests, too, coincide with the laboratory tests to the effect that where large quantities of milk are used, the cost of living is reduced by the lessened use of more expensive foods. It will be a long time, however, before the woman who orders the kitchen supplies will see the economy of ordering two quarts of milk at 5 cents each instead of one and one-half pounds of steak at 16 cents, yet the saving would be 14 cents.

The very qualities which make milk such a desirable food also render it undesirable from another standpoint. It is particularly fine media for the growth of bacteria, and through changes which may occur within itself or by acting as a medium or carrier, set up disease. Milk as ordinarily handled is particularly exposed to bacterial infection. The germs even invade the udder of the cow so that from a practical standpoint, none can be obtained in a sterile condition. During the process of milking, hair, scales from the body and dust from the air all add their quota. If the milk be allowed to stand exposed in buckets, as is too often the case, hundreds of other bacteria are added. The milk buckets and cans as a rule are rinsed with well water that contains thousands more, so that almost any milk will contain from one thousand to several thousand germs in each cubic centimeter (small thimble full) by the time the milk is ready to start to the customer. During delivery the exposure continues if the milk is carted in cans, and such is the usual method. The dust from the streets falls in the can each time the lid is removed to dip, and the bowl or pitcher may have been the same one used the day before and particles of sour milk still cling to its sides. Fortunately most of the forms which find

their way into milk in this manner are harmless, or at their worst, only produce a souring of milk. The most common danger, however, is that some forms will be introduced that will cause diarrhoeal and other intestinal disorders. It is from such causes that so many children have trouble in cities during the summer months. It is only occasionally that milk becomes the carrier of tuberculosis or other disease from animals, or that it becomes the means of conveying typhoid fever, or scarlet fever, or other infectious diseases from a dairyman's home. There are hundreds of well authenticated cases of disease being carried in this manner, but they are a small circumstance compared with "milk poisoning" in children, which passes under some other name.

THE HERD:—Good milk should contain four per cent of butter fat, and a high grade milk should contain five per cent or more. Milk of this quality can not be obtained from poor grade cows made poorer by poor feed. The general practice in city dairies is to select cows on the basis of quantity of milk produced, to keep them only during the time they are thought to be profitable, to turn the calves over to the butcher for veal and let the cow go fattened when she is no longer useful. The dairies are kept up by purchase. The result is a nondescript lot of cattle below the milking average in quantity and quality. The farmer does not sell his best cow to the dairyman. In not a single case has the dairyman weighed the product of each animal to know whether she is profitable or not, neither has he had her tested for quality. The result is a lot of herd averages of 3.2, 3.4 and 3.6 per cent of butter fat, and with total milk production of less than the average of the better dairies that furnish five per cent. Dairies depending upon purchase to keep up their stock have more unruly cows, more defective cows, and more disease than those rearing their own stock.

It would be surprising to many to know that it not infrequently happens that cows are kept tied in their stalls for days at a time during the winter, all feed and water being carried to them. This total lack of exercise is not conducive to good health. The close stabling of the cows makes it impossible to keep them clean without special attention, and they too often suffer neglect of the currying comb and brush. It is more important from a sanitary standpoint that inspection demands cleanliness of the animal, than the tuberculin test for tuberculosis.

THE FOOD:—The teaching at the present time is that food has little effect upon the quality of milk, which is dependent upon the individuality of the animal. It is acknowledged that food has a marked influence upon quantity. It is admitted that some foods will have a prejudicial effect upon the flavor of milk so that onions, turnips and spoiled foods are regarded as detrimental, and milk from cows fed on such food is considered adulterated. There never has been any controversy as to the healthfulness of pasture, the grains and mill feed. There has been much controversy as to the propriety of using brewer's grains, and many city ordinances prohibit their use. The dairymen and feeders maintain that the dairymen feeding malt feed can not show the high average per cent of fat in the milk nor will it keep so long as where sweet food is used. Taking the feeders of malted grains in a class, the average of the first 25 tests of herd's milk is 3.5 per cent of fat. Taking the larger dairymen who do not use malt grains and the first 34 analyses give 3.95 per cent of butter fat. It is also to be observed that the milk delivered at the creamery by farmers (and only two or three use the malt grains) is nearly one-half per cent higher than the milk delivered in the city. The cattle are too nearly alike to explain this difference. The milk from dairies using the malted grains will sour more

readily than that from sweet fed cattle. Whether this is due to the increased number of fermentation forms of bacteria to which the milk is exposed, or to a less stable compound of the lactose or some other substance in the milk, has not been determined. It may also be noted here that condensed milk factories stipulate that malt products can not be used as a food. This is because of the fermentative changes that are likely to result. They do, however, admit the use of silage.

THE WATER:—The water supply should be even more scrupulously guarded than the food supply. It serves a double purpose, that of water for the cow and for the washing of the utensils. The water for both should be equally pure, and it ought to be made an axiom that *water unfit to wash the pails or cans is unfit for cattle to drink*. The milking cow requires large quantities of water, and whether it be capable of demonstration that impurities may find their way into the milk, it is safest to take the benefit of the doubt and use only pure water. I am not aware that a single dairyman uses pond water, two use part spring water, but several have wells that are very suspicious. A shallow dug well in the corner of the cow lot can not escape contamination at some time. The contamination may not last all the time, and it may be, as is usually the case, that it is of a harmless character. The fact is that any contamination from the surface, no matter what may be its character, marks the well as one that may become infected and the cause of an epidemic. It only remains for the right kind of an infection to enter. It may require one year or forty years. The special forms which are partial to the water supply are the intestinal germs that cause diarrhoea and the typhoid form. Many of the most alarming epidemics of typhoid have been traced to such source. It is not an easy matter to obtain an adequate supply of water at all places about a city,

but as far as possible it should be from a driven well. As far as tested, all driven wells of more than twenty-five feet are supplying pure water. The hard pan near the surface acts as an effective barrier to the passage of germs, and those that come from below are harmless. A driven well of twenty-five feet is a deeper well from a sanitary standpoint than any dug well.

THE COOLING OF MILK:—When first drawn, milk has a temperature of about 100 degrees. It will lose part of its heat and come to the same temperature as its surroundings in a longer or shorter period of time, depending upon the bulk and upon the surface exposed to radiation. If left in the large bulk of the 8 or 15 gallon can, the cooling process is very slow, as there is very little surface from which to lose the animal heat, and nothing to force a continuous and rapid circulation of the milk to the exposed surface. In order to more effectively reduce the temperature of milk, special apparatus has been devised which reduces the bulk to a very large surface for radiation. This is done so effectively that on even small coolers, a pound of milk will spread over 8,000 square inches, and from 10 to 30 degrees of heat removed in five seconds. Upon even moderate sized machines, the same can be accomplished in one second. The ordinary 8 gallon can of milk will pass over the cooler in about 12 or 15 minutes and lose 20 to 25 degrees of heat, while the same if set in a tub of water might require an hour to an hour and a half to accomplish the same end.

The effectiveness of a cooler depends upon the area of exposure and the degree of coldness that may be maintained within, to abstract the heat. No cooler will abstract more heat than it gives off, so that if 100 pounds of freshly drawn milk passes over it, and it gives up 25 degrees of heat, it will necessitate that 100 pounds of water pass through at 50 degrees. If it is desired to cool the milk more than 25

degrees, the quantity of water that passes through must be proportionately increased. To cool 100 pounds of milk in a cooler, will require as much water as to cool the same amount in a tub, less the difference in the heat lost from the radiation from the tub during the longer exposure. It requires just as much water to cool 100 pounds of milk on a small Star cooler that is 17 inches wide and two feet high, which has 1,660 square inches of surface, as to cool it on a Peerless cooler two feet in diameter and two feet high, which has only 520 square inches of surface. The difference will be in the time required. The ordinary shotgun can present 440 square inches for exposure, and the milk can 872 inches, but the layer of milk and water in contact on opposite sides is not changed rapidly.

DELIVERY OF MILK:—Milk is delivered in four ways: (1) by dipping from large cans, (2) by drawing from the bottom of the can, (3) by carrying it in small cans sufficient for each customer, and (4) in glass jars. Each of these methods has its advantages and disadvantages, but the method in most common use is that of dipping. Fully nine-tenths of the milk sold in the city is retailed in this manner.

The delivery of such a large proportion of the milk by dipping, is the result of habit, and like many others, it is hard to cure. The delivery by means of dipping is the most objectionable of all. In the emptying of a 15 gallon can, the lid is removed on an average of 62 times. From our observation there will be four one-half gallon customers, 46 quart customers, and 12 pint customers. The lid will be off on an average of more than 30 seconds for each dipping, taking from 30 to 40 minutes for each can. By exposure, it was found that this was sufficient time for from 100,000 to 150,000 germs to fall into the can on a dry summer day, and as many as 400,000 on a dusty day. If the lid be made so that it fits into the top of

the can, it is an easy matter for an equal number to be deposited in removing and closing the top. In the delivery of the product of one day, some of the larger dairymen have the milk exposed on the street fully two hours to receive the dust and dirt. The catching of 200,000 or 300,000 germs in 15 gallons of milk is not much, when we consider that very bad milk may contain as many as 3,000,000 germs in 15 drops. But the germs coming from the street multiply with tremendous rapidity, and in a short time are a decided factor in the souring process.

In the delivery of milk by the dipping process, the infection does not end with the delivery to the customer. The milk is nearly always received in an open vessel and carried to the house, *another period of exposure*, sometimes is not placed in the proper storage place at once, *another exposure*, and not infrequently in vessels used for the same purpose the day before and having only been rinsed, *another exposure*. The dairyman may plead that he is not responsible for what happens to the milk after it leaves his hands, but if the delivery is made so as to avoid all these, it is to his credit. The delivery from the bottom of the can has the advantage over delivery from the top in that it avoids exposure in the can.

The delivery of milk in small milk pails or glass cans secures uniformity to all customers and obviates all the exposure incident to the other methods. The small pail is only applicable to the delivery of limited quantities of milk, and therefore need not be considered as a method in city delivery. In bottle delivery the milk is exposed to only such germs as are present when it leaves the premises. No cans are opened, no dust or dirt from the street enters, it is not received in an unclean bowl, but remains in its original package until ready for use. The most serious objection that can be urged is that the bottle may be used by a family where

there is sickness one day, and be delivered to another family the next. This necessitates thorough cleanliness and sterilization, otherwise this may be made a more serious menace to health than the can. No bottle should ever be accepted from a customer as being clean. After a thorough cleaning the final treatment should be in the steam sterilizer. This will insure no germs and the maximum of efficiency in preventing souring. The objection from the standpoint of the dairyman is that it is an expensive method, owing to the extra labor involved and the breakage of bottles.

TO IMPORT EUROPEAN FARMERS.

Mrs. Eugene H. Grubb of Carbondale, Colo., passed through Chicago last week on a somewhat peculiar mission. She is going to England, France, Germany and Holland, to the latter country mainly for the purpose of aiding her husband in finding three or four hundred families who will come to Colorado, settle down in the irrigated sections, and build up the sugar beet raising industry, the belief being that the Hollanders, who are thoroughly acquainted with the use of ditches for the purpose of keeping water off the farming lands of their own country will be particularly useful in the use of ditches used for irrigating purposes. Mrs. Grubb's relations will be principally with the women and children of Holland, this being the labor largely employed in the sugar beet culture.

Mrs. Grubb is accompanied by her husband, who has extensive landed interests in Colorado, and who has always been interested in irrigation matters. He headed the Colorado delegation at the irrigation congress held in this city a year ago. He carries influential letters to the Prime Minister of Holland, which, it is believed, will further the cause he seeks to advance. The visit to the countries other than Hol-

land will be made for the purpose of buying such prize winners in the way of cattle and horses as exhibited at the last International Live Stock Show, and may be subject to purchase.

Besides being a woman of affairs, Mrs. Grubb has another distinction. She was the last person to pass out the gate of the World's Columbian Exposition the night the "show" closed. Mrs. Grubb establishes this distinction from the fact that she was escorted out by a guard nearly an hour after the grounds were supposed to be vacated. She was "discovered" in a secluded nook, where she had fallen into a sleepless reverie while dreaming on the beauties of the scenes so soon to be given over to the hand of the destroyer.

Mrs. Grubb was a Chicagoan for twenty years before moving to Colorado.

A MOCKING-BIRD FARM.

Sounds funny, doesn't it? Yet it's not so strange after all. There's a big lot of birds of this variety in Tennessee, and they have a habit of nestling and breeding in the same locality year after year. Hence the spots where they thus make their headquarters are frequently spoken of as "the place where the mocking-birds are." And so it came about that the farm where my friend, a milkman, lives is known to many as "the mocking-bird farm."

Of this farm there is about 175 acres, and a good part of it is glady hill land. It is in the glades and the bushy woods that the birds nest year after year.

Of course the owner does not pretend to be conducting a bird farm exclusively. His business is, as intimated, dairying, to which is added small farming to some extent. But nevertheless, the mocking-birds are a good source of revenue to him. He is accustomed to the birds and their habits, and knows well how to handle them in captivity. He also is very careful to

guard against their extinction in their choosen nesting grounds.

"The birds," said he, "usually have four young to the nest, and when we find a nest of the young we take but two of them, leaving two for the old birds to raise. Our land is "Posted," which prohibits hunting, and saves the birds from the hunters. This fact, coupled with the way we take the young, accounts, I think, for the way the birds stay with us year after year."

"How about the small boy?" I queried.

"Oh, we make him our partner in the business. It's his business to hunt up the nests, keep track of the young and advise us when the young birds are about to take flight. Then he brings in our share, leaving two, as stated, for the parent birds. Of course the boy gets his share of the profits."

"What are the birds worth when they first come from the nest?"

"About 50 cents each," replied my friend of the milk wagon, "but we seldom sell them that young. We usually keep them until the singers, which are the males, develop, and then sell the latter for from three to five dollars each, and give the females their liberty. The young that we take are about half and half of each sex."

The Tennessee mocking-bird is a beautiful singer, that has something of the nightingale about it, for on warm moonlight nights in the early part of the summer, while the female is sitting or nursing her young, the male then seeks a high elevation, and pours out the joy and music of its heart in beautiful song that adds much to the glory of a summer's night in "Dixie land."

In addition I desire to say that I am not interested in the milkman's mocking-birds, and cannot agree to answer any correspondence that this article may evoke in connection with them.—H. B. Geer, in *Farmer's Voice*.

KEEPING OUT DISEASED LIVE STOCK.

During the past three years, according to reports received at the department of agriculture, the dreaded foot and mouth disease has been raging among the livestock in almost every country in Europe. The officials of the department are vigilant and are closely watching every report from abroad regarding the extent of the malady or to what degree it has abated. Nothing favorable has been heard for some time and the officials have refused to admit cattle, sheep or swine from abroad, except from the British Isles; The live stock interests of this country must not only be protected, but when it is considered that we have an export trade in cattle of some thirty or forty million dollars, the work of the agricultural officials is to be commended.

Secretary Wilson recently has entered into an agreement with the Canadian minister of agriculture whereby Canada is to station a first-class veterinarian in England, who is to test all cattle intended to be shipped to this country through Canada. These tests are made with a view to ascertaining what animals are afflicted

with tuberculosis so as to protect our own interests.

According to an American official, only 10 per cent of our cattle have tuberculosis, while those of Great Britain have reached the enormous proportion of 40 per cent. The department desired to protect the United States as much as possible and had taken steps to establish a quarantine against cattle coming from Canada and England, but the Canadian government entered strenuous protest. The Canadian minister of agriculture had said to Secretary Wilson that he saw no reason why Canadian cattle could and should not be admitted to this country without the test for tuberculosis at the border. The department of agriculture would not listen to this, but made a counter-proposition by which the Canadian government would send an expert to England, who, after careful examination of all cattle intended for the United States and which were to come by way of Canada, finding such to be free of tuberculosis, would make the proper certification to that effect; then the United States would allow them to come in to this country.

PULSE OF IRRIGATION.

FARMERS TURNING TO THE IRRIGATED STATES.

Discouraged by last season's drouth, many Kansas and Nebraska farmers are turning to the irrigated regions at the foot of the Rocky Mountains. Recent dispatches told of a party of farmers from Nebraska looking into the Wheatland colony in Wyoming, and others from the drouth-stricken region have moved to not less promising places in the irrigated district.

Undoubtedly the recent dry season was a most effective plea for irrigation. While farmers who depended on rainfall were watching their crops shrivel, the agriculturists in the irrigated districts of the West were computing their gains and watching a rising market with satisfaction. It is not strange that such an object lesson had its effect on the farmers of the Middle West, and that there has been a subsequent demand for irrigated lands.

While Kansas and Nebraska will always be great agricultural states, it is equally true that there will always be an element of chance in farming there. The farmer may have two or three excellent seasons, but he never knows when fortune is going to change, and is never certain that a drouth or a pest of grasshoppers will not wipe out all his profits and set him back, penniless and discouraged.

In Colorado or any of the other states that depend upon irrigation, there is no such element of chance. The only demand is a preservation of forests, and government aid in the storing up of flood waters. With irrigation fully developed, the Rocky Mountain states will become

havens of contentment and good fortune for the farmers who are now battling against discouraging conditions in less favored localities. — *Denver Republican*, Sept. 10.

OTTER CREEK, UTAH, RESERVOIR.

The report of J. W. Fairbanks, water commissioner on the Sevier river and Clear creek, has just been made regarding the work done by the Otter creek reservoir. The water drawn from it during the year was 576,000,000 cubic feet, which was drawn out during the fifty days of the irrigating season at the rate of 11,320,000 cubic feet per day.

Put into a more common measure, this immense artificial lake held 4,320,000,000 gallons, and 84,400,000 gallons were drawn out of it every day of the fifty days in which it was open. Still, the ordinary mind will not grasp what Sevier county's great reservoir is, but every man, woman and child in the world could come and dip a large bucketful of water out of it and there would still be some left.

Of this immense amount of water 1,323,000,000 gallons were lost by sinkage and evaporation between the reservoir gate and the heads of the various canals, leaving 2,997,000,000 gallons to enter the irrigating ditches. This supplied the various canals with thirty-eight irrigating streams of two and a half cubic feet per second—all an ordinary man needs—for fifty days.

The various canal companies that were entitled to water received at the head of their ditches every second during the fifty

days that the reservoir was open, cubic feet, as follows:

Kingston (Plute county).....	2,5437
Sevier Valley.....	14,4022
South Bend.....	14,504
Joseph.....	4,958
Wells.....	2,516
Elsinore.....	4,255
Brooklyn.....	5,0597
Richfield.....	21,6265
Annabella.....	2,1275
Vermillion.....	6,0125
Rocky Ford.....	3,5822

The great benefit of this water has been that when the natural flow of the Sevier river was down to forty-one cubic feet per second, the reservoir was supplying ninety-five cubic feet per second. Without this the various crops would have been about one-third what they are. The farmers who used that water are raising 250,000 bushels of grain, worth at least \$100,000 this season. They are raising hay that is worth \$75,000, lucerne seed worth \$8,000, and other crops worth \$40,000, where they would not have raised enough wheat for the bread of the people in the county without the help of the reservoir.

BIG SCHEME OF IRRIGATION.

Canadian Pacific Railway authorities have at present under consideration an im-

mense scheme of irrigation for the Northwest, by which it is proposed to make good farming and grazing country out of millions of acres, which now lie dry and arid, between Calgary and Medicine Hat immediately on the North railway line.

James Anderson, the leading irrigation engineer of the world, who has done such gigantic work in California, Egypt and other places, has recently been over this area and reports that there is nothing to prevent this great work being successfully carried out. His report is now before the executive in Montreal and it is understood that as an experiment 300,000 acres of the 3,000,000 barren acres will be put under irrigation.

The scheme in a nutshell is to build a dam in the Bow River, a mile east of Calgary, cutting intersecting canals and leaving the force of gravitation to do the rest. But before an experiment is made the ownership of the land to be benefitted will have to be settled. At present every alternate section is the company's property, the remainder being in the hands of the federal government. It is probable, therefore, that at the next session of Parliament, a new grant will be obtained, giving the company the ownership of the lands through which the irrigation canals will run and which at present are barren.

ODDS AND ENDS.

DENVER WOMEN HAVE NEW FAD.

"I'll give you my hat for yours."

"All right; mine's the best, but I don't care. It's different, anyway."

"There you are, Oh, my, it's more becoming to you than to me."

"How does yours look on me?"

"Oh, thank you. Want to trade anything else?"

This conversation occurred at an afternoon tea on Capitol hill recently. The principals were two young women of the same type of beauty. It may sound strange to an outsider, but such language is often heard in similar quarters in "days like these."

If well-dressed women choose to run the risk of wearing any of their things—hats, shirt waists, trimmings, frills or furbelows more times than the inexorable law of fashion allows, it is their own fault. All they have to do is to get something natty and chic in the first place, and after they have worn it once, twice or as many times as fashion's code permits, why, then trade it off. The party of the second part in the deal will be just as anxious to trade as you are, although she may not confess it.

This is the newest of the fads to strike Denver fresh from New York, with the stamp of approval of the smart set upon it. It has taken hold of Denver's well-dressed society girls with a relish. At the afternoon teas, at card parties, at Overland and even on the street hard bargains are driven daily. People are wondering how it is that Miss Ahead O'Date can afford so many new and handsome things, and "Oh, my, but Mrs. Hear-the-Latest has an extensive wardrobe. Her husband

must be making a killing down in that real estate office of his." All the while the theoretical head of the family is wearing a hat of the vintage of 1899 and his trousers bagging lazily at the knees, is shaking like a quaking aspen every time he looks at the calendar, for it is one day nearer the dreaded first.

But his wife isn't worrying. She has on a new hat every week, and her shirt waists are as the sands of the sea, with scarfs of all colors of the rainbow. It is enough to make the neighbors talk about her—that is, the neighbors who are not "next." But they are all getting next "powerful fast," and soon Capitol hill will be a busy millinery mart.

There is talk of auctions. Then there will be an intermingling of sets and cliques on a common ground, for all well-dressed women will have entree. Such bidding and by-bidding and "bearing" and "bulling" the market on 'change has never yet been recorded or even imagined.

But all this is sub rosa. One of the conditions is that the men must be kept in the dark. So lovesick swains and scoffing bachelors and pushing, pressing widowers and all, take notice. If you admire something that you see on your well-gowned friend, tell her so and let it stop there. Don't ask her where she got it. Even if you are a married man and thus worthily interested in the source of the supply, you will have to forbear all the same.

If, as Carlyle tells us in "Sartor Resartus," society is founded on clothes, this custom of trading off things which are undesirable, simply because you have worn

them, for things that are desirable, simply because you have never worn them, is bound to become the keystone of the structure.

All women who wish to be well dressed must get in line or they will have to go away back and sit down.

IS OUR P. O. DEPARTMENT AIDING GERMANY AT THE EXPENSE OF OUR EXPORTERS.

When importunity and pressure of facts became so strong that those in authority could no longer refuse to accede to the popular demand for the introduction of a foreign Parcel-Post service with some first class European government, it was decided that a treaty should be made with Germany, the first and only European government to secure such a treaty from the United States.

At the time this treaty was consummated it was claimed by some selfish people whose financial interests were not in tune with the innovation, that it would not be successful, the effect would be to flood this country with German manufactures, and that the balance of trade, by this method of transportation, would be in favor of Germany.

For some time past, champions of the extension of Parcels Post have given the subject careful study. They have watched the results of the German Parcels Post treaty with a keen eye, only to be confronted with an apparent confirmation of this theory. Yet how could this be possible in the face of the government report for the past year, which showed that the balance of trade was largely in favor of the United States? When it came to the importations by Parcels Post from Germany the reverse seemed to be the case, at least so far as the casual observer could discern from the reported statistics.

Why it was possible that such a showing should have been made can perhaps best be explained by the private transportation

companies, who suffer such a financial loss by reason of the Parcels-Post treaty. It is to be presumed, however, that they will not do so, for it is a fact that it is for their mutual interest that the present erroneous impression prevail, in order to secure an adverse official report against the further extension of Parcels Post.

How many individuals in the United States understand the present Postal Union, so to speak, between the leading European commercial countries in so far as their parcel post arrangements are concerned? It is safe to say that not one out of every fifty thousand of the business men of the country has ever given the subject a thought, beyond a passing glance, at the figures that may have been presented to them by interested parties through the press, and which tend to show that the United States is the loser by the present arrangement.

At the present time the Parcels Post importations into the United States credited as coming from Germany are, as a matter of fact, sent into this country from every manufacturing center in Europe, all being first sent to Germany, from England, France, Austria, Switzerland, and Belgium. They are put into the German mail, thus entering the United States as coming from Germany, when the truth of the matter is that they are the result of the combined export trade by means of Parcels Post, of all Europe, to this country.

Are our postal officials absolutely blind to the situation? Are they wholly unacquainted with the true condition of affairs? It is far easier to believe that they are only too glad to have the public retain this erroneous impression in order that they may, the more easily, defeat the further extension of Parcels Post when this question is again prominently before the American public. When the people do realize that our commerce with foreign nations will greatly increase as a result of

the widening out of this system, all efforts toward the extermination of Parcels Post in the United States, for the benefit of existing private transportation companies, will be without avail.

There is no doubt that the American public will realize the situation as soon as they are correctly informed. When the public once realizes that it is not fair that American trade should be hampered and held back it will demand that our postal authorities give to our commerce the best postal trade facilities that are enjoyed by any nation.

It is not fair to ourselves that any one country, especially when that country is our greatest competitor, shall enjoy an exclusive Parcels Post treaty with the United States, such as is enjoyed by the German Empire. As this partiality becomes better known, all the countries of Europe will use the German Post-Office to a still greater extent for forwarding their packages to the United States. In other words, we have placed Germany in a position where she can control the parcel trade of Europe with the United States, at the same time so arranging matters that our exporters cannot compete for the natural return trade, with the countries outside of Germany, as no Parcels Post treaties have been made with them, and without which it will be practically impossible to carry on a parcel trade. This situation is certainly injurious to our foreign trade. The only way for us to profit by the great advantages afforded by the facilities offered to our foreign trade by the Parcels Post, is to give us the same facilities for reaching the markets of the countries of Europe that they now have of reaching our markets through Germany.

WHEN THE GRAVY'S ON THE BUCKWHEATS.

When the gravy's on the buckwheat and
the sausages are hot,
When the steam is floating upward from
the shining coffee pot.

When the cook stirs up the batter that
was set the night before,
And when little Bob and Clara smack
their lips and yell for more,
Oh, it's then a man is always feeling pret-
ty near his best—
If there isn't any trouble with the works
beneath his vest—
And it's then he ought to humbly thank
the Lord for what he's got—
When the gravy's on the buckwheat and
the sausages are hot.

There's a fragrance that comes floating
from the pancakes on the plate
That should nerve a man to action—make
him strong for any fate—
There is joy, there's inspiration in the
smears on Bessie's chin,
And it's good to see dear Willie as he
scoops the sausage in.
And what sweeter music is there than the
rasping, slapping sound
That the busy cook produces as she stirs
the stuff around?
Oh, each precious, luscious mouthful
quickly finds the proper spot
When the gravy's on the buckwheats and
the sausages are hot.

—Chicago Record Herald.

TAMPERING WITH TRIFLES

A BOER.

The Boer is still a hopping
On the kopje,
And the British, never stopping
In their hopje,
Say that "We regret to say
Everything just comes our way
Sometimes us, but mostly they,
Are on topje.
"We have chased them far and wide
On the veldt,
Till our chargers like to died,
And our beldt
Hung all loose and limp and slack,
Then the Dutchmen chased us back,
And their sudden, swift attack
Made us peldt.

"When we banish them, they say:
'Aber nit!"

It's their own outlandish way—
Just to sit

With a rifle in their fist,
On the hills the sun has kissed.
When they've shot, they've never missed
Not a bit.

"So we're worried, and we're harassed
Most to death;
And we're flurried and embarrassed,
And our breath
Cometh to us in short pants,
It's no fun to have to prance,
And forever look askance
Dodging death."

—Ex.

UNCLE EPH'S ADVICE.

W'en yo' mental atmospherical condition
ain't de bes'—

W'en hit's sorter dull an' gloomy in de
sky;

W'en dey's headaches on yo' features an'
yo karn't get any res',

An' yo got dat achin' feelin' in yo eye,
Drop yo' troubles an' yo cares.

An' jes' wander anywheres
An' imagine yo's de king ob all creation.

Kase dey ain't no chance to smile
W'en yo' worry all de while;

An' yo might as well indulge in jubila-
tion.

W'en yo' study up yo' troubles an' exag-
gerate yo' pain,

Jes' reflect dat dar's no pleasure in a
groan.

Fo' no mattah how you'se achin' yo' c'n
make hit right again

An' widout a single supplement ob moan;
Take yo' tackle an' yo pole

An' explore some sunny hole
Where de speckled trout is leapin' up an'
swishing'—

Set down on de bank an' dream
Ob de comfort in de stream

An' shake off yo' trials an' worries while
yo' fishin'.

UNCLE HIRAM'S OBSERVATIONS.

"I've seen," said Uncle Hiram, "lots o'
noble men an' brave

Through jes' one bit o' folly brought t'
ruin an' the grave—

Men rich endowed with honor, men re-
spected an' revered,

Whose qualities were envied an' whose
virtures were endeared.

An' yet they made a failure, much t'
ev'ry one's surprise.

But, my boy, I've watched the matter,
an' in this the secret lies:

They were men who in position of advan-
tage had been placed,

With a hundred dollar income and a
thousand dollar taste.

An', my boy, I've seen them sinkin' in the
treach'rous swamp of Debt;

I've watched the ooze creep higher, an'
the waters o' Regret,

An' I've sometimes felt like callin', as I
stood upon the shore,

"The way out, fellers, lies in jes' re-
trenchment, nothin' more."

Sometimes I've even said it, to a good
friend, jes' that way,

An' while he heard, he couldn't compre-
hend a word I'd say.

He'd keep a sinking deeper in the swamp
o' daily waste,

With his hundred dollar income and his
thousand dollar taste.

So I've learned a valued lesson that to
you I fain would teach.

Don't ever feed on apples that you find
beyond your reach;

An' if you've money jes' enough to pay
for bread it's plain.

You're doin' wrong by buildin' up a likin'
for champagne!

You'll find your Uncle Hiram's right, as
on through life you go,

That some men live on what they make
an' some on what they owe.

But the first class, though they're plod-
ders, pass the ones who've forged in
haste

With a hundred dollar income and a
thousand dollar taste.

—Roy Farrell Greene, in *American Agri-
culturist*.

“I WISH’T I’D TOLD.”

“Now, Tommy, dear Tommy, don’t tell,”
said she.

“Come, say Tommy-boy, that you won’t.”

“And there’s something down town mighty
swell,” said he,

“And it’s yours, little man, if you don’t.”
(But I wish’t I’d told!)

For she, you must know, is my sister Kate,
And the prettiest ever you see;

And she hadn’t kissed folks at our garden
gate,

Nor at anywhere else,—’cept to me.

(And I wish’t I’d told!)

Then that Elihu came. Pretty soon he
began

To come every night, an’ he’d stay,
An’ keep sayin’ to me, “Go to bed, little
man,

And you’ll see what I’ll bring you some
day.”

(Humph! I wish’t I’d told!)

Days they’d snoop off an’ leave me with
nothing to do,

But I tagged them one time to the gate,
And that’s when it happened,—she said,
“Elihu!”

Au’ he said, “My own little Katel!”

(I saw,—an’ I wish’t I’d told!)

O then it was, “Tommy, don’t tell,” said
she,

“Now promise me true that you won’t.”

“And there’s something down town mighty
swell,” said he,

“And it’s yours, dear old chap, if you
don’t.”

(But I wish’t I’d told!)

Then he gave me a knife, and a kite, and
a play,

And a goat, and a dollar in gold.

Now Pa’s give him my Katie, to take her
away,

And he wouldn’t, perhaps, if I’d told!

(O dear! How I wish’t I’d told!)

—Charlotte Whitcomb in *Orange Judd’s
Farmer*.

WITH OUR EXCHANGES.

SCRIBNER’S MAGAZINE.

Scrivner’s for November contains an ar-
ticle by Nelson Lloyd, entitled “Among
the Dunkers.” A continued article, by
F. Hopkinson Smith, begins in this num-
ber. A second paper, by Theodore Roose-
velt, entitled “With the Conger Hameds.”
“Without Law or License,” by Sewell
Ford. Continuation of “The Pines of
Lory,” by J. A. Mitchell. The third
paper, by Francis V. Greene, of “The
United States Army.” “Marquis Ito,”
by Frederick Palmer, and “Russia of To-
day,” by Henry Norman, M. D.

LADIES’ HOME JOURNAL.

The Thanksgiving number of The La-
dies’ Home Journal is replete with good
fiction and interesting and novel features.
It opens appropriately with an article
which tells “Where the President’s Tur-
key Comes From.” Then there are de-
lightful stories by Hezekiah Butterworth
and Laura Spencer Porter, and a new love
story called “Christine,” by Frederick M.
Smith. Cleveland Moffett has an inter-
esting story about Ira D. Sauky, the
great evangelist, and Edith King Swain
recounts the famous ascents she has made
in various parts of the world. Will Brad-
ley’s original designs for a house begin
with the breakfast room, and Wilson
Eyre, Jr., presents plans for a country-
house and a garden. Mr. Bok gives much
good advice to young married couples in
his editorial. Another most timely fea-
ture is “Why Should a Young Man Sup-
port the Church?” by the Rev. Francis E.
Clark. Many home-made Christmas gifts
are shown, and the first of “The Journal’s
Amusing Puzzles” appear. The regular

departments are exceptionally good and the illustrations superb.

M'CLURE'S MAGAZINE.

Nothing could be more timely than three of the articles which go to make up McClure's Magazine for November. William Allen White, in his inimitable style, analyzes Roosevelt in a way which shows this unclassified man in a new light—the *true* light. Ray Stannard Baker explains "What the United States Steel Corporation Is, and How It Works." The "true story of a recently discovered 'Treasure Island'" is told by Sturgis B. Rand in "The Romance of Christmas Island." A very striking Western tale of adventure is "Why the Hot Sulphur Mail Was Late," by Chauncey Thomas, with splendid pictures by Charles S. Chapman. "The Tipster," illustrated by W. R. Leigh, is the last of Edwin Lefevre's Wall-Street Stories—some think the best. M. Quad has written in his merriest vein of an incident in the life of one "Colonel Josyln, U. S. A.," for which story A. I. Keeler has supplied the illustrations. Kate M. Cleary, whose story, "The Stepmother," attracted so much attention, contributes a pathetic Thanksgiving tale, "The Mission of Kitty Malone." Henry Hutt's beautiful pictures catch the true spirit of N. V. McClelland's dainty sketch, "Nancy and I and the Girl." There are poems and other features, all of which make the November McClure's a notable number.

THE FORUM.

The November Forum opens with a timely character sketch of "Theodore Roosevelt," from the pen of A. Maurice Low. It is followed by a paper, "Preserving a State's Honor," in which Willard Saulsbury explains how it has come to pass that Delaware is at present without representation in the United States Senate. "Sugar and the New Colonies" is the title of an article by Charles A.

Crampton on the economic significance of our recent expansion. Hon. Martin Dodge, writing on "The Government and Good Roads," reports what has been done, by the Washington Office of which he is Director, for the improvement of the highways in various parts of the country. Karl Blind, who himself took part in the organization of the Sicilian insurrection of 1860, reveals a page of its inner history in an article on "Crispi and Italian Unity." Price Collier contrasts "The Ethics of Ancient and Modern Athletics." President C. F. Thwing discusses the respective merits of "The Small College and the Large." Hon. Charles Denby, a former minister to Peking, contributes a description of the peculiar methods of "Agriculture in China." "The Political and Commercial Future of Asia" is forecasted by W. C. Jameson Reid. Walter S. Allen argues against the imposition of "Taxes on Street Railway Franchises." "Preferences and the Bankruptcy Law" is the topic of a paper by Harold Remington. In the concluding article S. P. Verner writes optimistically, not to say enthusiastically, of "The Development of Africa."

THE NOVEMBER DELINEATOR.

A seasonable atmosphere rises from the various useful and valuable features of the November DELINEATOR. The styles shown are those for early Winter; the dress-making article tells about the making of coats; the fancy needlework article bears upon Thanksgiving and Christmas gifts; the crocheting articles are those of a Winter character; the gardening article deals with the pruning and protection of rose trees throughout winter. Every woman who wishes to get splendid value for her expenditure should buy THE DELINEATOR for itself. It in turn will help her to economize in household matters at every point.

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FROM THE AUTHOR'S PREFACE

In January, 1897, appeared the author's first book on this subject, entitled "Sugar, a New and Profitable Industry in the United States, for Agriculture, Capital and Labor, to supply the Home Market with \$100,000,000 of Its Product." That book was received with favor, not only among farmers and capitalists and by the press, but especially in the Congress of the United States and by American Statesmen at home and abroad.

National legislation favorable to the development of our domestic sugar-producing industry was enacted by Congress during the summer of 1897. This was followed by a phenomenal interest in America's domestic sugar industry, which, however, gave way to uncertainty with the advent of the Spanish war and the problems raised thereby. Provided those problems are now solved with due regard for American interests, it only needs proper direction and right management to secure for the United States large and permanent good from a vast development of its domestic sugar-producing industry.

Many of those best capable of judging have been kind enough to partly attribute the promising outlook for this new industry, at the outbreak of the Spanish war, to the book referred to, to the American Sugar Growers' Society organized by the author, and to the agricultural journals under his editorial direction. This would seem to impose upon the author a moral obligation to do whatever lies in his power to help the industry through its new politico-economic crisis.

It also seems incumbent upon the author to present the important scientific, practical and financial results of the seasons of 1897 and 1898, in addition to the fruits of all prior experience. Thus, unfortunate and costly mistakes in this new industry may be avoided, and uniform success attained by both farmer and capitalist.

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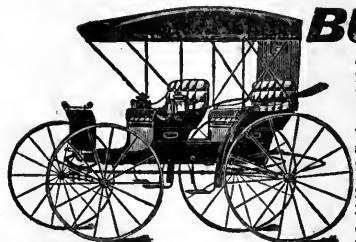
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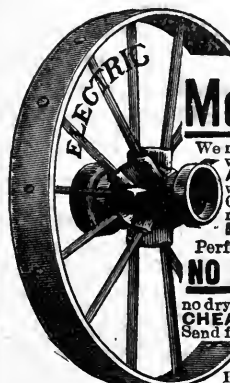
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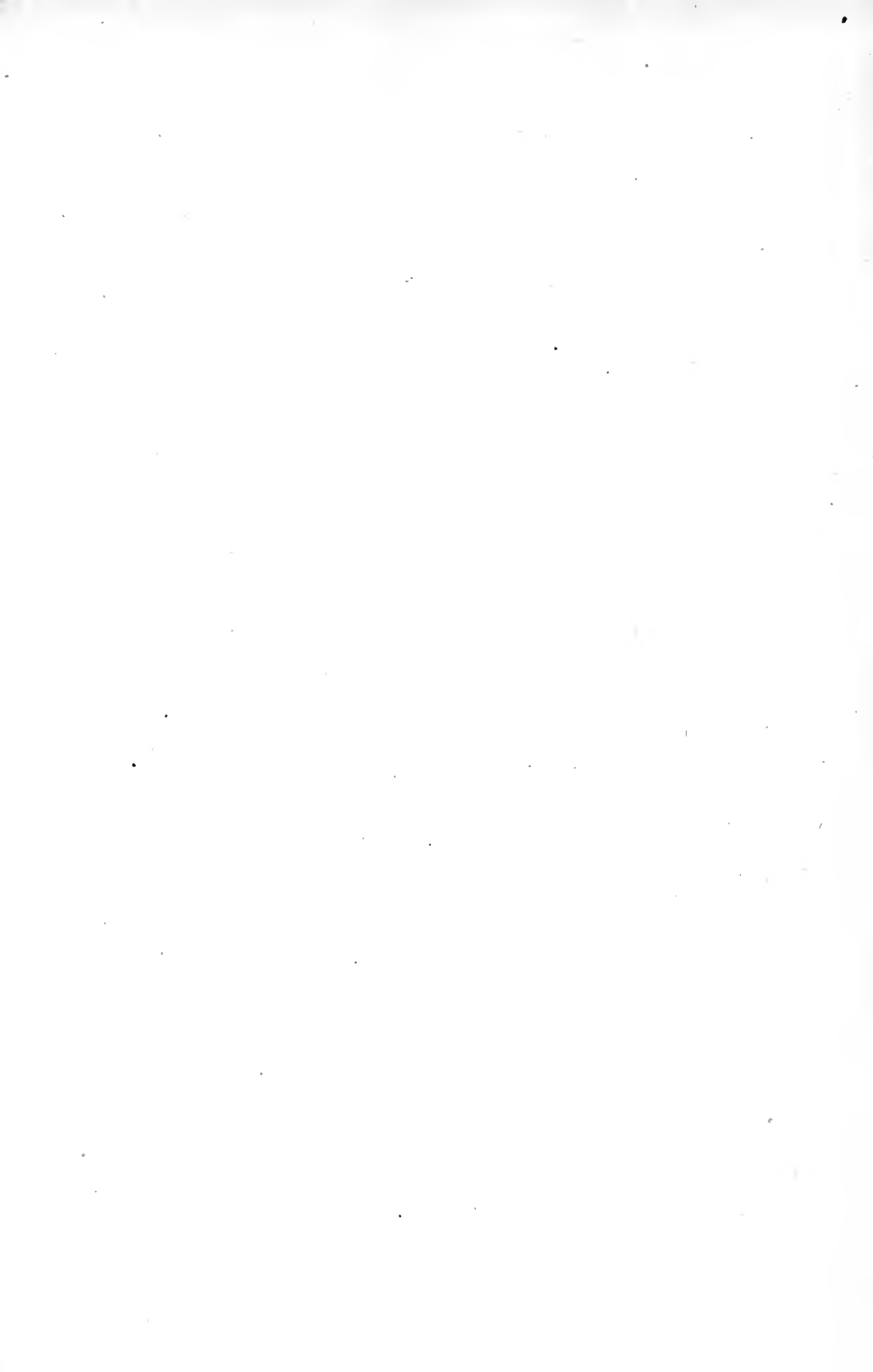
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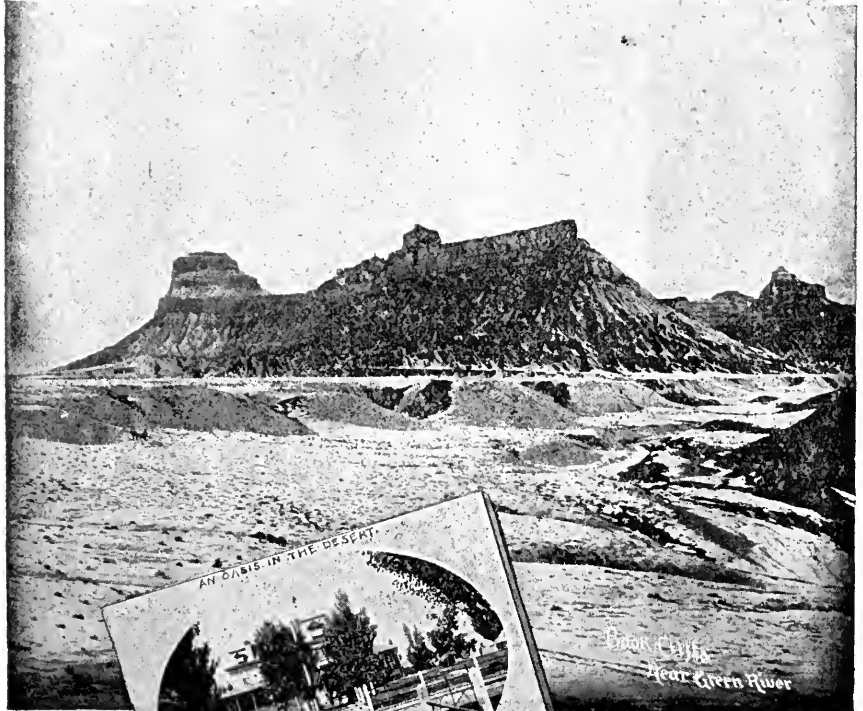
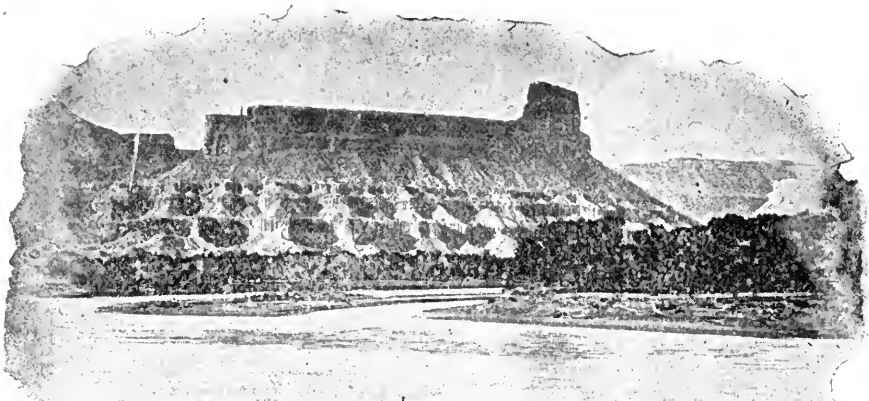
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Investigations with swine.
Value of various feeding-stuffs for pigs.
Danish pig-feeding experiments.
Feeding and management of swine—effect of feed on the carcass of a pig

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Look at this
Near Green River

THE IRRIGATION AGE.

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CHICAGO, DECEMBER, 1901.

NO. 3

An extract from the president's message on irrigation will be found on another page of this number. The *Chicago Tribune* says editorially on this subject:

"The question of the irrigation of the arid lands owned by the general government was not considered at all twenty-five years ago. It is beginning to be considered seriously now. The space which the president, who is familiar with conditions in the West, gives to it in his message shows that he looks on it as one of no small importance.

"When the agitation for the irrigation of these arid lands began there was a feeling of opposition to the measure except in the regions which would be specially benefited. The impression existed that the states and territories in which these arid lands lie were anxious that the government should expend millions in making these lands cultivable so that the population and wealth of the states and territories in question might be increased. The owners of fertile farms in the East and Middle West did not look with favor on what seemed to them a scheme to add at their expense and that of other taxpayers tens of millions of acres to the area of cultivable land in the West. They saw in this a reduction of the value of their own farms and farm products.

"This hostile feeling is gradually disappearing. It is coming to be understood that the work of making these arid lands cultivable to the extent that the water

supply will permit—there is not water enough to irrigate all—will be an exceedingly slow one. No great body of farm lands will be thrown suddenly on the market. The demand for farm lands is such and the value of those now under cultivation has so increased as to make it expedient from an economic point of view to enter on the work of reclamation of these arid Western lands. Private enterprise has made a beginning, but it cannot accomplish much. The states in which these lands lie cannot alone deal with the question satisfactorily. The general government will have to co-operate.

"While the president advises action he discourages hasty action. The job is too large to be gone at pell-mell or taken up piecemeal. He says 'we must not only understand the existing situation but avail ourselves of the best experience of the best experience of the time in the solution of its problems. A careful study should be made both by the nation and states of the irrigation laws and condition.' When the necessary knowledge has been obtained the general government can take up this great work of converting millions of acres of arid lands into fertile fields."

Irrigation is being adopted by the successful gardeners and small fruit growers through the world. The fact that water can be applied to fruit and vegetables at any times required is argument enough to convince any one of the value of irrigation. Thorough tests in the rain belt re-

Reclaiming the Arid Land.

Irrigating the Garden.

gion have demonstrated that irrigation makes better flavored products and more than double the yield. In this sense the application of moisture by hand has become a science. This science dispels droughts, and makes crops annual successes. At best the rain dependence is only an uncertain substitute for independent soil moisture by irrigation. Gardens, small frurt orchards and vineyards are especially benefitted by irrigation, even though there be an abundance of rain for general field crops. The scienrific application of water just at the exact time needed solves the long mooted problem of woether or not the garden pays for any except the professional market garden.

National Irrigation. George H. Maxwell says in his editorial comments in the *National Irrigation*: "There ts only one way by which the national government can be assured that its appropriations will fulfill their purpose of promoting homebuilding and that is to reserve every acre for which water is made available by national reservoirs or carals, for actual settlers who will go on the land and reclaim it and make it their permanent home.

But this is what the advocates of "national aid io irrigation" who are not in harmony with the National Irrigation As-

sociation oppose and are attempting to prevent.

The Mandell bill in the last session of congress, and the State Enginneers' Bill prepared by Engineer Bond, of Wyoming, make no reservaiion of the lands for actual settlers, and should either bill become a law, the moment it was known that a reservoir or a canal was to be built to provide water for any government land, the last acre of land that could be irrigated from it would be gobbled up by speculators under scrip or desert land locations. This would be done long before any actual settlers could by and possibility locate their homes upon it. The result would be "national aid to irrigation" to be enjoyed by a few spectators who would thus defeat the whole purpose of congress and divert a great national movement to their selfish personal gain. If they could do this they would destroy the national irrigation movement.

If one single appropriation were made for national irrigation works, and the lands irrigable therefrom were all absorbed by speculators instead of going to homebuilders, the national irrigation policy would be set back ten years. The confidence of the poeple of the East in the whole movement would be destroyed.

IRRIGATION IN INDIA AND AMERICA.

BY. E. H. PARGITER, OF THE IRRIGATION BRANCH, PUBLIC WORKS DEPARTMENT, PANJAB. INDIA.

(Continued from last month.)

The physical configuration of a country to be traversed by a canal naturally influences the design of the canal, and usually determines the limits of its size. In the great and almost level plains of North India, there is practically no limit to the width possible, as far as the nature of the ground is concerned. There the width and discharge are determined, in most cases, by the quantity of water available in the river supplying a canal; if the whole of the low cold weather discharge of the river can be utilized for irrigation, then the canal is designed to take this discharge, and is given a suitable maximum bed width and minimum depth of supply for it; bearing in mind also that this width, with a greater depth of supply, shall allow of double or even perhaps treble that discharge being taken during the hot weather when the supply in the river is many times greater. The depth of supply possible to be taken in safety in a canal constructed to allow of free flow or gravity irrigation, with its minimum cold weather discharge, thus limits its maximum discharge during the hot weather, and of course it would not be practicable to take, as a rule, more than double the depth of the low supply, consistently with the safety of the banks, and reasonable economy in construction and maintenance.

In some cases, as in the Jhelam canal now under construction, the small size of the doab to be irrigated, limits the area of land for which water is to be provided; and all the available cold weather discharge of the river is not needed. In such cases, the canal is designed to take only as much as it needs; and there is no necessity to allow for largely different hot and cold weather discharges; though, as a matter of fact, with approximately equal areas to be irrigated in the two seasons, a considerably larger supply will be required in the hot weather, owing to the greater loss by evaporation, and the greater quantity of water required by the crops then grown.

The almost level plains of North India allow of curves of great radius being given to a canal; so that a canal with a bed width of 250 feet or more, a depth of supply of 10 or 12 feet, and a discharge of

8,000 second feet or more, can be safely piloted through the country for many miles.

But, in most cases in the arid states of America, the canals do not traverse great level plains, but wind about the sloping sides of low hills, or through rolling prairies, or are dug out of the sides of steep bluffs and benches. Here they must take whatever course a hill side may allow of, since they must follow its contour. In these circumstances, a large canal is obviously unsafe. The sidelong nature of the ground in which it has to be excavated, limits its width very strictly; and the frequent sharp curves and even bends, it takes as it winds around a hillside, limit its velocity and depth. As however in such cases, there is plenty of fall or grade in the country, irrigation requirements are easily met by having a series of small canals at different levels. A marked feature in such country is that advantage can be taken to turn into reservoirs, valleys and depressions traversed by placing embankments across their natural outlets, and filling them up at times when the water is not in demand for irrigation.

An important feature that largely affects the efficient working of a canal, depends on this difference of construction imposed on us by the physical nature of the country traversed, whether we can have one large canal with a single head at a favorable point in the river, or whether we must have a series of canals with separate heads at different points in the river. That feature is the weir across the river below a canal head. In the former case we can afford to spend a large sum on a perfect weir that will hold up the whole, or as much of the river supply as we need, in times of low water, and yet be perfectly safe when passing floods and torrents in times of high supply. By holding up the supply, we can feed the canal with topwater, tolerably free from the heavier sandy sediment; and we form a large settling basin in the river above the weir. This can be easily scoured out from time to time by opening the undersluices of the weir, when the river bed is allowed to resume its original natural slope or grade. It is always advisable to close the canal head at such times to prevent the silt laden water entering and silting up the head channel. If the canal becomes much silted, and at the time the demand for water for irrigation is great, so that it is not advisable to lose water by running it through the escapes to scour out and wash away the silt, it is often possible to force a supply for a time over the silted bed, by raising the supply level at the canal head by means of the weir.

But in the latter case of a series of small canals, it would not pay to provide each head with such a costly weir; and in consequence such canals must work less efficiently. On the American rivers where so often the water is all fully appropriated among different canals; and the supply is insufficient to meet the demands, the great point is to

put into a canal as much water as can be got from the river. A simple weir is required to keep the water in the river at a certain minimum level above the bed of the canal, or at least to keep the river bed from falling below the level of the canal bed; but bottom water as well as top has to be taken in, and heavy silt deposits naturally result. The weir is not constructed to hold up the water much above its natural level, for the cost of doing so would be prohibitive in the case of a small canal; if a considerable drop or fall were made in the river below the weir, the foundations of the weir would have to be very deep and massive and the flooring of great length, to withstand the pressure and scouring action of the water passing over and beneath in the soil.

In a river, where several such canal heads were fairly close together, it might promote efficiency and ultimate economy to amalgamate the heads into one, and let the canals branch off from a common main channel. Then it might be practicable to build an efficient weir, as the cost, distributed over all the canals, would not be a financial burden on any one. But every such case would have to be decided on its own merits and possibilities, according to the physical configuration of the ground.

The practice of irrigation in America, is now showing the great advantage derived from co-operation among the users of a Lateral; and the efficiency and economy of having one main lateral for each farm. It can readily be understood that the same principle will apply to canals also; and that two or more canal heads may with advantage be combined into one, if there are no special circumstances to hinder such an arrangement.

The methods of construction and of the working canals in America, they resemble more nearly those of the inundation canals, than those of the great perennial canals of North India. The latter are really monuments of engineering skill, enterprise and management; so much so, that professional pride in and love for them, on the part of their designers and constructors, has usually tended to obscure in their minds, the special merits and uses of the simpler inundation canals, which requires for their design and construction, usually no great engineering skill. As has all ready been explained the chief advantage of an inundation canal, is that its proper use does not tend to swamp land by raising the subsoil spring level so much as perennial canal irrigation would do. In the bottom lands bordering a river, where the water is not far down below the ground surface and can economically be raised from wells for irrigation during the Indian cold weather months. Inundation canals are best suited to the land. But in the higher lying lands more remote from the rivers, perennial canals alone will satisfy all requirements, and are a neces-

sity; since the subsoil water is too far down to allow of its being raised cheaply enough for irrigation use. Each class of canal then has its place, and both can co-exist side by side; for in the case of Inundation canals the extra cost of working wells during the cold weather is set off by the smaller water rates to be paid for canal water during the hot weather: for an Inundation canal, having no expensive headworks, is cheaply constructed, and does not need in order to make it a financial success, to charge as high water rates as a perennial canal does.

It is amusing to note how the same names even have been applied to the same class of works in America and India. In India, where engineers have been brought to look upon a fine perennial canal as alone worthy of the name of "canal" the roughly made untidy looking Inundation canals are spoken of scornfully as "ditches;" and in America all the early, small, roughly made canals have very naturally been termed ditches rather than canals, their constructors and owners not considering the latter more ambitious title at all applicable to their humble creations.

It is admitted that irrigation in America is really only in its commencement—just as now in India, after having designed many large perennial canals from most of the great rivers, engineers are turning their attention to improving the humbler Inundations canals, by combining their numerous separate heads into fewer, or even into one, in order that an efficient weir may be constructed for it:—so in America, as matters call for improvement, the present wasteful systems will be reformed with a view to greater economy in the use of water, and the consequent increase in the area of land that can be irrigated and inhabited. The winter season in America does not call for very much irrigation, and tends to make canals work more as intermittent ones; so that there is every year plenty of time and full opportunity to execute repairs and make alterations or improvements. There is thus not the necessity for solid and permanent construction of works, like those on the large Indian canals; but, no doubt, the ever recurring large maintenance charges of a roughly and unskillfully constructed canal will be found more wasteful of revenue, than interest charges on a larger capital spent on efficient and permanent first construction. In the future, therefore, with engineers better trained, and more experienced, new canals will be constructed more carefully with a view to wear well, and the old ones will be gradually improved by having their cheap rough temporary works replaced by more permanent ones. The hurry to get things started, so characteristic of pioneer work in America will in time give place to the wish to have things done more with the idea of permanent efficiency.

To be continued.

IRRIGATION FOR THE WEST.

EXTRACT FROM PRESIDENT ROOSEVELT'S MESSAGE.

The forests are natural reservoirs. By restraining the streams in flood and replenishing them in drought they make possible the use of waters otherwise wasted. They prevent the soil from washing, and so protect the storage reservoirs from filling up with silt. Forest conservation is therefore an essential condition of water conservation.

The forests alone cannot, however, fully regulate and conserve the waters of the arid region. Great storage works are necessary to equalize the flow of streams and to save the flood waters. Their construction has been conclusively shown to be an undertaking too vast for private effort. Nor can it be best accomplished by the individual states acting alone. Far-reaching interstate problems are involved; and the resources of single states would often be inadequate. It is properly a national function, at least in some of its features. It is as right for the national government to make the streams and river of the arid region useful by engineering works for water storage as to make useful the rivers and harbors of the humid region by engineering works of another kind. The storing of the floods in reservoirs at the headwaters of our rivers is but an enlargement of our present policy of river control under which levees are built on the lower reaches of the same streams.

The government should construct and maintain these reservoirs as it does other public works. Where their purpose is to regulate the flow of streams, the water should be turned freely into the channels in the dry season to take the same course under the same laws as the natural flow.

The reclamation of the unsettled arid public lands presents a different problem. Here it is not enough to regulate the flow of streams. The object of the government is to dispose of the land to settlers who will build homes upon it. To accomplish this object water must be brought within their reach.

The pioneer settlers on the arid public domain chose their homes along streams from which they could themselves divert the water to reclaim their holdings. Such opportunities are practically gone. There remain, however, vast areas of public land which can be made available for homestead settlement, but only by reservoirs and main line canals impracticable for private enterprise. The irrigation works should be built by the national government. The lands re-

claimed by them should be reserved by the government for actual settlers, and the cost of construction should so far as possible be repaid by the land reclaimed.

The distribution of the waters, the division of the streams among irrigators, should be left to the settlers themselves in conformity with state laws and without interfering with those laws or with vested rights. This policy of the national government should be to aid irrigation in the several states and territories in such manner as will enable the people in the local communities to help themselves, and as will stimulate needed reforms in the state laws and regulations governing irrigation.

The reclamation and settlement of the arid lands will enrich every portion of our country, just as the settlement of the Ohio and Mississippi Valleys brought prosperity to the Atlantic states. The increased demand for manufactured articles will stimulate industrial production, while wider home markets and the trade of Asia will consume larger food supplies and effectually prevent Western competition with Eastern agriculture. Indeed, the products of irrigation will be consumed chiefly in upbuilding local centers of mining and other industries, which would otherwise not come into existence at all. Our people as a whole will profit, for successful homemaking is but another name for the upbuilding of the nation.

The necessary foundation has already been laid for the inauguration of the policy just described. It would be unwise to begin by doing too much, for a great deal will doubtless be learned, both as to what can and what cannot be safely attempted, by the early efforts, which must of necessity be partly experimental in character. At the beginning the government should make clear beyond shadow of doubt, its intention to pursue this policy on lines of the broadest public interest. No reservoir or canal should ever be built to satisfy selfish, personal or local interests; but only in accordance with the advice of trained experts, after long investigation has shown the locality where all the conditions combine to make the work most needed and fraught with the greatest usefulness to the community as a whole. There should be no extravagance, and the believers in the need of irrigation will most benefit their cause by seeing to it that it is free from the least taint of excessive or reckless expenditure of the public moneys.

Whatever the nation does for the extension of irrigation should harmonize with, and tend to improve the condition of those now living on irrigated land. We are not at the starting point of this development. Over two hundred millions of private capital has already been expended in the construction of irrigation works, and many million acres of arid land reclaimed. A high degree of enterprise and

ability has been shown in the work itself; but as much cannot be said in reference to the laws relating thereto. The security and value of the homes created depend largely on the stability of titles to water; but the majority of these rest on the uncertain foundation of court decisions rendered in ordinary suits at law. With a few creditable exceptions, the arid states have failed to provide for the certain and just division of streams in times of scarcity. Lax and uncertain laws have made it possible to establish rights to water in excess of actual uses or necessities, and many streams have already passed into private ownership, or a control equivalent to ownership.

Whoever controls a stream practically controls the land it renders productive, and the doctrine of private ownership of water apart from land cannot prevail without causing enduring wrong. The recognition of such ownership, which has been permitted to grow up in the arid regions, should give way to a more enlightened and larger recognition of the rights of the public in the control and disposal of the public water supplies. Laws founded upon conditions obtaining in humid regions, where water is too abundant to justify hoarding it, have no proper application in a dry country.

In the arid states the only right to water which should be recognized is that of use. In irrigation this right should attach to the land reclaimed and be inseparable therefrom. Granting perpetual water rights to others than users, without compensation to the public, is open to all the objections which apply to giving away perpetual franchises to the public utilities of cities. A few of the Western states have already recognized this and have incorporated in their constitution the doctrine of perpetual state ownership of water.

The benefits which have followed the unaided development of the past justify the nation's aid and co-operation in the more difficult and important works yet to be accomplished. Laws so vitally affecting homes as those which control the water supply will only be effective when they have the sanction of the irrigators; reforms can only be final and satisfactory when they come through the enlightenment of the people most concerned. The larger development which national aid insures should, however, awaken in every arid state the determination to make its irrigation system equal in justice and effectiveness that of any country in the civilized world. Nothing could be more unwise than for isolated communities to continue to learn everything experimentally, instead of profiting by what is already known elsewhere. We are dealing with a new and momentous question, in the pregnant years while institutions are forming, and what we do will affect not only the present but future generations.

Our aim should be not simply to reclaim the largest area of land and provide homes for the largest number of people, but to create for

this new industry the best possible social and industrial conditions; and this requires that we not only understand the existing situation, but avail ourselves of the best experience of the time in the solution of its problems. A careful study should be made, both by the nation and the states, of the irrigation laws and conditions here and abroad. Ultimately it will probably be necessary for the nation to co-operate with the several arid states in proportion as these states by their legislation and administration show themselves fit to receive it.

THE HOME CIRCLE.

Supper is ready! Funny little flock
That struggles through the grass with tired feet
And sturdy appetites that need no clock
To warm them when the hour comes to eat!
The dull, blind world might find them but a row
Of happy country children, but for me
Bright beauty, grace and wisdom lurk below
Each rumpled head, and deeds that are to be.
Brave men and strong, and noble women lurk
In shabby little coat and tumbled frock;
Add all for which I live and dream and work
Supper is waiting! Funny little flock!

INTEREST IN FOREST PRESERVATION.

BY T. S. VAN DYKE.

Before Sunset Club of Los Angeles, Cal.

The arguments in favor of forest preservation have the advantage of being so conclusive that they are disputed by few outside the cattle and sheep men who want the range. But this very advantage tends to deaden enthusiasm in a great many, for enthusiasm generally has its birth in intense thinking among the contestants in a disputed question. The question of forest preservation is now in a very satisfactory state of advance but we need more constant discussion and increase of enthusiasm in it until, at street corners, it is as much a topic of conversation as the latest scandal of the millionaire, and in social gatherings, rank equal with the consideration of Peter Scarem or The Struggle for the Last Pigtail.

In nearly all I have heard on the subject the sheepman is considered the most guilty party in burning off the forests. He is as bad as represented and even worse. But there are others. Two almost as bad are of most eminent respectability. But lack the excuse of the sheepman. He does it to increase the grass—that is for profit. The other two do it for pure laziness or stupidity—generally both.

These are the hunters, campers and fishermen, nearly all in pursuit of pleasure, and the farmers at the base of the mountains. The fisherman is much less of a fire fiend than the others, but only because he camps lower down on the streams and more in the bottom of the canyons along gravelly flats or sandy bars where there is no carpet of dead grass or pine needles to spread his fire. Otherwise, he is quite as certain to select the largest log or the biggest living tree to make his fire against, and quite as certain to repeat the performance at the next camping place although he just found his fire so big at the last one that it was impossible to put it out. Especially is this the case with the tenderfoot who is so fast becoming the terror of nature. It seems but a few years when none but the experienced went hunting or fishing. Occasionally a green hand was along with the party but he was generally left at home as a nuisance and seldom dared to start out on his own account. Today hunting and fishing are the proper thing for the business man who wants rest as well as for the men of means or leisure. Railroads and good wagon roads penetrating the mountains in so many directions have made it possible for thousands to go there where but a few years ago it took so much time that they did not attempt it. The first performance of the tenderfoot is always

to make the biggest fire possible. If fuel is handy he will have a fire big enough to barbecue an ox if only a cup of tea is needed. And at night though the evening be warm he must have sheets of flame streaming up among the trees, because it looks so cheerful, or so wierd as his wife tells him. To expect a man to put out such a fire is demanding considerable of human nature in these days of economizing energy. He has had enough to do to make it. The small fire, if he should accidently make one, he leaves to be blown about by the rising wind because he thinks it wont do much harm. That is, when he thinks at all. I have seen many such a one stand right beside a fire and empty the coffee pot off on one side and all the dishwater, etc., when it was just as easy to put it on the fire.

Among the older hunters and fisherman there is more recklessness than stupidity. Too many of them simply do not care. They will make a fire in dry leaves, pine needles or dead grass when the sandy bed of some little dry run is just as convenient, and are quite as much opposed to wasting energy in putting it out as the most recent formation of a tenderfoot.

What shall we do with these classes? Nothing in the way of reformation is possible. The only way is to keep them entirely out of those sections where the danger is greatest as in some of our southern mountains. My interest in hunting and fishing is quite as great as it is in irrigation so that what I say on this subject is at least sincere. I shall expect to do considerable of both yet as I have in the past and I believe not only that I will lose nothing by having a portion of the forest reserve closed against me that I will actually be the gainer. The question of refuges in which game shall at all times of the year be absolutely safe against all disturbance is already up among those interested in game preservation. In many parts of the country, and probably in all, the establishment of large places of refuge will soon make game so much more plenty outside that the loss of the territory will be more than make up. In southern California our best hunting is not at all in the higher mountains where the forest laws must be applied but in the lower hills. To these the higher ones would serve as a nursery to increase the supply. It is not so much the case with fishing but the same principle applies to a great extent. The greatest drain upon our streams is by those who ascend to the small tributaries high up in the hills where they can catch fingerling easily by diverting the stream and various other tricks when they do not bite well. While it is not necessary to exclude hunters and fishermen from all the forest reserve, I still believe it would be no bad thing if it were done and no one allowed to camp there for any purpose except under the direct supervision of a forest ranger of that section. In that case his name, business, movements, etc., could all be registered, all his

camping places known, and he could be held responsible for all his acts.

In southern California many of the worst fires are in autumn, starting at the base of the mountains and sweeping upward. While this is not so common as it was it is still common enough. In almost every case it is done by the farmer who wants to burn some brush or rubbish on his own land and selects one of the dry, hot days with a desert wind in the fall that makes every thing burn well. It is too much work to run a fire guard around the outside. It is also too much trouble to do the thing at night when the wind is down or do it in sections so that each can be managed. It is far cheaper, especially for the dry rancher whose time is so valuable for rolling cigarettes, to wait for a day when there is nothing to do but to touch a match and let the whole thing go off by itself. Why of course he didn't do it on purpose. And surely he has a right to make a fire on his own land. He couldn't help it either, the wind shifted on him, or nature interfered with his handling of it, and why should he be punished for what he could not help when doing a lawful act on his own land?

It is plain that convictions can not be had in such cases, or of the hunter, fisherman, sheepman or tenderfoot just as long as the burden of proof is on the prosecution to show that the burning of the public forest was wilful, malicious, negligent or careless, or can it be done if the defendant can offer in evidence due care on his part, for he will always be ready to swear that he was careful and there will rarely be any evidence to the contrary.

To meet this I drafted a law some three years ago the effect of which would be to make every one absolutely responsible for the consequences of any fire made or used by him after being left by any one else. To prevent any hardship as well as to aid in its enforcement the fine was put at only one hundred dollars, the idea that if one does not know enough to make a fire that cannot escape from him, one hundred dollars is cheap tuition. If he does not want to pay it, all he has to do is to keep out of the woods and practice on making fires that he can control before he goes into them. This was unanimously approved and recommended to congress by the forestry convention that met in Los Angeles three years ago. It passed the house all right but in the senate was changed some. The essential features are in one way or another preserved but the fine was raised to a possibility of a thousand dollars which is too great for western juries. It also lets out the man who burns up the country by reckless making of a fire on his own land. This was probably not intentional. The law is a great improvement over the old one as it is not necessary to prove negligence in all cases and it makes it the duty of every one to extinguish a fire that he makes. But it still allows him to make a fire of any

size and the wording is so changed that if a fire escapes in spite of due dilligence he may be excused. No amount of diligence should be an excuse because he is always at liberty to stay out of the woods if he does not know how to behave as a woodsman should.

Of all the people in the world, we, of Southern California and especiaily of its business center, Los Angeles, are the most vitally and immediately interested in forest preservation. Our interest is not remote as in Oregon where the rainfall is so great, and where there is already many times more water than the next century can learn to use. We make talk of our climate and scenery and out of door attractions as we please, and it is all true enough, but after all our prosperity is dependent mainly on the productive power of the soil. For though there are thousands who do not care to cultivate, there are few who care to sit down in a desert for the mere inhalation of climate, and most of these are quite as much opposed to a semi-desert as to the full-blown article. Our resources are strictly limited by our water supplies and these are limited by our watersheds. That is so far as we know. We have no right to assume that any of our water comes from the Sierra Nevada of the north or any other distant source. We know nothing about it. But we do know that our local watersheds are sufficient, aided by the vast gravel reservoirs of the slopes and plains, to account for all the water we yet have and considerably more. But where the rain shed from a single acre of the mountain top in winter is worth one hundred dollars or more in the land below we cannot afford to risk one drop of it to accommodate the whimsical, the reckless or the lazy.

CONSTRUCTION OF STORAGE RESERVOIR.

The following bill was introduced in the House of Representatives December 2, 1901.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That all moneys received from the sale or disposal of public lands in the states of California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, North Dakota, Oregon, South Dakota, Utah, Washington and Wyoming, and in the territories of Arizona, New Mexico and Oklahoma, be and are hereby reserved, set aside, and appropriated as a special fund in the treasury, to be known as the "reclamation fund," to be used for the survey and construction of reservoirs and other irrigation works for the reclamation of arid lands.

Sec. 2. That the Secretary of the Interior is hereby authorized, for the purpose of reclaiming arid lands, to cause to be examined and surveyed reservoir sites, tunnel sites for diversion of water, and irrigation canals connected therewith in said states and territories, and to require reports as to the same, together with estimates of the cost of construction thereof, and reports as to the quality and location of the public lands which can be irrigated therefrom, as to all facts relative to the practicability of each enterprise.

Sec. 3. That upon the filing of such report the Secretary of the Interior may, in his discretion, withdraw from public entry the lands embraced within the reservoir sites at highwater mark and a strip of ground one hundred feet in width bordering on the same, and at the base of the dams thereof, and the land within fifty feet on each side of the center line of the irrigating ditches and tunnels, together with the public lands which it is proposed to irrigate therefrom.

Sec. 4. That upon the determination by the Secretary of the Interior that the reservoir and irrigation project is practicable, he shall cause to be let, upon proper notice, contracts for the construction of the same in whole or in part, payments to be made out of the reclamation fund.

Sec. 5. That upon the completion of each irrigation project the lands to be irrigated thereby shall be subject to homestead entry after notice by the Secretary of the Interior, upon the condition that, in addition to the requirements of the homestead act, the entryman, on the making of final proof of settlement, shall pay to the government the sum of five dollars per acre, and each entryman shall be limited to the entry and settlement of not exceeding eighty acres.

Sec. 6. That after construction the Secretary of the Interior shall cause the said reservoir or other irrigation works to be operated at the expense of said reclamation fund until the major part of the land intended to be irrigated from each reservoir has been duly located upon as aforesaid, when the management and operation of the same shall be turned over to the said homesteaders and their heir, who, together with the homesteaders afterwards locating upon the lands to be irrigated by such project, and their heir, shall manage, operate and maintain the same, either as a body or through a corporation to be formed by them, as may be formed by them, as may be required by the Secretary of the Interior.

Sec. 7. That nothing in this Act shall be construed as interfering with the laws of any state or territory concerning irrigation or the distribution of water.

Sec. 8. That the Secretary of the Interior is also authorized to cause to be dug artesian wells to be used for irrigation purposes on public arid lands, which shall be open to settlement as above prescribed, or to do any other thing necessary for the reclamation of said arid lands, and the cost thereof shall be paid out of said reclamation fund.

Sec. 9. That in case the water thus provided shall be more than sufficient for the reclamation of the irrigable public lands proposed to be irrigated, or if the Secretary of the Interior determines that land in private ownership is better suited for the utilization of the waters, or if there is a sufficiency for both, then rights to the use of water may be sold at a price to be fixed by the Secretary of the Interior, but no water right shall be granted for an amount exceeding eighty acres to any one landowner, and the price and terms of use of same shall be such as the Secretary of the Interior may deem just and fair, such amounts so obtained to be paid into said reclamation fund.

Sec. 10. That when it becomes necessary for the construction, operation, or maintenance of any reservoir or irrigation works proposed or constructed under this Act, to acquire any right or property, the Secretary of the Interior is hereby authorized to acquire the same for the United States, either by purchase or condemnation under judicial process, and to cause to be paid from the reclamation fund the sums which may be needed for that purpose.

Sec. 11. That the Secretary of the Interior is hereby authorized to make such rules and regulations for the purpose of enforcing the provisions hereof as may be just and proper.

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

A NEW CEREAL.

A new grain has been introduced in the western section of the United States during the past two years. It is known as speltz and promises to be one of the most valuable cereals for cattle, hogs, sheep and general farm purposes. It may be sown in the fall or spring and will make good winter pasture and summer green manuring. Reports from Illinois are to the effect that speltz has yielded 90 bushels of seed and 8 tons of hay per acre. The grain furnishes excellent food for all kinds of stock, and the hay is of the best quality. It has the power of resisting drouth and stools out so much as to make a poor stand return fair crops of grain.

Speltz comes from Germany, where it is recognized as one of the most valuable plants. It is not a wheat, oat nor corn, but a grain incorporating all the elements of these cereals. It grows very rank and resembles barley heads when ready for cutting. Some call it a mammoth wild rye. It succeeds well on sandy soil and yields better when in rich land. It takes up much of the natural plant food and requires annual dressings of the land with potash to give the best returns. It will yield better if sown on land that formerly had clover, cow peas or other legumes. The addition of a perfect fertilizer, containing about 9 per cent available potash, 7 per cent phosphoric acid, and 2 per cent nitrogen will insure a satisfactory crop.

Land should be plowed in August or September and put in thorough condition before planting. Sowing broadcast is advisable, but the crop will give satisfactory returns by being drilled in rows the same

as wheat, using the ordinary press drill. If sown in the fall, it will grow up and stool out wonderfully, having as much as 100 stalks from one kernel of seed. It can be pastured throughout the winter and early spring and left to grow into seed stalks in midsummer. A field of speltz will make excellent winter pasture for sheep, hogs and cattle. The farmers of Austria report it better for winter feeding than any of the grains or grasses.

Speltz may be harvested the same as wheat or other grain and threshed in the same manner. The grains are larger than in barley and the thresher needs to be set accordingly. When threshed, the grain may be crushed or chopped or fed whole. Some boil it and mix with hay rations for milch cows, and others make it into chop feed. The hay left from the thresher is greedily devoured by all kinds of stock and is rich in muscle making food. A Canadian stock grower states that his speltz yielded at the rate of 100 bushels per acre and he found it one of the most valuable stock foods grown.

The seed of speltz is limited yet and naturally sells for a good price. It can be purchased from the leading seedsmen for about 5 cents per pound. It may be sown with perfect assurance of making a crop in all latitudes. Being a native of Austria, it is adapted particularly to the dry districts of the south and west. It is certainly a most desirable crop where the rainfall is light or drouths are of frequent occurrence. In sandy soil requiring a strong grassy binder, there is nothing better, as the stooling qualities and stiff straws make it a perfect wind break. The long blades

THE IRRIGATION AGE.

droop over and protect the soil surface from sudden drying by wind or drouth.

The experimental stage of speltz in America seems to be over and all doubts as to its usefulness have disappeared. It will soon be generally planted in all localities where a cheap forage and stock cereal is wanted. Poultrymen will find it an ideal crop to grow for feeding for market. It is superior to other grains, except corn for feeding hogs, and the immense yields from a given area make it a crop that every farmer should grow. It should be fed on the farm, where the hay and grain can both be utilized. In fact, the main secret of success in farming is the selling of poultry, pork and beef made by the farm crops, rather than disposing of the grain and robbing the farm of its returnable fertility.

MONEY IN BARLEY.

Barley is one of the most profitable general crops that can be grown in all sections of the United States. It can be used for feed for poultry, hogs, stock and horses and always commands a good price on the general market. The yield ranges from 75 bushels to 150 bushels per acre in the western states and a similar crop may be obtained in older sections where the soil is kept in good tilth and suitable fertilizers are used. Barley sells for from 75 cents to \$2.00 per bushel, the price depending on the location of the market. Crushed barley is always desirable for feeding at livery barns and is much in demand for city feed stuff.

The growing of barley dates back over 4,000 years, to the land of Egypt. It was one of the most important cereals grown on the Nile and was prized as a food for man and beast. The Egyptians crushed the grain and made a drink much relished by all families. The flour was used in making bread and soups and the green cereal was boiled and cooked about the same as rice. Straw was used in the

brick yards and in covering houses and barns or sheltering places for stock and sheep. The women converted barley straw into many fashionable articles for home use and adornment. It was the all purpose cereal throughout the country in ancient times.

There are three distinct varieties of barley, known as the two rowed and beardless. A new kind recently introduced in the northwest, called Mansura, is of the six rowed variety and is highly recommended. The Highland Chief is a popular two rowed barley. The White Hulless is a favorite with many growers. The Silver King is recommended as a great cropper, yielding as high as 173 bushels per acre in Wisconsin. All varieties are good stoolers and when sown in the fall make excellent winter pasture. Pasturing does not injure the plants unless too many stock are put on the field early in the fall or too late in the spring.

Barley requires a rich, moist, loamy soil, and will succeed better when sown after a cultivated crop of potatoes or other similar products. Land containing an excessive amount of vegetable decomposition generally produces rank straw but not good grain. If the land is low and wet or has an abundance of clay, it will not give satisfactory results. Barley grown for the brewing market must be well fertilized to give best results and yield profitable returns. A fertilizer containing 9 per cent available potash, 7 per cent phosphoric acid and 5 per cent nitrogen, applied at the rate of 500 to 1,000 pounds per acre will give profitable returns. If too much nitrogen is used the straw will lodge and the grain will not fill properly. Instead of this, a mixture of 200 to 300 pounds of acid phosphate, 100 to 150 pounds of muriate of potash and 100 to 125 pounds of nitrate of soda can be substituted.

Land for barley should be plowed as early in the fall as possible and put into good condition before sowing. If th

seed is to be sown in the spring the fall plowing will cover the former crop and retain moisture for a long period and the surface will be made mellow by the winter rains and freezes. Barley should be sown at the rate of about one and one-half bushels per acre. Some prefer to plant with press drills, others sow broadcast. For winter pasture that sown in the fall is probably better put in broadcast. Where irrigation is practiced the seed should be drilled and the water applied by furrows. Barley may be killed by too much water, but it will withstand drouth more than most cereals. Statistics show that the production has decreased in the past few years, which is a sure indication that it may now be made profitable by proper growth and marketing.

ALFALFA IN NEW YORK.

I have raised alfalfa on a small scale for about eight years past, and consider it a valuable grass for all kinds of stock, when cut green for horses, cattle, sheep, and even hogs and hens. I wintered 40 hens last winter; gave them a small forking of green cured alfalfa, with the leaves on, which they dispatched easily, and I think was a help to them with their grain rations. I have fed it in small quantities to my three cows for a number of years, and find there is no better hay for cows giving milk than alfalfa, for quantity and quality. It needs more curing than most any other hay and should be cured mostly in the cock to preserve the leaves, and should be cut greener than common clover; as soon as it first begins to blossom it should be cut, before the stalks get hard and tough; usually three times in each summer in Central New York. All kinds of soils and farms are not suitable for the raising of alfalfa. I would not sow it on rough stone land, nor on poor land with a hard pan bottom. When young it is a tender plant, more so than our common clover for the first year or so.

The rich bottom lands along our brooks and rivers where not too low and wet, and the water does not stand on the ground for days in the spring and no hard pan bottom, seems well adapted for its growth. I have made a success in raising it on such bottom land; black muck, much like the prairie soil I have seen in the Western states. The roots grow longer and stronger every year for a few years, when in good soil, branching out more after being cut off. I have seen more than 50 branches from one root. It also does well on our gravelly and loamy soils when put in condition. It will kill out in a low spot or a sink hole where snow water or ice settles and freezes up in the spring of the year, and stands on the land for a few days. I consider it excellent for a permanent meadow, but would not sow it in my regular rotation where I plowed up once in three or four years, as the roots get so strong and large as to make hard plowing, requiring a plow point sharpened on an emory wheel to cut off the roots. The ground should be nearly level, but may do if a little rolling, if no sink holes for standing water. I made a mistake, for years, in sowing too little seed to the acre and sometimes by sowing too many other kinds of seeds with it, especially orchard grass for one, which would choke out the alfalfa; and by sowing three bushels of oats to the acre with it; that shaded it too much. My best seeding has been 30 pounds of alfalfa seed per acre and not more than one bushel of oats with it. That has furnished a small crop of good heavy oats, and shaded the alfalfa just about right to get a splendid start the first year. It requires rich and well cultivated land to produce a good crop of alfalfa. The land should be well manured, hoed, cultivated and dragged, with crops for two years, and brought into as fine tilth as for a garden; then sow in the spring, when we sow spring grain; roll the land down smooth, after going over

the seed with a light drag, and you will be likely to get a good cutting the first year, but do not pasture it the first or second year, or very late in the fall at any time, especially with sheep, as they eat it down very very close so that it may die out in the winter, as the first winter is the hardest time for alfalfa. The roots at four years old in good land may be 3 feet long with us here, and in the Western world will run down 10 or 12 feet, so it is said. It is their best grass and their main dependence in some of the Western states, and is becoming more and more thought of all over the country and will be used more and more in the Eastern states as we become better acquainted with it, and find our stock of all kinds will thrive and fatten on it.—*The Practical Farmer*.

BUREAU OF FORESTRY.

The Bureau of Forestry of the U. S. Department of Agriculture continues to receive requests for advice and assistance in the management of private woodlands in the South. One of the latest requests is for a working plan for 1,000,000 acres of longleaf pine land in southeastern Texas, the property of the Kirby Lumber Co. and the Houston Oil Co., of Texas.

The holdings of these companies cover about eighty per cent of the virgin forest of longleaf pine in Texas. The officials state that they are anxious to exploit their forests on scientific lines, cutting the merchantable timber in such a way as to insure protection to the young growth. A preliminary examination of this large tract will be made during the winter, by agents of the Bureau. All things considered, this large area of timberland, if handled on the lines which the Bureau will advise, should prove to be one of the most interesting undertakings in the line of forestry by private owners yet attempted in the United States.

The above request for assistance is but

one of a number that have recently been received by the Bureau of Forestry. The Baltimore & Ohio Railroad Co. has asked for a working plan for its tract of 125,000 acres of mixed hard and soft woods, situated in Nicholas and Pocahontas counties, southeastern West Virginia. Burton & Co. has asked for an examination of their tract of 25,000 acres of pine land situated in Berkeley county, South Carolina. The East Tennessee Iron and Coal Co., owning 60,000 acres of hardwoods in the Cumberland mountains, desires to cut its timber on conservative lines, and has requested a preliminary examination of its tract.

From North Carolina comes a request from Mr. Hugh McRae, for advice in the handling of 16,000 acres of hardwood situated near Grandfather Mountain. A request has been received from the Georgia Iron & Coal Co., with headquarters at Atlanta, Ga. This company desires advice in the handling of two tracts; one of 16,000 acres in Bartow County, and the other of 30,000 acres in Dade County. An examination is also asked for by another firm, for 16,000 acres of pine land in Polk County, Ga. Agents of the Bureau of Forestry will inspect these tracts at an early date.

A working plan is to be made this winter by the Bureau of Forestry for the woodlands belonging to the Okeetee Club the preliminary examination having already been made. This tract is located in Beaufort and Hampton counties, South Carolina, and contains 60,000 acres of longleaf pine land.

The foregoing include only the most recent requests for assistance from private owners in the South, The Bureau for more than a year past has been co-operating in the handling of timber tracts in that section. At Sewanee, Tenn., the domain of the University of the South, consisting of 7,000 acres of hardwoods, is being lumbered according to a working plan made

by the agents of the Bureau. A working plan has also been completed for 100,000 acres of pine lands in Arkansas, belonging to the Sawyer & Austin Lumber Company, of Pine Bluff. Another interesting piece of work just completed by the Bureau is a working plan for a tract of 60,000 acres in southeastern Missouri, belonging to the Deering Harvesting Co. of Chicago.

During the summer the agents of the Bureau of Forestry have been at work collecting the necessary data for a working plan for 85,000 acres in Polk and Monroe counties, East Tennessee. This tract is the property of U. S. Senator George Peabody Wetmore, of Rhode Island, and the timber consists of a wide range of hardwoods. A working plan has also been made during the past field season for a tract of 60,000 acres in the Cumberland Mountains of Tennessee.

In October, 1898, the U. S. Department of Agriculture, through its Division of Forestry, first offered to give practical assistance to farmers, lumbermen and others, in the handling of their forest lands. The response to this offer was immediate, and in three years private owners of over 4,000,000 acres of woodland have availed themselves of the opportunity.

In no part of the country is wider interest being shown in conservative forest management by private owners, than in the Southern states. Up to date the amount of private lands in the South for which advice in handling has been asked of the Bureau, is 1,534,000 acres, and a very large part of the work which will be done by the Bureau for private owners in the immediate future will be in that section.

The industrial development of the South on all sides during the last ten years has been remarkable, but no single industry has made greater strides than the lumber business. This is not surprising when it is considered that the Southern states contain a greater percentage of forest area

than any other section of the United States. The South has become a very important factor in the lumber markets of the world, not only through its wealth of forests, but from the fact that it has unusually good transportation facilities. In reaching the home markets Southern lumbermen have the advantage of a number of excellent railroad systems to handle their products and such important seaports as Norfolk, Charleston, Savannah, Mobile, Tampa, New Orleans and Galveston, provide excellent outlets through which to reach the foreign markets.

Within recent years many lumbermen from the North have been attracted to the southern field; the forests of Pennsylvania, Michigan and Wisconsin having been almost exhausted, many of the leading woodmen of those states are now engaged in cutting timber in the South. The forests of the three states just mentioned were once considered inexhaustible, but once lumbering begins in earnest no forest area is inexhaustible. The present condition of the forests in many northern and eastern states is sufficient evidence on this point.

The South now has a great army of lumbermen cutting away its forests, and in spite of their great extent, unless the cutting is done on conservative lines, the day is not far distant when the conditions now existing in the North and East will be found there also. For this reason it is encouraging to see the interest in practical forestry displayed by the owners of private timberlands. This tendency to cut timber conservatively, looking to the future value of the forests as well as to present profits, must be the safeguard. Conservative methods are now being taken up in the North when almost too late, and it will be greatly to the credit of southern lumbermen if they begin the protection of their forest in time; taking to heart the sad experience of people in other sections.

In addition to more than a million and

a half acres of private forest land in the South, the Bureau of Forestry has requests for the handling of more than 2,500,000 acres in other sections. Added to this are nearly 50,000,000 acres of United States forest reserves and state lands, for which the Bureau is asked for technical assistance from time to time.

Not only have the people throughout the country shown interest in practical forestry, but congress at its last session so far recognized the importance of the government's work in this line as to raise the Division of Forestry to the rank of a Bureau. The annual appropriation was also increased from \$88,520 in 1900 to \$185,440 in 1901. Still the demands upon the Bureau continue to greatly outstrip its resources.

1,000 KINDS OF GRASS IN AMERICA.

A report on the work of the division of agrostology of the Department of Agriculture, since its organization in 1895, has been submitted to Secretary Wilson by Professor F. Lamson Scribner, the government agrostologist.

The report says that of the occupied public lands about 365,500,000 acres are now regarded as fit only for grazing purposes, and in addition there are 124,300,000 acres of forest land, the greater portion of which is also used for grazing.

The relation of the grazing industry to forest reserves, the water supply, erosion etc., the report says, can be solved only by long and careful investigation of the facts and conditions prevailing. As a result of the field work already done the department has been enabled to recommend to farmers and stockmen throughout the country the forage crop adapted to their conditions and special requirements and to carry on experiments with forage plants likely to prove valuable in any particular region.

Within the United States are grown over 1,000 species of grasses and, perhaps,

100 or more other plants of sufficient forage value to justify their investigation and cultivation. Because they are native, says the report they have been too often not only neglected, but abused, and in some cases partially exterminated. Many of these grasses have been shown by these investigations to take kindly to cultivation and produce much larger quantities of hay and pasture than ordinarily supposed:

COAST'S GREAT RAISIN YIELD.

The raisin industry of this country forms a subject of considerable interest because virtually the entire consumptive demand, which was formally met wholly by importation, is now supplied by the single state of California, the only raisin producing state in the Union.

It is well known that no variety of native American grape has yet been developed suitable for the preparation of raisins. Over twenty-five years ago choice varieties of the raisin grape were introduced into California from Spain, the country from which our raisins were derived.

The industry did not at once assume commercial proportions, but it is notable that so early as 1885, in the crop year ended September 1, 1886, the efforts of increased production in California began to be shown in a decrease of imports. In the fiscal year 1885-6 imports declined to 40,387,746 pounds from 53,703,220 pounds only two years previous. Productions in California on the other hand, began in that year to assume commercial proportions for the first time and amounted to 9,400,000 pounds against 3,500,000 pounds in the previous year.

The impetus given to the industry at that time was never relaxed, production increased by leaps and bounds until in the crop year ended September 1, 1895, the high record mark was reached of 103,000,000 pounds. Naturally the effect upon imports of this remarkable increase of

production was very marked, and in the fiscal year 1894-5 they had fallen to 154,921,278 pounds.

Since 1894 the production of raisins in California has declined, but this, it is claimed, has been due to adverse climatic condition and not to any decline of interest in the industry. Production, however has been almost equal to the demand and although imports have not wholly ceased, they are practically offset by exports of California raisins, which are now sent in small and experimental quantities to all parts of the world.

The raisin producing section of California comprises ten counties—Fresno, Kern, Kings, Maderia, Mercer, Orange, San Bernardino, San Diego, Tulare and Yolo. It is estimated by some authorities that as many as 64,000 acres are devoted to the cultivation of the raisin grape in these counties. The City of Fresno, which is known throughout California as the "Raisin City," is the center of a section which produces about two-thirds of the entire output of the state. Eight months of sunshine and an abundance of water irrigation makes this the ideal grape producing section of the world.

HERE IS A NEW WORLD TO CONQUER.

Some interesting facts regarding the great size and possibilities of our country were brought out at one of the recent hearings before the committee on irrigation and arid lands. It is not usually realized that an enormous area of our country, 600,000,000 acres in extent, lies unutilized. Of course, a great deal of it is and always will be unfit for the support of a large population, but with proper management it is destined to become the

home of thousands and even millions of people.

This great tract lies entirely west of the Mississippi Valley and extends over the Rocky Mountains, the Great Desert and into California. Much of it at present is a barren and desolate wilderness, with too scanty a rainfall to provide the necessary moisture for any but the hardiest vegetation. Irrigation is to effect the change.

Years of successful experience in the artificial watering of land has proved beyond doubt its wonderful efficiency in certain portions of this arid section—in California, in Colorado and elsewhere—so that it is but a question of capital and enterprise before the whole large problem will be solved. Every year sees an advance towards this desirable end.

Congress has some phrases of the matter constantly before it; United States Geological Survey has rendered valuable assistance in determining the flow of the rivers, which must be used for water supply, surveying and estimating the cost of dams and reservoirs and pointing out past mistakes and errors which may be avoided.

Close the mind's eye for a moment and picture the accomplished result. Fifty million people added to the population east of the Missouri River, for this is the number of inhabitants the present waste lands are capable of supporting—a great nation in itself; an agricultural community, changing desolation into fruitful lands and creating a constantly increasing demand on Eastern manufactures, taxing to the utmost the carrying capacity of the great transcontinental railroad lines. It means a new and bright era of development for the country.

ODDS AND ENDS

SINCE WE GOT THE MORTGAGE PAID.

We've done a lot of scrimpin' an' a-livin' hand-to-mouth,

We've dreaded too wet weather an' we've worried over drouth.

For the thing kept drawin' int'rest, whether crops were good or bad.

An' raisin' much or little, seemed it swallowed all we had.

The women folks were savin', an' there ain't a bit of doubt

But that things they really needed lots of times they done without.

So we've breathin' somewhat easy, an' we're feelin' less afraid

Of Providence's workin's, since we got the mortgage paid.

I wish I'd kept a record of the things that mortgage ate,

In principal an' int'rest, from beginnin' down to date!—

A hundred dozen chickens, likely fowl with yellow legs,

A thousand pounds of butter an' twelve hundred dozen eggs.

Some four or five good wheat crops, an' at least one crop of corn,

An' oats an' rye,—it swallowed in its lifetime, sure's you're born,

Besides the work an' worry, ere its appetite was stayed!

So we're feelin' more contented, since we got the mortgage paid.

We've reached the point, I reckon, where we've got a right to rest,

An' loaf around, an' visit, wear our go-to-meetin' best,—

Neglectin' nothin' urgent, understand, about the place,

But simply slowin' down a bit, an' restin' in the race!

In time I'll get the windmill I've been wantin', I suppose;

The girls can have their organ, an' we'll all wear better clothes.

For we've always pulled together, while we saved an' scrimped an' prayed,

An' it seems there's more to work for since we got the mortgage paid.

—*Orange Judd Farmer.*

A PROUD FATHER.

The *Kansas City Journal* thus quotes an old Missouri man: "I've a daughter that's the handsomest young woman in our town. She's mor'n that; she's smarter 'n lightin'—smarter 'n Jim Blaine. She made the vale-o'-victory speech in high school last summer, an' she's 'now learnin' all about the shorthand pot-hangers in a private business college. But I ain't a-goin' to let her stop theer. By Jingo," and he brought down his knife handle with a bang on the table—"I'll never, never let up till her eddication is finished in the best cemetery in the land. I guess I know what life is, gents, and don't you forgit it. I've served in the calvary myself for mor'n five years, an' had a hand in the little game over in Cuby. Any man that served in Uncle Sam's calvary, and he needn't be one of Rosey's rough riders—nayther, ain't worth a dose of this oyster stew if he don't know life."

A MONUMENT TO JENNIE WADE.

There was unveiled last week on the battlefield of Gettysburg a monument which commemorates one of the most touching and picturesque incidents of the

great war. When the great battle of Gettysburg was fought a modest brick cottage stood where the fight was thickest. It was occupied by Miss Jennie Wade and her mother. Both were in full and earnest sympathy with the Union and while the tide of battle rose and fell the two women busied themselves in drawing water from the well near the house and filling the empty canteens of the soldiers. Their spare moments were occupied in tender services to the dead and wounded of the Union armies, many of whom were brought into the yard surrounding the Wade house and laid on the grass under the shading trees. On the second day of the battle Miss Wade with her mother started to cook food for the almost ex-

hausted soldiers and while at work a minie ball crashed through the house and struck her in the head, death being instant. No movement to raise a stone over her grave was started until a party of Iowa women, members of the Relief Corps, visited the battlefield last year. One of the party was a sister of Miss Wade and is now prominent in the work of that corps. Accordingly it was suggested that the loyal women of Iowa should undertake to build the monument. The movement was successful from the start and the monument which was recently unveiled is among the handsomest and most significant on the historic battlefield.

FRISCO LINE

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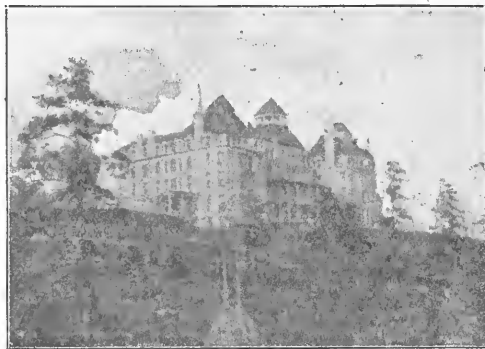
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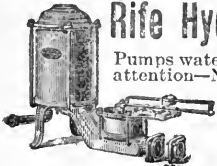
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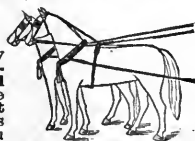
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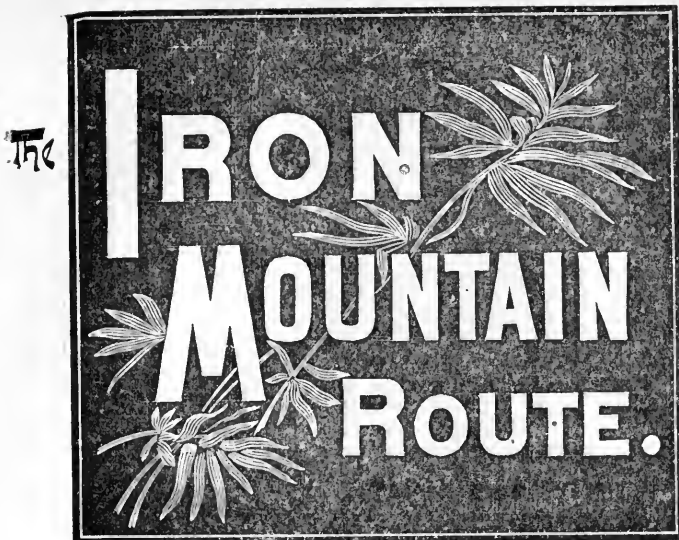
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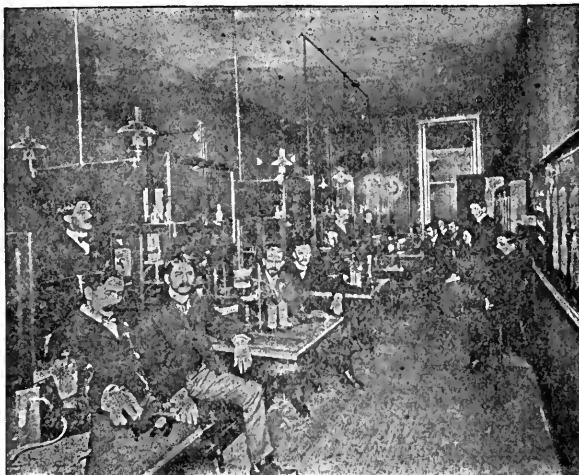
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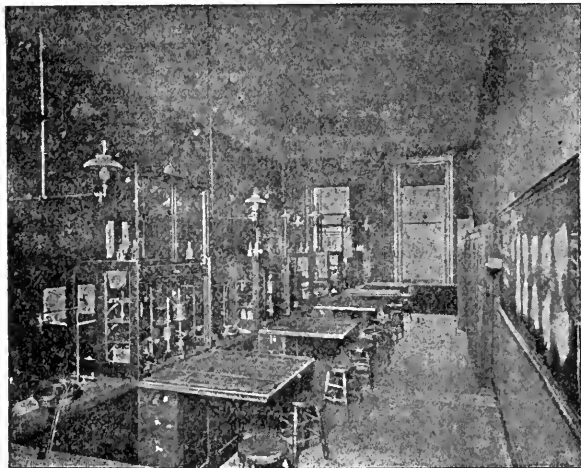
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