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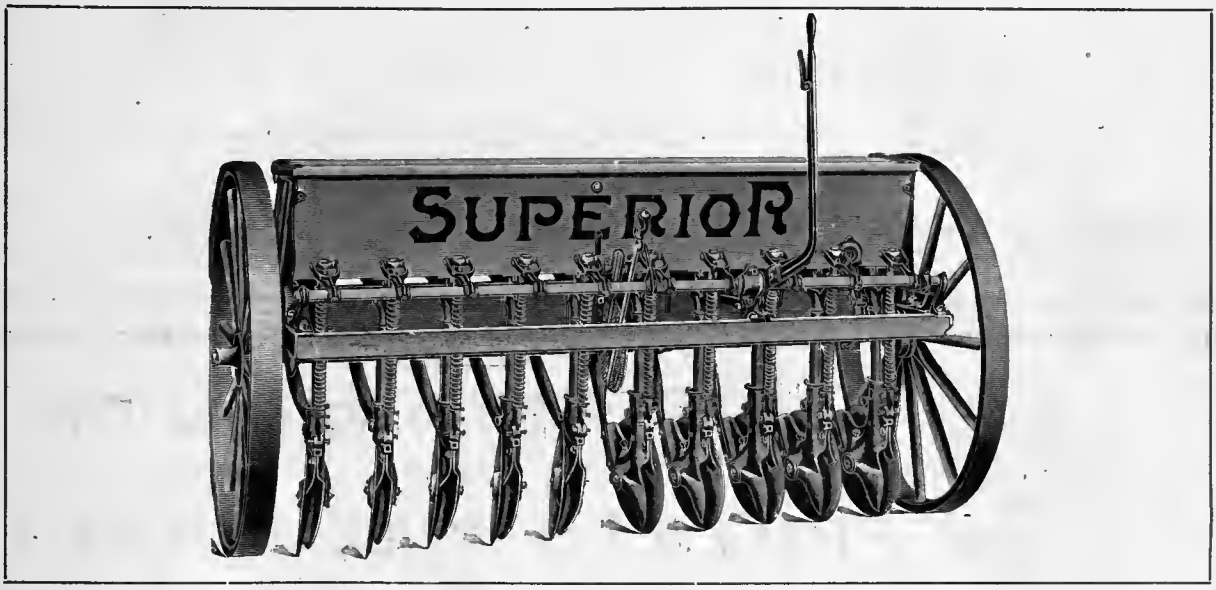

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SPRINGFIELD, OHIO

THE IRRIGATION AGE

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THE IRRIGATION AGE

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A monthly illustrated magazine recognized throughout the world as the exponent of Irrigation and its kindred industries. It is the pioneer journal of its kind in the world, and has no rival in half a continent. It advocates the mineral development and the industrial growth of the West.

EDITORIAL

Notice. For the convenience of the large number of libraries and other institutions that regularly bind the different volumes of THE IRRIGATION AGE we are beginning Volume 18 with the present (November) issue. This is done so that it may not be necessary to bind two different sizes in one volume.

L. G. C. Mayer: Mr. L. G. C. Mayer, Agent and expert, pumping and farming machinery investigations, United States Department of Agriculture, called on the IRRIGATION AGE recently and explained the object of his work, which appears in detailed form in another column. It is hoped that manufacturers generally will give such aid as they can to the department in its new line of study and research.

Have You? If any of the readers of THE IRRIGATION AGE who are members of the National Irrigation Association have been notified of annual meetings, and have on hand any report of the meetings, giving full proceedings, election of officers, etc., etc., they will confer a favor by sending same to this office.

Interesting. Our readers will find the articles reprinted in this issue from the Denver Republican of October 10th a very fair description of the standing of Geo. H. Maxwell among the people who have kept track of him in the west. The reply of Prof. Elwood Mead, of the department of agriculture, to the attack made on the department by Mr. Maxwell will also prove interesting reading.

Personal and Confidential. In a circular headed "Personal and Confidential" issued by Geo. H. Maxwell, late last year, appears the following paragraph:

"A fund of $100,000 a year could be expended wisely and to advantage in carrying on the necessary educational campaign, in printing and circulating literature and pamphlets, in conducting a wide correspondence with thousands of leading men throughout the country to awaken their interest, in publishing an illustrated monthly magazine and a weekly journal as the organ of the movement . . . in the support of a lecture bureau and in holding an annual irrigation congress."

The above was signed by Mr. Maxwell as Executive Chairman and sounds strange to one who heard his harangue about killing off the National Congress by merging it with the Trans-Mississippi Congress.

To Whom is Credit Due? Our old friend Wm. O. O'Neill, who was killed at San Juan Hill, was the first to push the subject of National Aid, and the Editor of the AGE has the original manuscript of articles written on that subject long before Geo. H. Maxwell ever attended a National Irrigation Congress. In fact some of the matter on the subject of National Aid was published in "Wind and Water" long before The Congress held at Phoenix, Arizona, in 1896, which, as we understand it, was the first National Congress that was honored by the presence of Mr. Maxwell, and if the memory of the writer serves him right, that gentleman

had nothing to say on the subject he now advocates at that particular meeting. It is our impression that Mr. Maxwell entertained the delegates with a talk on The Wright Act in which he was so deeply interested at that time. As soon as a copy of the proceedings of the Phoenix Congress are placed in our hands we will give our readers extracts from the speeches of Wm. O. O'Neill and Geo. H. Maxwell, which will clearly show who was the first champion of National Aid, and it may perhaps, prove that all of Maxwell's fireworks and ammunition were deliberately appropriated after "Bucky" O'Neill's untimely death.

Why? If The National Irrigation Association is a national organization for national good, why should the list of its members be held as private property by Geo. H. Maxwell or any other individual? The editor of IRRIGATION AGE asked Mr. Maxwell for a list of the members and he declined to furnish it, giving as an excuse that he feared that it would possibly fall into the hands of the enemies of the cause. What cause! Why should he fear to have the list made public? Is he or his associates any more the friends of irrigation and National Aid Laws than the rest of us? Answer, Mr. Maxwell.

Our New Form. Beginning with this issue the size and general form of THE IRRIGATION AGE is changed and improved. The old Magazine form was found too small to accommodate the illustrations which we wish to present from time to time, hence, it was thought better to double the size of the pages and offer something new and attractive in our cover design. By increasing the size of the pages our advertisers will be gainers, as they will secure twice as much space as formerly, without additional cost. This will hold true with all advertisers who are now with us. After January 1st, however, the page rate will be $600 per year to all new advertisers or those who have not entered into contracts for space.

This increase in our rates is fully justified by our largely increased circulation. The paid list of the magazine has more than doubled since December, 1901: in fact, the increase in paid subscriptions during 1902 has exceeded the combined increase of the three preceding years.

We will be glad to receive from our subscribers names of friends who are interested in irrigation, farm drainage or kindred subjects, to whom sample copies will be gladly mailed.

The publishers will strive to add 5,000 new names to the list during 1903.

Fred. J. Kiesel. We are presenting as our leading illustration in this issue a half-tone portrait of Mr. Fred J. Kiesel, of Ogden, Utah, the newly elected chairman of the Executive Committee of the 11th National Irrigation Congress. Mr. Kiesel was born in Ludwigsburg, Wurttemberg, Germany, in May, 1841, and left for America in 1857, where he lived in the South until 1862. He crossed the plains in 1863, arriving in Salt Lake City in the summer of that year.

Soon after locating, he engaged in mercantile pursuits, freighting and forwarding to Montana and Idaho. Mr. Kiesel was very active at the front of the line of construction of the Union Pacific, Oregon Short Line, and the Utah and Northern railways and subsequently in 1879 moved to Ogden, where he has since been engaged in the wholesale grocery business, also in the manufacture of salt and in various irrigation enterprises, agriculture, horticulture and the breeding of fine cattle and horses. He is also heavily engaged in the bottling of a natural mineral water known as the "Idan-ha"

HON. FRED. J KIESEL, OGDEN, UTAH.
Chairman Executive Committee, 11th Irrigation Congress.

at Soda Springs, Idaho. The wholesale business carried on by the firm of Fred J. Kiesel & Co. is one of the largest in the Inter-mountain section; goods being distributed in Utah, western Wyoming, Nevada, Idaho and Montana. Mr. Kiesel is a prominent member of the Lutheran Church, has been active in politics as a democrat, has filled the office of mayor of Ogden, was a member of the Constitutional Convention, member of the National Commission from Utah to the World's Fair, Chicago, and was also a member of the upper house of the legislature. Mr. Kiesel states that he is now retired from active politics and intends to devote all activity left him to irrigation and the further development of his jobbing business. He is a man of extraordinary activity and push and is all-round interesting and com-

panionable. We will devote some space in future issues to the irrigation enterprises in which he is the leading spirit.

GEO. H. MAXWELL.

Mr. George H. Maxwell is given the following editorial notice in the *Denver Republican* of October 10, under the heading: Mr. Maxwell and The Irrigation Congress.

It would be base flattery to assert that the sum total of what was accomplished at the Irrigation congress, whose session has just closed at Colorado Springs, will have any great bearing on the solution of the great practical questions which confront the people of the West. Indeed, if we were called upon to express an opinion, we should be inclined to say that it was of very much more consequence in the exploitation of the feelings, prejudices and ambitions of its ruling spirits than it was calculated to promote the objects at which it was professedly aimed.

The power behind the throne and, indeed, frequently in front of the throne, was Mr. Maxwell, who has for a number of years been conspicuous in irrigation matters. Mr. Maxwell is a man of plausible exterior and good address. He has a tongue between his teeth that many good public speakers might envy. He lives in good style and occupies himself exclusively in irrigation matters. Precisely how he lives so well without any visible means of support and how he can afford to devote all of his time to such affairs without a private fortune to back him is not too clear to an inquiring mind. But the fact remains that he does it, spreading the irrigation propaganda throughout the country not only through his Washington weekly paper but through visits and speech-making in the arid regions of the West. Just where he always stands on the irrigation question is not so self evident as a mathematical demonstration. He opposed the existing federal irrigation law with all his powers until he discovered that its passage was a foregone conclusion, when he came in out of the wet with such a sudden right about face as furnished food for laughter to the ungodly.

Since then he has apparently assumed full charge of the work in the West, although not carried on the government pay roll or in anywise in the employ of Uncle Sam. He has been everything and all of it, deciding where reservoir sites are to be selected and when they are to be built. In some sections of the arid region the impression prevails that he is a sort of foster child of Uncle Sam, and whatever he says goes with his gifted parent. There is no foundation in fact for the impression, but Mr. Maxwell does nothing to destroy the delusion. As a matter of fact, he does what he can to encourage it by adroitness and indirection.

It occurred to the astute and industrious Mr. Maxwell that so long as he was about it he would entirely eliminate the agricultural department. If he needed an official back door he would utilize the geological survey. It was for this reason that he sent no invitations to any of the eminent gentlemen connected with the agricultural department to attend the irrigation congress. Fortunately two weeks after the other invitations had been sent out other people saw fit to attend to that duty for him. But even when they came his fast and loose programme was so arranged that they would be eliminated, and it looked as though they would return to headquarters with their undelivered speeches quietly reposing in their inside pockets. And he very nearly succeeded in his design. But in such a gathering as an irrigation congress such men as Elwood Mead and Willis Moore have many friends. These finally discovered the conspiracy afoot to eliminate them, and under the skillful management of Ex-Senator Carey of Wyoming, backed by a great majority of the Colorado delegates (among others), Mr. Mead was briefly heard and Maxwell's scheme of fusing with the Transmississippi congress was voted down with singular enthusiasm.

Mr. Maxwell is doubtless a valuable man in his own way and his own sphere, whatever it is, but so far he has only succeeded in placing the geological survey in a false attitude before the public and perhaps arousing a spirit of antagonism in the two branches of the public service. If this should prove to be true, it would be exceedingly unfortunate for the arid region and for the cause of irrigation. Its baneful effects would be directly traceable to too much Maxwell, for that gentleman without any apparent official authority is assuming everything and placing Mr. Maxwell in an odd and indefensible attitude before the people of the West who have high hopes, even though they may never be realized, for the reservoir bill that recently passed congress.

The Queen Ranch Rider of the West is Miss Annie Pantenburg, of Sidney, Nebraska. She is a tall, winsome lass of nearly eighteen years and weighs one hundred and thirty pounds.

Her father was an old-time freighter between Sidney and the Black Hills in the days when Indians, buffaloes and road agents were as plentiful as jack rabbits. Later he became an extensive ranchman. As a child little Annie was his right bower, because she was a fearless rider and an expert in stock marks and brands and all matters pertaining to the range.

She took to this life as naturally as a young duck to water, and never is so happy as when mounted on her favorite saddle horse and engaged in the manipulation of stock on the range. Since her father's death, three years ago, she has had entire charge of the ranch; buying, selling, roping, branding and breaking her stock for the eastern market.

Coupled with the fearless disposition inherited from her father, she has acquired a rare skill in horse wrangling. Single handed and alone she will rope, hobble, harness and hitch the wildest member of the band and in a very brief time have him going a sober gait that would put to shame the work of many a professional masculine horse wrangler. She also loves a trotter and any evening can be seen speeding a favorite black which gives every indication of being heard from on the grand circuit when his education has been perfected.

Notwithstanding so much of her young life has been spent in the saddle, she has found time to acquire a good business education. She is a book-keeper, can figure out the interest on a note, draw up a bill of sale and mortgage, measure a stack of hay and figure the number of tons, and write a beautiful letter in a hand like copper-plate.

Miss Pantenburg is a magnificent specimen of a western ranch queen. She neither sings, nor does she play the piano; the only music in which she delights is the jingle of her spurs and the rhythmic hoofbeats of her trotter as she speeds down the avenue. She drives the finest and fastest pair in Sidney and takes nobody's dust on the course.

LATERALS AND THEIR MANAGEMENT.

BY E. H. PARGITER, SUPERINTENDING ENGINEER, IRRIGATION BRANCH, PUBLIC WORKS DEPARTMENT, DELHI, INDIA.

The natural method of irrigating a tract of land, of conveying to it the life-giving streams of water from one main source of supply, and distributing them to every part, can best be learned from the similar processes we see in the vegetable and animal world. Here the body or substance of a plant or animal is irrigated by its sap or blood. The main source of supply is repeatedly subdivided into smaller and smaller channels, until the network of these is spread over the whole body, and every cell has a supply brought to it. The same principles will everywhere work out the same results. Consequently in all irrigating countries, we find the same process of a canal branching off into a system of distributaries or laterals, each of which in turn gives off field water courses, to supply every little plot of ground with the water it needs. This, obviously, is the only plan on which a number of different interests can combine, each in the first place seeking its own interest; but in the combination mutually seeking the best interests of all.

MR. EDWYN H. PARGITER, DELHI, INDIA.

But what is not so obvious is that this same principle of mutual co-operation must be carried out to the very end, in order to ensure the truest economy in the use of the water, and the highest efficiency in most expeditiously conveying it to every plot of ground to be irrigated. The same principles that have, in India, worked out rules for the maintenance and management of laterals and watercourses, are now working out the same rules in America. Co-operation has been found to be the necessary preliminary to successful working of a lateral. The supply of water required for several different farms or estates, can be utilized to far greater advantage by each receiving the whole supply for its share of a certain time, rather than by each receiving its share of the supply continuously for the whole of that time. The advisability of such a system of rotation of supplies is now as clearly recognized in America, as in India. But the joint use of a common channel by several owners necessarily involves its maintenance by them jointly also; and it is as to the best and fairest method of apportioning to each user his proper share in the work of maintenance, that differences of opinion arise, and shareholders disagree; with the result, often, that the whole, or part, of the common channel is not kept in proper order, and some, or all, suffer by receiving a poorer supply of water than they might. This is due to a perverse and short-sighted trait of selfish human nature, whereby each irrigator fails to see why he should be called on to do work which at first sight does not seem to benefit himself, but only others.

Now the management and maintenance of a lateral is very rightly made over to the users of that lateral, as they are most directly concerned in its being always kept in good working order, and are always on the spot to see to this being done. But what they often fail to see, is the necessity of co-operation in the whole of the work, in the maintenance of the whole of the common channel. The irrigators at the lower end, or tail, can quite see the justice of their doing their share in the maintenance of the whole lateral from its headgate down to the end where they receive water. They will help in clearing the whole channel of silt and weeds, and in repairing breaches or strengthening weak banks along its whole length. They quite acknowledge the fairness of their bearing a share in the cost of bringing the water they require from the canal to their land. But an irrigator, who takes off water higher up the course of the lateral, often cannot see why he should do a single stroke of work for, or bear any part of the cost of, clearing or repairing the lateral, below the point where he takes off his water. In consequence he fights hard against any rule requiring him to help in this way; holding that it is other people's work, and that it is none of his business to do work for them, which does not benefit himself.

Now if each irrigator from a lateral were allowed to neglect that portion of it beyond his own land, the burden of maintenance would vary for each according to the distance of his land from the head of the lateral, and might come very heavily on those at the lower end; so much so as to limit very soon the practicable working length of a lateral; and consequently the number of shareholders in it; and so, also, the quantity of water carried in it. But the smaller the channel the less efficiently and economically it will work; the greater will be the proportionate share of cost to each shareholder, and the less the available supply of water in times of scarcity. At such a time, indeed, when the whole supply is taken in rotation by each irrigator, each has at his disposal a larger supply in the case of a larger channel, and can irrigate more land in a short time than he could with the smaller supply of a smaller channel in a proportionately longer time. The irrigators along the upper end of a lateral will thus directly benefit by having many others as sharers lower down; and in consequence they can fairly be expected to help those others in maintaining the whole length of the lateral, from which they thus benefit. Even if each irrigator along the upper portion never requires to take the whole supply, still he reaps the benefit of using a larger and more efficient channel involving a proportionately smaller cost and trouble to maintain.

As it would be quite impossible to ascertain and apportion correctly to each shareholder the exact length of channel he should help to maintain, after calculating the exact benefit he derives from having so many other shareholders using water beyond the point he takes his off, the only reasonable and feasible plan is to make all equally responsible for the maintenance of all common channels; each having his share allotted proportionately to the area of land he irrigates; or to the quantity of water he uses, where different crops require very different quantities of water. Every portion

of the channel, conveying water to more than one shareholder, is to be considered part of the common channel, and all shareholders are to be responsible for its complete maintenance. Where any watercourse branches off for the land of one shareholder alone, that watercourse would not be common, but belong wholly to that shareholder, and he alone would have to maintain it; no other could be called on to help in its cost. This principle is now generally recognized everywhere as the only reasonable and efficient way of working laterals. In India it is not clearly laid down yet, by laws or regulations, but it is usually acted on; though often enough it is resisted successfully by powerful men, who take water from the upper portions of a lateral, where the irrigators lower down are unable to influence them, and will not seek the aid of the canal authorities for fear of arousing the enmity of their more powerful neighbors. But it is very clearly the only principle that can be fairly allowed in justice to all shareholders; and none are overburdened in comparison with others. It may sometimes appear necessary to modify it in cases where the land at the upper end is high and not readily commanded by the water, while the land lower down lies low and is well commanded at all times. But even in such cases no modification is required or would be fair. For when it is the turn of the higher land to take water the whole supply can then be given it; and though the land may be so high as to allow of only a slight grade or slope in the water surface from the lateral head on to it, yet this whole supply will irrigate it in a reasonable time, whereas a partial small supply never would. The time allowed for the turn would, of course, have to be longer than that for lower lying lands towards which there would be a greater velocity of the water in the lateral, and so a greater quantity of water-flow in a given time, but the share in the cost of maintenance would not then depend on the time of the turn, but on the area of land irrigated, and the quantity of water used. The owner of the high land would thus very largely benefit by there being many other shareholders in the lateral, and should, of course, help them in maintaining their longer channel, as their larger supply of water helps him. He can irrigate more land and do it more efficiently and rapidly by being one of many shareholders in a large lateral, than he could if he had only a small, separate, short lateral of his own. Experience has clearly shown that but little can be done with a continuous small supply, in comparison with what can be done with the same total quantity of water used in a larger body for a shorter time.

As these shareholders who take water from the upper portion of a lateral so evidently benefit from there being other shareholders lower down, it is clearly only just and proper for the former to join with the latter in the maintenance of the channel further down. And no way of apportioning to each his share in the cost of maintenance can be found so practical and fair as the extremely simple one of considering as common channels, for the maintenance of which all shareholders in the lateral are jointly responsible, all portions of the lateral which convey water to more than one shareholder; and of apportioning to each a share in the cost according to the quantity of water each uses; which again will be usually according to the area of land each irrigates. This will be true mutual co-operation both in the benefits of irrigation, and in the cost and trouble of obtaining those benefits.

But it may happen that when some clearance or repairs must be promptly carried out, some of the shareholders will refuse to join the others in doing the required work; it may be, because they have other urgent work in hand or even from sheer obstinacy. As they cannot be allowed either to delay the work by making the others wait their convenience or whims, or to escape bearing their fair share of the work, if the others do it without their help it becomes necessary to provide legislation to insure such cases being properly attended to so that irrigation shall not suffer. In the Northern India Canal Act, No. VIII., of 1873, this matter is efficiently dealt with. It is enacted in Section 19 that when the necessary maintenance of any watercourse is not being done, any shareholder may apply to the officer in charge of the canal, stating the case. The canal officer will then issue notice to all the shareholders to attend on a certain day that he may investigate the case. He does so on that day, no matter how few of the shareholders may attend, and if he considers that the work is necessary, he may issue an order directing it to be done at once. Such shareholders as are willing to get the work done can then at once get it carried out, either by themselves, by hired labor, or by contract work. When completed an account of the total cost is given to the canal officer with a statement of expenditures incurred by each who has contributed. He then apportions the total cost among the shareholders according to their shares, and directs all who have not contributed their share to pay up within a certain time; and then such as have contributed more than their share are recouped for the excess incurred by them. Should any one not pay up as ordered, the money is recovered from him by process of law. If the shareholders who institute the proceedings are not in a position to do the work themselves, or bear the cost of it, the canal officer may, on their request, get the work done himself, by hired labor or contract, and then recover the cost from the shareholders as stated above.

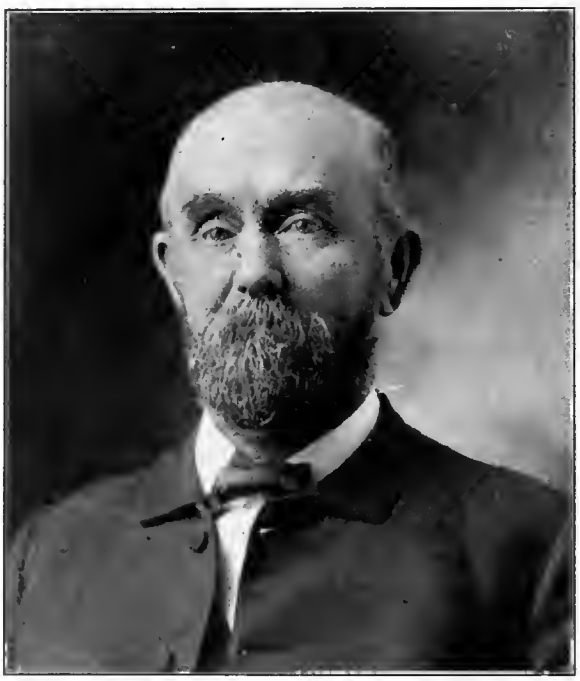
This procedure proves prompt and effective; and the people freely avail themselves of it. In India, the canals being mostly owned and administered by government, such legislation is readily provided. But in America, with privately owned canals, the difficulty of getting such legislation provided by a State may be considerable. The canal management must then have recourse to by-laws; which can be arranged to suit the requirements of each canal. Before being given a share in a lateral, and a right to take water from it, each would-be irrigator should be required to sign a common agreement for the lateral, binding themselves to abide by and to carry out the principles explained. In the case of irrigation already established it may be difficult to get perverse or obstinate shareholders to agree to these conditions, in their ignorance of the benefits to be derived from mutual co-operation, but by leaving them severely alone, to receive only their small share of the supply continuously, instead of being allowed a turn in the whole supply, they should soon find out their mistake. Public opinion and social pressure may also often be brought to bear on them; and as each such case can only be treated on its own merits, no general advice can be given; there will generally be found some means of inducing refractory people to see that their own best interests will be in a line with the public good. But in the case of new irrigation the way is clear and the remedy prompt and efficient.

Still, even if cases could be brought forward to show that in them these principles and conditions did not apply, they would be only the exceptions that may be said to prove the rule. It is, after all, only a matter of applying to laterals the same principles of government that all communities recognize as necessary for their existence and well being. The contributions of all go into a common fund for the common good of all. A man would not have his State taxation reduced because he could show that he derived less benefit from the government than another man who paid less in taxation. In all such matters of individual and exceptional detail we must act on the motto *"de minimis non curat lex,"* if anything at all is to be done.

August 27, 1902.

GEO. L. M'DONAUGH.

We show in this issue a half-tone photo of Mr. Geo. L. McDonaugh, Colonization Agent of the Union Pacific railway. Mr. McDonaugh is one of the successful men in this line of business and is known all over the West as a hustler in the truest sense of the word. The special prominence attained by the colonization department of the Union Pacific Railway during the past two years is attributable in part to the efforts of this gentleman. Those wishing information on subjects pertaining to Colonization can address Mr. McDonaugh, care E. L. Lomax, Omaha, Neb.



GEO. L. MCDONAUGH,
Colonization Agent Union Pacific Ry, Omaha, Neb.

Richard Harding Davis went to Spain to attend the coronation and see the great coronation bull fight. He has witnessed bull fights also in many Spanish-American countries. In the Christmas *Scribner's* he has a satirical article called "The Gentle Art of Bull Fighting," in which he advances a special claim for a new hero of the bull fight, the humble chulo who sweeps up the debris in the ring.

WHAT IT COSTS TO PUMP WATER.

J. J. VERNON, IN DENVER FIELD & FARM.

An experiment was undertaken with the three following points in view: First, the development of a water supply from the underflow in sufficient quantities for irrigation purposes. Second, a test of the efficiency and economy of different makes of pumps. Third, the determination of the cost of irrigating different crops by pumping, under varying conditions of drouth. One six-inch well forty-eight feet deep with a slotted strainer located in a twelve foot gravel stratum furnished over 800 gallons of water a minute or something over 6,400 cubic feet an hour at the rate of 177 cubic feet a second.

At the end of a thirty-hour continuous run there was no sign of a diminution of the water. During this run 63 acres of alfalfa were irrigated in 23 hours and 45 minutes at a cost of $1.30 an acre for fuel. This field was irrigated on June 5th with river water, but had received no water from that date until irrigated by pumping on July 30th, 55 days later. The ground was very dry and cracked open quite a depth. Since at this season of the year alfalfa is usually irrigated once in from 14 to 21 days, it is quite probable that twice the quantity of water was required for the irrigation that would have been necessary under normal conditions.

Taking this as probably true, the cost of irrigating alfalfa would amount to about 65 cents an acre under normal conditions of dryness and frequency. It is no more than just that I should add that this run was made with inferior fuel and the cost is likely to be less rather than more. The following figures are based on a cost of about $2.25 a cord for wood. Computations from the data obtained from the tests that have been made will no doubt be of interest, though incomplete, and are as follows:

Cost of fuel for irrigating alfalfa, covering the surface of the ground: One inch deep 19½c an acre. Two inches deep 39c an acre. Two and a half inches deep 49c an acre. Three inches deep 58½c an acre. Three and a third inches deep 65c an acre. Six inches deep $1.17 an acre. Six and two-thirds inches deep $1.30 an acre. Area that could be irrigated in twenty-four hours, covering the surface of the ground: One inch deep 42 acres; two inches deep 21 acres; two and a half inches deep 16 4-5 acres; three inches deep 14 acres; three and a third inches deep 12 3-5 acres; six inches deep 7 acres; six and two-thirds inches deep 6.3 acres.

Size of farm that could be irrigated by running twenty-four hours each day if an irrigation be given to the successive fields every fourteen days, covering the surface of the ground: Two inches deep 294 acres; two and a half inches deep 235½ acres; three inches deep 196 acres; three and a third inches deep 176 2-5 acres; six inches deep 98 acres; six and two-thirds inches deep 88 1-5 acres. Size of farm that could be irrigated by running ten hours each day if an irrigation be given to the successive fields every fourteen days, covering the surface of the ground: Two inches deep 122½ acres; two and a half inches deep 98 acres; three inches deep 81 2/3 acres; three and one-third inches deep 73½ acres; six inches deep 40 4-5 acres; six and two-thirds inches deep 36.7 acres.

Renew your subscriptions to the IRRIGATION AGE for 1903.

PRACTICAL IRRIGATION—ADVANTAGES OF GARDEN AND ORCHARD IRRIGATION.

BY JOHN M. IRWIN.

Sup't Agencies, Stover Mfg. Co , Freeport. Ill.

The object of this article is not to instruct those who are interested in reclaiming large areas of our arid plains, who depend on the Government or corporation water canals for water, but to point out to the farmers and gardeners the advantages of irrigation.

Dry seasons are not unusual in every part of the United States, therefore irrigation is advantageous and profitable in all parts of the country in dry years. It is in dry years that irrigation becomes indispensable in making good crops. Every farmer and gardener knows that, were he in position to supply artificially enough water to his land to make up the deficiency of the rain fall, he would be able to harvest full crops. How is this to be done, and can it be done? In answer to the first question the reply is, make a well that will furnish enough water, then build a good earth reservoir of suitable size and puddle it thoroughly so that it will not leak, and then put in a good pumping plant. With such a preparation, start the pump and fill the reservoir with water. Always keep the pump running when the reservoir is not full, so as to be prepared with a good supply of water for use when wanted.

The answer to the question, "Can it be done?" is not as easily given. Has a well been made or can one be made to furnish enough water? How high must the water be raised, how much land is to be watered and what is the deficiency, in inches of rain fall? The quantity of water the well supplies, if all is taken out, will determine the amount of land that can be irrigated. The power required to pump a given quantity of water in a given time depends on the perpendicular distance from the water level in the well to the highest point of delivery. It requires twice as much power to lift one gallon two feet high as to lift it one foot high. It also costs twice as much power to lift enough water for two acres, one foot high, as for one acre, one foot high. It will also require twice as much water to complete the irrigation if the deficiency of rain fall is ten inches as it will if the deficiency is only five inches.

The system of irrigation by means of pumping plants has been so simplified in this country that in the states of Louisiana and Texas thousands upon thousands of acres grown to sugar cane and rice are irrigated entirely by pumping plants. In California many of the great fruit farms, and not a few of the grain farms, are irrigated by pumping plants. It was during the dry season of last year (1901) that the need for irrigation was felt by the farmers over such a large area of this country. The field crops were generally cut short and gardens were nearly or quite destroyed, and the fruit crop, also, was very generally injured by the drouth. The loss of vegetables and fruit would have been prevented by the use of pumping plants, and the loss sustained from failure of fruits and vegetables in the year 1901 would have gone a long ways toward the cost of enough pumping plants to have made such failure impossible. As a result of last year's drouth, and lack of means to irrigate and save the vegetable and fruit crops, these articles of food were extremely scarce and very high in price; so much so, that while large importations of them were made from foreign countries, still the great mass of people did not enjoy as much as could have been economically consumed. It is to emphasize the value of irrigation as applied to small areas, such as gardens and orchards, that this article is written.

It may be said that the Germanic races, which include Americans, look upon irrigation as something needed to insure crops in the arid section of the coun-

IRRIGATION MILL AND RESERVOIR.

try, but of no value elsewhere, and forget that aridity and dryness are synonymous terms. Large sections east of the Missouri river became arid last year (1901); so dry that all vegetation withered and died. For the time being the area of aridity had enlarged to enormous proportions and the same system of insuring the crops in Colorado, Arizona and California would have insured the crops in Missouri and Illinois. But to insure success in any new undertaking it is necessary to begin in a small way, and as experience is gained, increase the operations.

As the vegetable gardens and orchards contribute so much of the necessaries of life, prudence suggests that to guard against injury or failure from drouths an irrigation plant of sufficient capacity should be installed by every farmer. The time to do this is when conditions are favorable. Some preparation must first be made and the necessary means provided. It is not prudent to delay until the drouth comes, but in time of good opportunity provide the irrigation plant.

Once having become familiar with irrigation, from its use in the garden and orchard, it could be easily extended to the field crops, by increasing the capacity of the plant. There is no better nor more economical power than the wind mill for operating a pump for raising water for irrigation. Many farmers already own one or more wind mills and by making a reservoir to store the water, could, without much cost, irrigate their

gardens and orchards, when a dry season set in. A pumping plant for irrigating will be equally serviceable for supplying stock water, since the drinking troughs may be supplied from the reservoir. In fact, the earth reservoir is the best for storing water. It is simple, easy and convenient to combine the work to supply water for the garden and orchard as well as for the stock. The small irrigation plant that takes care of the garden and orchard soon pays for itself, even though neither vegetables nor fruits are grown for the market. The saving in the purchases made necessary for the table, in the absence of vegetables and fruits from a good garden and orchard, will soon amount to as much or more than the cost of the plant.

The writer knows of instances where the irrigation plant was used for growing both fruit and vegetables for the market and for both industries produced enough to pay for the cost several times over, the first year. It is in arid countries, as well as during dry years, that vegetables and fruits are so scarce and sell at such high, and for the irrigator, remunerative, prices.

It is an old adage which says, "In time of peace prepare for war." May one not be permitted in these times of plenty to say, "In time of prosperity prepare for dry seasons," and suggest the best time to install an up-to-date irrigation plant for the garden and orchard is this year, and thus insure for the future full crops? To delay means, wait until the dry season arrives. To do so means great haste, and too often overlooking essential features that may greatly lessen the proper efficiency of the plant.

This is a practical age and ours are the most practical people in the world. Practical people provide against uncertainties, therefore prudence decrees that irrigation must intervene to save the crops in dry years in the humid sections. Wisdom ordains that the fertile soils of our great arid regions must be made fruitful by irrigation to supply homes for other millions.

THE RIO GRANDE VALLEY.

The following letters will be interesting to many of our readers along the Rio Grande river as well as many others who advocate dams as against pumping plants. It will be worth the while of manufacturers of pumping machinery of all kinds to study conditions in the valley of the Rio Grande river.—Ed.

The Irrigation Age, Chicago, Ill.:

Following the line of pumping irrigation which I am pleased to note you are following very closely, I enclose you a letter we received from Mr. Samuel J. Hensley of Presidio, Tex., which may be of interest to your readers, coming as it does from a man of as wide experience as Mr. Hensley.

Respectfully,

J. A. SHARP,
Manager, Rio Grande Land & Imp. Co.

PRESIDIO, PRESIDIO COUNTY, TEX., Nov. 15, 1902.

Rio Grande Land & Imp. Co., El Paso, Tex.:

DEAR SIR: Without the honor of an acquaintance with you I beg the liberty of addressing you a line on the subject of Agriculture and Irrigation in El Paso Valley. To begin with I am a Californian. A son of the land of gold, flowers, fruits and progressive people. I have watched the growth of that land of beauty from 1853 to this the day when the efforts of the most intelligent, most metropolitan people on earth have produced what is about as near a "Garden of Eden" as we are likely to know in our day. I was raised on the banks of irrigation ditches and bathed in them when a child. I am the first man that ever placed a trancet on the Swilling Canal, the first and original (American) canal in the Salt River Valley in Arizona, following the course of the old Aztec Canal, where Phoenix now stands. I have since that time taken two canals from the Rio Grande and been connected with other enterprises of that nature.

With that experience and the fact that I have been an agriculturist all my life, I feel that my views on the subject of Irrigation in the Rio Grande Valley may be of some worth, and have decided to give you an opinion without the asking, which I hope may at least serve to increase your faith in the new enterprise of which I see you are at the head.

The Big Dam at El Paso will be a failure and a menace to the city and valley as long as it holds any considerable quantity of water, which will not be very long, as the slickens (sediment) will equal about 1/20 of the water that flows into the basin with the result that within 10 years it will be filled to the top of the wall, making a more or less level valley the size of the space covered by the water when the dam is full. This deposit can not be flushed out, as claimed by the supporters of the enterprise. After the basin fills there will be left only an interesting waterfall which may be utilized for generating electricity or other power, nothing more, and the International Dam will have served the sole purpose of giving employment to an army of laborers and inflating values of real estate for the time, which may or may not be good for the growing city of the Southwest.

On the other hand, I predict that your enterprise for supplying the valley with water by means of pumps is entirely feasible and that you will meet with great success, and that you will do more for El Paso than all the dams that may be built in the years to come on the Rio Grande.

There is still another feature in your favor which many gardeners will agree is of much importance. The muddy waters of the Rio Grande are sure destruction to many plants. The fine sediment covers the leaves and the plants die. It is worthless for the irrigation of flowers of many kinds. It rots tomatoes, onions, melons and lettuce, and cabbage plants are often destroyed by being covered with the slime from the water. I own a large farm at Paloo in this county which is irrigated from a ditch from the river, and I know what I am writing about. The alluvial deposit which the water brings to the land is good for the land, of course, but the difficulties it brings are more than an offset to the advantages.

I have simply written you this letter to encourage you in the good work you have commenced for the good that others will receive from your efforts and with the hope that it may serve you some good in your undertaking. I have had two struggles with canals from the Rio Grande and frankly own that I have more faith in pumps than dams, and if I had used pumps in the beginning I would be wealthy to-day, whilst as a matter of fact, I am land poor through trying to dam the river until now in despair I say D—n the river, and will put in a pump as soon as I can get one.

Respectfully,

Your obt. servt.,
SAMUEL J. HENSLEY.

PROF. ELWOOD MEAD'S REPLY TO GEO. H. MAXWELL'S ATTACK.

An open letter to the delegates to the National Irrigation Congress at Colorado Springs, October 6-9, 1902.

WASHINGTON, D. C., October 15, 1902.

GENTLEMEN: Those of you who were present at the Wednesday evening session of the Congress will recall that after my statement of what the Department of Agriculture is doing for irrigation an address was made by Mr. George H. Maxwell criticising the irrigation work of this Department. The lateness of the hour and my enforced departure before the next session of the Congress prevented any reply at the time, although I very much desired to make this because silence on my part might be construed to be an acquiescence in his statements. Since then, I have concluded, in justice to Secretary Wilson and the work under my charge, to reply to the portion of his address which is regarded as uncalled for and unfair, and this can be most conveniently done in an open letter.

Although several of Mr. Maxwell's criticisms were by implication rather than by direct statement, the impression which he sought to convey seemed to be:

That I had, officially and otherwise, opposed the passage of the National irrigation act.

That the Department is carrying on a propaganda to force other arid States to adopt the Wyoming code of irrigation laws.

The paragraph which he objected to will be found on page XCII of the Secretary's report for 1901:

"If the States are to control the water supplies, there should be satisfactory assurance that whatever is made available by public funds shall benefit the actual users of water and not enrich the holders of speculative rights. In some States there is such assurance. These States are entitled to National aid, because it is known from present conditions that such aid would be clearly beneficial. But there are other arid States where the doctrine of riparian rights jeopardizes the success of every irrigation work now built, as well as any works which the Government might build. In other States rights have been established to many times the existing supply, yet there is nothing to prevent new claims being filed, new diversions made, and unending litigation over the conflicts thus created. For the Government to provide an additional supply on these streams before existing controversies are settled would simply aggravate and intensify the evils of the present situation. Whatever aid Congress extends should be conditioned on the enactment of proper irrigation codes by the States, and be made to promote the greater efficiency and success of such laws rather than interfere with their operation."

No one will question that this deals with one of the most important problems of Western irrigation and that, if the facts are as stated by the Secretary, it was his duty to submit them to Congress and the Nation. To have withheld this information would have subjected the Secretary to just criticism, because it has a vital relation to any irrigation legislation. The only question which can be raised regarding this paragraph in the Secretary's report is as to whether or not the conditions described exist. Mr. Maxwell said *they do not*. In this, he is contradicted by President Roosevelt, whose support of National irrigation he cannot well question, and who, in his first message to Congress, describes these conditions in stronger language than Secretary Wilson used. I desire that every one interested in this discussion shall compare the following quotation from President Roosevelt's message with the above paragraph in Secretary Wilson's report, in order that there may be no mistake regarding their agreement: (The *italics* in this and all other quotations are mine.)

"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, 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 constitutions the doctrine of perpetual State ownership of water.*"

If Secretary Wilson's statement is untrue, the President's message is untrue, but both are true. They are supported by the reports of the State engineers of Colorado, Nebraska, Utah and Idaho, and by Mr. Maxwell's own State, and by the action of the Water and Forest Association. In a petition addressed to the Secretary of Agriculture, asking for an investigation of the water-right problems of California, signed by the Director of the California State experiment station, by the President of Leland Stanford University, by the Manager of the State board of trade, by the President of the San Francisco Savings Union, the Bank of California, the California Academy of Sciences, and by a large number of the leading business and professional men of San Francisco, the following statement is made:

"We respectfully submit that nowhere in America are there irrigation problems more important, more intricate, or more pressing than in California. Neither are there any whose study would be more greatly instructive. We can offer, we presume, examples of every form of evil which can be found in Anglo-Saxon dealings with water in arid and semi-arid districts. Great sums have

been lost in irrigation enterprises. Still greater sums are endangered. Water titles are uncertain. The litigation is appalling."

The paragraph in Secretary Wilson's report, which Mr. Maxwell attacked, did not affect the passage of the National irrigation act. It did not suggest delay in the passage of this act. It did recommend that the act should contain a clause requiring the arid States to accept its conditions and pass laws providing for public control over the distribution of water thus made available. I believe that such a provision would have been a wise one and that future events will demonstrate this.

It does not matter on what grounds Mr. Maxwell bases his statement that I opposed the passage of the National irrigation act. It is not true. For twelve years I have been an advocate of National aid for Western irrigation. I was consulted by a number of members of the committee of seventeen who framed the National act, and every one of these will bear testimony to my support of the measure from beginning to end. Among these are Senators Warren and Dietrich, Congressmen Mondell, Burkett, Sutherland, Newlands and Shafroth. While I did not regard it as a perfect measure I advocated its passage, believing that future legislation would cure its defects. I challenge Mr. Maxwell to name a single member of either house of Congress to whom I ever spoke in opposition to this act. He cannot do this, because there was no such opposition either in word or thought.

There is no foundation whatever for the statement that I am attempting to force other States to adopt the Wyoming code of water laws. I have urged that titles to water should be established by some systematic and orderly procedure, as land titles are, that the water of Western rivers should be under public control and be divided by public officials, that rights to their use should be limited to the actual needs of users, and that with every irrigated farm should go a right to the water which makes it productive. In doing this, I am simply advocating policies which the experience of all irrigated lands has shown indispensable to enduring peace and success. So fas as the Wyoming irrigation code embodies these principles, it is a good law, and the same is true of the Colorado irrigation law, the Nebraska irrigation law, the Canadian irrigation law, the Australian irrigation law, and the irrigation codes of Egypt and Italy, in all of which these features are found in large measure.

As was explained in my statement to the convention, a large part of the irrigation work of the Department has to do with the practical questions which confront farmers, but it is also gathering and publishing the facts which show the character of different irrigation codes and the results which have attended their operation. We are doing this to protect rather than injure the present users of water, and the appeals of Mr. Maxwell to the fears and prejudices of those who do not understand the Department's work have no basis in fact.

Because of Mr. Maxwell's dislike for me personally, he has in his publications, in letters, and otherwise, misrepresented the work of the Agricultural Department and my views and acts. Before this personal difference arose, Mr. Maxwell repeatedly commended the work of the Department's Irrigation Investigations. In the *National Advocate* of October, 1900, he wrote as follows:

"The excellent work which Elwood Mead, of the Department of Agriculture, and his assistants are doing throughout the West along irrigation lines, is becoming well known. As State engineer of Wyoming, Mr. Mead achieved for his State such an enviable reputation in the irrigated region that his broader work of investigation under the General Government is meeting with much favor and is being watched with deep interest. His first annual report on 'Irrigation Investigation' is just issued, and will be found of great value to the West."

He wrote differently in February, 1902:

"Mr. Mead goes out from Wyoming to California to tell the people of California what they must do to put themselves in shape to get appropriations from Congress for national irrigation works, and he finds the horrible hobgoblin of riparian rights in the way. He prepares a careful dissertation on the laws of water in California in relation to riparian rights, but overlooks the celebrated case of Fifield v. Spring Valley Water Co., 62 Pacific Reporter, 1054, where the Supreme Court of California has established it as the law of that State that a riparian owner can not prevent the storage of flood waters above him, and their appropriation to beneficial use. The magnificent reservoir of the Spring Valley Water Company, on San Mateo creek, from which it supplies water to the city of San Francisco, stands today as a living refutation of Mr. Mead's theories as to conditions in California."

No one in public position should object to candid and truthful criticism, and I have always welcomed it, but the paragraph just quoted is not fair to myself or to the public. One would suppose from reading it that I had gone to California on my own motion and had prepared a report with especial relation to the securing of appropriations from Congress. Nothing could be further from the truth. The report in question was prepared in response to a petition to the Department of Agriculture, asking that I conduct the investigation and promising to pay a large part of its expense, which was done. The facts were gathered by some of the leading irrigation authorities of this country, including the professors of civil engineering in the University of California and Stanford University, and such civil engineers as James D. Schuyler and Edwin M. Boggs, of Los Angeles, C. E. Grunsky and Marsden Manson, of San Francisco, and such students of the legal and economic phases of irrigation as William E. Smythe, of San Diego, and Prof. James M. Wilson, of the University of California. These gentlemen were unanimous in their conclusions and I am willing that Bulletin 100 of the Office of Experiment Stations shall stand as an answer to the criticism quoted above and to those made by Mr. Maxwell at Colorado Springs. Since its publication a commission having among its members the chief justice of the California Supreme Court, an ex-justice of that court, a distinguished member of the California bar, the presidents of Leland Stanford and California universities, the professors of civil engineering in these two unversities, Mr. F. H. Newell, of the U. S. Geological Survey, and myself, has been asked to frame an irrigation code to carry out the reforms recommended by this report. Mr. Maxwell sought to convey the impression in his address at Colorado Springs, and in the extract above quoted, that the water-right problems of California had been substantially settled, but the Commission asked to frame this law think differently. They have recently issued a report from which the following is quoted:

"If it be the unalterable law of this State that an owner of riparian land may, as at common law, prevent any one above him from taking any water out of the stream for beneficial use, merely that the stream shall flow past his place undiminished in quantity,

and whether such riparian owner can put the water to a beneficial use on his land or not, then no legislation that we may suggest, or the legislature enact, will materially relieve the situation. If that be the law, and it cannot be changed or modified, there is probably no water in any stream in the State that can be legally appropriated, and the right to the use of water that has been appropriated heretofore has only been acquired by the sufferance of riparian owners or their neglect to assert their rights. The enforcement of such a law would be disastrous in the extreme. The majority of the Commission do not believe, if this is the law of the State, as declared by the Supreme Court, that it cannot be changed by the legislature."

This is not my statement. I have not been able, much to my regret, to attend the meetings of the Commission and had no share in the preparation of this report. The conclusions above expressed are those of able jurists, and Mr. Maxwell once agreed with them, as can be seen by reading a brief he filed in th United States Court of Appeals in San Diego Flume Company v. Souther et al. The following quotation shows how different were the views he held before he began his attempt to eliminate the irrigation work of the Agricultural Department:

"The uncertainty as to what the law of California is as to the source, nature and extent of a right to the use of water and the status, under the Constitution, of a water company distributing water for irrigation, on the one hand, and the irrigator, using the water, on the other, is a great public detriment to California, *retarding both investment in the construction of irrigation work and the settlement of irrigated lands;* and as it now stands it is to be feared that the decision in this case will rather intensify that uncertainty."

There has been no important change in the laws and no new interpretation given since the above statement was made, to bring about Mr. Maxwell's conversion to the opinion that California needs no reform in its irrigation laws.

One of Mr. Maxwell's grievances is that I entered the Department's service from Wyoming. He apparently does not like that State or any of its citizens. In the supplement to the *National Homemaker* for March, 1902, he voices this feeling as follows:

"The fact should be borne in mind that it seems to be always an influence coming from Wyoming which makes trouble whenever the effort is made to get through Congress legislation which would insure the settlement of the public lands by small farmers.

"Wyoming was for years the storm center of the theory of State cession. The ablest argument in its favor ever presented was the paper read by Elwood Mead, then State engineer of Wyoming, before the American Society of Irrigation Engineers at Denver, some years ago. Failing to get State cession, the Mead-Mondell Leasing Bill was brought forward as an alternative. This bill raised such a hornet's nest of opposition in the West, and even in Wyoming, among the small settlers, that Mr. Mondell himself, who had introduced it, moved to lay it on the table."

Now, what are the facts? A Wyoming Senator secured the passage of the Carey Act, which has done more to promote settlement than any law passed by Congress in ten years preceding the National irrigation act. Under it, land must be both lived on and cultivated before the Government parts with the title. No man has done more to promote irrigation legislation than Senator Warren, of Wyoming, and when this attack on the State of Wyoming was written every member of its delegation was working with all the zeal in his power to secure the passage of the National irrigation act, Mr. Mondell having charge of the bill in the House.

Mr. Maxwell speaks of a paper of mine as an argument in favor of cession. It was rather a discussion of land and water laws, with cession urged as a means of reform in their abuses. It was prepared seven years ago when cession seemed the most promising method of securing National aid in development. It was published by Mr. Maxwell in the first issue of his *National Advocate* as one of his opening guns in favor of such aid and was commended by him in a public address. When he speaks of the Mead-Mondell Leasing Bill, he seeks to convey a falsehood without directly uttering it. There never was any such bill. I have been in favor of leasing the public grazing land in small tracts to actual settlers, but Mr. Maxwell could just as truthfully have used this fact to call the Lacey Land Leasing Bill the Mead-Lacey Bill as he could to call the Mondell Leasing Bill the Mead-Mondell Bill, because I had nothing to do with the framing of either of them and never saw either until after they had been introduced in Congress and printed. He could with equal truth have called it the Maxwell-Mondell Leasing Bill, because he formerly advocated leasing, as is shown by the following quotation from an address he delivered in Wichita, Kansas, and published in No. 2 of *The Homebuilder,* issued by the National Irrigation Association:

"The public grazing lands should be leased and the revenues derived therefrom used to build large irrigation works, such as reservoirs, main canals, and great dams or diversion works, which would be beyond the scope of the resources of the land owners."

Judging from the fervor with which Mr. Maxwell now supports the National irrigation act and attacks those whom he claims opposed it, one would suppose it had, from start to finish, received his unswerving support. This was not the case, however. In February, 1902, when it seemed as if the bill would fail, he issued a supplement to the *National Homemaker,* in which he speaks of the bill and its advocates as follows:

"No true friend of western development can contemplate this compromise committee bill without chagrin and humiliation.

"No broad-minded eastern man, who wants the whole country to grow and prosper, can contemplate it without disappointment and disgust.

"Every open and avowed opponent of the National irrigation movement will hail it as a confirmation of the charge that the whole movement is a scheme of speculators and land grabbers to loot the National Treasury for selfish, private profit.

"No one needs a microscope to find the bugs in the bill. They are so plain that he who runs may read. They invite and make certain the defeat of the measure.

* * *

"No western man can justify the bill to the East.

"No bill can be passed without the support of the East.

"*And there you are!* * * *

"What is the use of wasting any more precious time trying to unite the West?

"It can not be united on any measure which the country generally will approve.

"As one of the most influential eastern members of the House of Representatives, who is a friend of national irrigation, provided it makes homes, has said of this bill:

"'It has no more chance than ice in hades!'"

The 17 western members who framed the National irrigation act can answer for themselves whether "the whole movement was a scheme of speculators and land grabbers to loot the National Treasury for selfish, private profit." That is Mr. Maxwell's statement, not mine. If I had said it, I would have expected to be charged with opposing the bill and would have been chary about charging opposition on the part of others.

For more than four years, Mr. Maxwell has been before the country as the head of the National Irrigation Association. He has maintained expensive offices in Chicago and Washington. He has carried on a correspondence bureau from the first named city and run a press bureau and published a paper in Washington in which he has praised his supporters and abused those whom he dislikes. He has given his entire time to his propaganda. It is fair to ask who has furnished the money for this censorship of Congress and of public officials, and what has been the real influence which controls his activities? The San Francisco *Chronicle*, in an editorial, answered these questions:

"'George H. Maxwell of San Francisco, who has been prominent in the National Irrigation Association for years, is the uncompromising foe of the bill and declares that it can not pass. The organ of the irrigation association has published an article against the bill, and this is being used by the eastern enemies of irrigation to show that the western people do not agree among themselves.'

"It is quite time that this so-called 'National Irrigation Association' should be unmasked. It is an association of five transcontinental railroad lines, which each contribute $6,000 per annum to the concern, and it is nothing else whatever. Its agent is this man Maxwell, who spends money lavishly in Washington and elsewhere, ostensibly for the 'association,' and we challenge the proof that the association has ever received any income worth mentioning except from the treasuries of these railroads. If it is a public association, maintained in the public interest, why does it not issue the financial statement usual in such societies? It does not dare to print such a financial statement, and it can not be got to do so. This is no secret. It is perfectly well understood at Washington."

In a subsequent editorial, the *Chronicle* was even more explicit:

"This so-called association seeks $5 annual subscriptions from eastern merchants and manufacturers, and probably does succeed in getting a few—possibly enough to pay the cost of obtaining them. No financial statement is ever rendered to the public. The real contributors to the funds of this 'association' have been the five great transcontinental railroads—the Great Northern, Northern Pacific, Union Pacific, Southern Pacific and Santa Fe lines, each of whom contributed $6,000 a year, making a fund of $30,000 a year in addition to the 'pick up' from other sources. It has the sympathy, and possibly the material aid of private owners of large tracts of irrigable land, some of whom are in Congress. It has the influence to secure prominent politicians to serve as 'presidents' and 'vice presidents,' whose functions are to preside at public meetings and make irrigation speeches. The real power is in the 'executive chairman,' which is a prominent office filled by George H. Maxwell, well known in this State."

I am informed that substantially the same charges were made before a congressional committee. *Mr. Maxwell has never publicly denied them, and I know that he can not truthfully deny some of them.*

PAWNE

There is no reason for criticism of the railway managers for contributing to a movement for irrigation development. They have, I believe, contributed to the support of Mr. Maxwell's association for the same reason that they give reduced rates to home seekers, because they have the same interest as the public in the settlement of the vacant lands to which their lines run. But Mr. Maxwell, with one hand reaching for the railways' contribution, and the other for the $5 annual dues of members in his association, while declaring that "the National Irrigation Association stands for a principle and will inflexibly adhere to it" is another affair.

Since the passage of the act Mr. Maxwell's activities have increased rather than diminished. The character of his labors is described in the Denver *Republican* of October 10, as follows:

"Since then he has apparently assumed full charge of the work in the West, although not carried on the government pay roll or in any wise in the employ of Uncle Sam. He has been everything and all of it, deciding where reservoir sites are to be selected and when they are to be built. In some sections of the arid region the impression prevails that he is a sort of foster child of Uncle Sam, and whatever he says goes with his gifted parent. There is no foundation in fact for the impression, but Mr. Maxwell does nothing to destroy the delusion. As a matter of fact, he does what he can to encourage it by adroitness and indirection."

This statement is made because of a belief in the value of the work being done by the Agricultural Department, and that to have it misrepresented and misunderstood would be an injury to the whole country; because of a belief that Mr. Maxwell's present activities are altogether selfish and that they threaten the working of a beneficent measure. A thorough understanding and investigation of the questions I have raised is desired by myself and all those connected with the irrigation work of the Agricultural Department.

Respectfully, ELWOOD MEAD.

PAWNEE PASS, COLORADO.

In this issue is shown a half-tone photo of the Pawnee bluffs on each side of Pawnee Pass, near Sterling, Colorado, where the citizens of the South Platte Valley hope to see a government reservoir which will store enough water to irrigate 250,000 acres of land below it. As will be seen from the formation shown in photo, these bluffs, which are about one hundred feet higher than the valley or plain below them, curve like two huge horns toward each other, forming a lower

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semi-circle rim to a basin which extends back as a water shed for upwards of 70 miles. The space between these ledges varies from 3½ to 5 miles in width, and it is claimed by those who have made a study of the ground, that by building a dam across between the two promontories a distance of a little over 1¼ miles a reservoir 9 miles long and from 4 to 5 miles in width will be established which will hold enough water to amply supply 200,000 or more acres lying under it. The photo shown was taken expressly for the IRRIGATION AGE to show the formation at Pawnee Pass, through which flows Pawnee creek. The people of Sterling and vicinity are building great hopes on the possibilities of this work being accomplished.

RESOLUTIONS OF THE TENTH IRRIGATION CONGRESS.

RECOMMENDATIONS OF THE COMMITTEE ON RESOLUTIONS.

"The Tenth National Irrigation Congress felicitates the entire American people upon the enactment of the national irrigation act of June 17, 1902, one of the most beneficial and wide-reaching measures in the history of our legislation, and rejoices in the fact that its passage was due neither to partisanship or sectionalism, but to the patriotic and united co-operation of men from all parts of the country, irrespective of political complexion.

"The grateful acknowledgments of this congress are due to Theodore Roosevelt, president of the United States, for his invaluable assistance in the cause of irrigation. His message to Congress in December, 1901, marked the beginning of a new epoch in the history not only of the arid West, but also in that of the whole region. Without his powerful aid and that of his administration it would not have been possible to secure the passage of that great act which will inaugurate and put into erective motion the national irrigation policy for which we have been striving so long. Great as his administration may be, we believe that none of its achievements will rebound more to the greatness of our people and the glory of our country than will the passage of the national irrigation act. We send him our greeting and give him our assurances of our most sincere respect and admiration.

"We appreciate the invaluable assistance rendered to this glorious consummation by, and here express our sense of obligation to, the secretaries of the interior and of agriculture, to the friends of the bill in the Senate and House, and to all who have labored so effectively and unceasingly to secure this inauguration of the policy for the reclamation by the national government of its arid empire—a policy which will be productive of greater good to a greater number than any governmental achievement of modern times.

"This congress, having confidence in the fairness and intelligence, ability and integrity of the administration and in those officials of the interior department to whom is intrusted the execution of the national irrigation act, deem it inexpedient at this time to make specific recommendations regarding the manner of carrying the law into effect, or the policy that shall be pursued in the expenditure of the available funds, and leaves all questions relating to this subject to their discretion and judgment.

"We urge the enactment of adequate national and state laws for the preservation of our forests. Forest reserves should be extended wherever necessary for the preservation of the water supplies; more rangers should be appointed for the protection of the reserves from fire; adequate provision should be made for the prompt extinguishment of all fires; burned areas should be reforested, and the national government should, wherever practicable, utilize its troops as a forest patrol, and, with the co-operation of the states, rigidly guard against forest destruction.

"We call attention to the recommendation of President Roosevelt in his message to Congress, in which he

points out the overshadowing importance of a wise administration of the forest reserves for the perpetuation of the forests and their protection as sources of water supply.

"In this message the president made the following recommendations:

"'At present the protection to the forest reserves rests with the general land office, the mapping and description of their timber with the United States geological survey, and the preparation of plans for their conservative use with the bureau of forestry, which is also charged with the general advancement of practical forestry in the United States. These various functions should be united in the bureau of forestry, to which they properly belong. The present diffusion of responsibility is bad from every standpoint. It prevents that effective co-operation between the government and the men who utilize the resources of the reserves, without which the interests of both must suffer. The scientific bureaus generally should be put under the department of agriculture. The president should have by law the power of transferring lands for use as forest reserves to the department of agriculture. He already has such power in the case of lands needed by the department of war and of the navy.'

"We earnestly urge upon Congress the enactment at its next session of a law which will carry into effect this recommendation of the president in his message.

"We believe that the principles of irrigation and forestry and their relation to our social and economic problems should be taught in all the higher institutions of learning of the country.

"We urge the Legislatures of the several states to provide for a full representation of their irrigation and forestry interests at the exposition to be held in St. Louis, Missouri, in 1904, and pledge them our support, believing that such action will not only prove to be of incalculable educational advantage to the people directly interested, but will demonstrate to our own countrymen and to the world that the estimate which we place upon the importance of forestry and irrigation to mankind is not excessive.

"The Tenth National Irrigation Congress has learned with sorrow of the death of Major John Wesley Powell and mourns the loss as that of one of the pioneers in explorations and studies of the arid region. In particular we wish to express our profound appreciation of his unremitting efforts for national irrigation during the early days of the movement.

"We express our appreciation of the successful labors of the president and other officers of this congress, who have worked earnestly and faithfully, and the results speak for the value of their efforts."

A Californian has placed an order with New Orleans fanciers for all the chameleons he can get at $10 a hundred. He does not want them as a decoration for ladies, nor as dainty dishes for the Chinese, but to rid the orchards of insect enemies. The chameleon lives entirely on insects. Its green color deceives the average insect, and when it shoots out its long, pink tongue, it never fails to hit the mark and capture the game. To them is due the protection afforded New Orleans from the swarms of insects that prevail in that semi-tropical climate. The value of the lizard in keeping down and destroying insects has long been recognized, and the dealers say they have done considerable business in lizards for years, particularly in the East.

THE OLD MILL.

"There's a dusty old mill on the bank of a stream
Where the road winds its venturesome way,
And the waters that urge the old wheel ever seem
As they leap down the rocks with the jolliest gleam
On a midsummer's day, as they're running away,
To be chasing the sunbeams in play.

"But the dusty old mill on the bank of the stream
Sings a song of content thro' the day,
And the miller in white, like the soul of a dream,
Flitting busily on in pursuit of his theme,
Measures time to the lay that the stones ever play,
As the waters go laughing away.

"When the shadows glide out from the trees on the hill,
At the close of a midsummer's day,
To caress and enfold the old moss-covered mill
Till the wheel, soothed to rest, becomes passive, then still,
There are fortunes to weigh that the waters in play,
Have tossed up to the genius in gray.

"Oh! the mossy old mill nestles under the hill,
Taking toll the soft night-breezes pay,
Resting there in the fairylike moonlight until
The quick flashes of dawn its gray spirit shall thrill,
And the glad waters play, ever laughing and gay,
Thro' the wheel all the long, golden day.

—Geo. E. Bowen, in *Inter Ocean.*

When the grafters discovered the other day that the fund available for irrigation reclamation in the West had suddenly grown to $9,500,000 a great gleam of joy overspread the face of nature. Just think of all that money brought so quickly into the grasp of men who a few months ago could not flag a bread wagon and we have some idea of the opulence in store for them.—*Denver Field & Farm.*

The big irrigation project near Wichita Falls, Texas, is already proving a great success. An immense storage reservoir was constructed which is now partly filled. This reservoir forms a lake nine feet deep and covering an area of more than 1,200 acres. When filled the reservoir will be eighteen feet deep and cover 2,200 acres. A complete system of canals and ditches leading from this reservoir has been constructed and next season 20,000 acres of land will be placed under irrigation. No effort at irrigation from this reservoir was made until August of this year, when the water was turned on about two thousand acres and the ground softened so that plowing could be done. Different kinds of crops were planted as an experiment even at that late date, and the results have been simply marvelous.—*Denver Field & Farm.*

When it comes to the actual work of building reservoirs the government at Washington will have to send us out better engineers than those whom we have already seen or we will be threatened with flood and disaster worse than the Johnstown horror. Three parties of geological surveyors are now playing at work in running the lines on the Pawnee site in eastern Colorado. They are a fine set of amateurs in hydraulic work. Recently they started near Jackson lake to run levels. Instead of running a preliminary line to see how the grade could be determined as any of our Colorado engineers would have done, they began the expensive work of cross-sectioning at once and the first thing they knew they had run slap-dab up against a range of hills which they could not circumvent by climbing over, digging under or going around. All the work was thus lost and they had to do it over again along different lines.—*Exchange.*

Pulse of The Irrigation Industry

WHAT THE DEPARTMENT OF AGRICULTURE IS DOING FOR IRRIGATION.

BY ELWOOD MEAD, CHIEF OF IRRIGATION INVESTIGATIONS, OFFICE OF EXPERIMENT STATIONS.

[An address delivered at the National Irrigation Congress, Colorado Springs, October 9, 1902.]

The passage of the National Irrigation Act was one of the most significant events of the last session of Congress, and is destined to have a far reaching influence in increasing population in the arid States and in shaping the laws and customs under which their people will live and work. It shares with the Panama Canal in public interest. The bureau which has its administration in charge has before it great responsibilities and great opportunities, and it is the duty of all friends of irrigation to contribute in every way possible to the success of its labors. This requires that there shall be moderation, patience, and co-operation with those intrusted with the work. The making of surveys and preparation of plans is a labor which requires time and ought not to be hurried. Harmony and public spirit are essential and every one who has the best interests of the West at heart must seek to promote these. Speaking for the Department of Agriculture, I can say that this is the spirit and purpose with which its irrigation work is being prosecuted and will be carried on in the future.

Irrigation, however, is more than a matter of ditches and acres. The construction of irrigation works and overcoming material obstacles are only one feature of western agriculture. After the channels are dug and the dams built, new and different issues have to be dealt with. The problems of the engineer are succeeded by those of the farmer. Irrigation is not unlike railroading. The location of the railway line, the fixing of grades, and the laying of the track are only the beginning of a railroad. Much of its after success depends upon the ability and judgment shown in these preliminary steps; but when the line is completed, the work of the engineer ceases and that of the passenger and traffic manager begins. The questions of rates, the questions of the relation of the road to the public welfare are then matters of vital interest, and their solution requires a different training and a different kind of ability from that which built the road.

So in irrigation. The value of the works constructed under the National Irrigation Act will, in the end, be measured by the success of the farmers who live under them, and the success of the farmers depends in large measure upon the skill and economy with which water is used, and upon rights to water being established and protected. Just and effective water laws and proper officials to administer these laws are as much a part of an irrigation system as ditches and dams. The building of National irrigation works is destined to make this more apparent than it has been in the past, because when there is an abundance of water in the stream there is no need of public control; but when we seek to use not only the natural flow but to store the floods, and to water farms stretching for hundreds of miles along rivers, and even across State boundaries, the distribution of the water supply, so that each one will be assured of his proper share, is a problem in administration as complex and important as that which confronts the managers of the great trunk railway lines. The value of the irrigated farm and the pleasure and profit of the farmer depend in large measure on men being able to till their fields without having to watch the stream to see that some one does not steal their water supply. Stable water rights and proper protection are as essential to the success of irrigation as are stable railroad rates to the prosperity of the business world.

The Department of Agriculture is the branch of the Government created to promote the growth of rural populations and to foster conditions which will make farm life pleasant and prosperous. This Department is therefore vitally concerned with irrigation, because it is the foundation of agriculture in nearly one-half of the country, and is the means by which a balance in population between the East and West can be brought about and the demands of our growing trade with the Orient fully supplied. There are several bureaus of the Department which deal with questions relating to irrigation, and especially to the prosperity of the arid region, in which valuable work is being done. But I wish to speak particularly of the irrigation investigations carried on by the Office of Experiment Stations, which deal with the agricultural and economic questions which must be solved in order to lay an enduring foundation for the future agricultural life of the arid West. This office supervises the expenditures of the fund provided for agricultural research in the different States, under which $15,000 go annually to each agricultural experiment station in the arid region. It is also charged with the promotion of agricultural education throughout the Union. Its irrigation work brings a closer association between what is being done by the State and what is being done by the Nation, and is an agency for securing harmony and co-operation in working out the perplexing questions which confront the State and Nation in the control and use of water supply.

Dr. A. C. True, the director of this office, has for many years been an active and earnest friend of irrigation development. He realizes that it is the foundation of western agriculture, and has used his influence with State boards of agriculture and trustees of agricultural colleges to give it the largest possible recognition in their work. Irrigation investigations carried on under this office help to broaden the work of the State stations and furnish information for Congress and the whole country regarding both the problems and possibilities of the arid West. It occupies, therefore, a distinct field. It is working to promote the success of National works by helping farmers to use water with more skill and success. It is aiding the States in studying the causes which have made water right litigation so costly and harassing and by the publication of reports is helping to bring about a better understanding of the issues involved and a more speedy and lasting settlement of these questions. In this work have been enlisted the irrigation experts of every one of the agricultural colleges of the West and the co-operation of all of the State engineers' offices. The experience and results of widely separated localities are being brought together, and irrigators of one section are being shown what has been learned elsewhere.

The most valuable work of the office, however, is its studies of irrigation laws and institutions. The character of rights to water established by law will do more than all other influences combined to determine whether

western farmers are to be tenants or proprietors. Every acre of land irrigated ought to have a right to the water it requires. In this way the owner of every home will be secure and water monopolies be impossible. The disposal of the water resources of the West should be hedged about with every safeguard that wisdom or experience can suggest, and to do this there is need at the very outset of a full understanding of the existing situation. The first thing needed is the facts; the next thing is an enlightened public sentiment which will make the right use of them. We need to know what has been done by private enterprise in the past. We need to fully understand all the merits and defects of State irrigation codes. We need to know the extent of the water supply. This the Geological Survey is determining. Then, we need to know what are the character of the rights to that supply, and this the Office of Experiment Stations is studying. Making these investigations under the National authority gives them an impartial character and shows to Congress and to the States the vital relation of State laws already enacted to the welfare of irrigators.

The wisdom of Congress in guaranteeing the protection of rights already established and in making State laws governing the rights to water supreme will, I believe, be vindicated by the future, because in a matter so vitally affecting the welfare of the home as the control of the water supply, changes in laws should come through the action and consent of those most concerned. The need, however, of a larger measure of public supervision over streams is becoming more and more manifest.

The great demand for water for irrigation purposes, the greater need of cities and towns for domestic uses, the importance of streams in the generation of power, are making it absolutely necessary that some simple and final method of protecting rights to streams shall be provided. The Office of Experiment Stations is endeavoring to bring this about and with the most encouraging results. No feature of these investigations has met with more appreciative recognition than the study of water-right problems. The value of what has been done is not to be measured, however, by the results already achieved, because all educational influences must be slow in their operation. The real value of the work being done by the office can only be told by its future influence on the social and industrial life of the West.

The irrigation work of the Department of Agriculture supplements its work along other lines in the arid region. It goes along with the Bureau of Plant Industry in its efforts to bring about a better management of the grazing areas; with the Bureaus of Chemistry and Soils in their studies of soils and water; and with the Weather Bureau in its measurement of rains and snows.

Nor is its irrigation work confined to the arid region. It is an essential part of the Department's work in the humid East. It is showing that irrigation is a benefit rather than a drawback, and is helping the farmers of that section to make use of it. Nothing is more significant than the rapidly growing demand for information and advice about irrigation which is coming from eastern farmers. Letters from every State in the Union not only manifest an active desire to know more about irrigation in the arid West, but how it can be applied as an aid to production in the East. The answering of these inquiries and the furnishing of this advice are destined to be an important factor in promoting the success of agriculture throughout the country, and in strengthening the demand for land and water under the works which the Nation is to build.

Those of the uninformed masses of the people who attended the National Irrigation Congress at Colorado Springs this week came to the conclusion that something has evidently been doing in Colorado within the past score of years, and that we are surely becoming civilized through the beneficent influence of the waters led captive. These folks see that Colorado has awakened at last and is now first in the rank of irrigated states. Twenty years ago farming was practically an unknown quantity in Colorado. The people were all after the elusive dollar hidden in the bowels of the earth in the mines. It was a speculative era. Only the live stock that grazed on the plains brought reward to the yeomanry.

The speculative era passed and investors began to investigate the possibility of the application of water from the streams to the soil. Money came to us from the East by the bagful. Great canals were constructed and now Colorado is blessed with the investment of $100,000,000 in the building of irrigating ditches, reservoirs and laterals. Today the question of irrigation is acknowledged to be one of the greatest of all the prominent ones before the people of the West. Proper irrigation means that Colorado will double and treble its population and become one of the foremost agricultural states of the Union.

The whole western half of the United States contains today less than one-tenth of the total population of the entire country. Two-thirds of it is yet government land. If the water that goes to waste every year in our western rivers were saved and used for irrigation the West would sustain a greater population than the whole United States contains today. Millions of acres will in time be transformed from deserts into populous and prosperous farming communities. Alfalfa fields crowded with improved stock will take the place of sand and sagebrush. Valleys and hillsides will blossom with the fruiting of the orchards and vineyards and the now arid plains will be carpeted with fields of waving grain.

Great as will be this agricultural development, it will constitute but a part of the whole grand result. Farms will bring both railroads and cheap and plentiful food into many regions of the West where immense bodies of minerals are awaiting only transportation and a lower cost of living to make it possible to work them profitably. Not only this, but the waters stored in mountain reservoirs will furnish power for all mining operations and the changed conditions which must result if all the waters that now go to waste are stored and saved can scarcely be conceived at this time. The irrigation congress this week anticipated all these possibilities and again rallied the people into renewed energy and enthusiasm regarding the future.—*Denver Field & Farm.*

The following letter to the *Leader* was received recently: "Editor Leader: Will you please tell me how to make cement for a ground dirt reservoir? I have a tank that leaks. Thanking you in advance for the information, I remain, yours truly.—Subscriber." The following makes a good cheap cement for ground tanks: 72 per cent clean sand; 3 per cent lime; 25 per cent coal tar, by weight. Mix well and plaster over tank about three-quarters to an inch thick. When dry paint over with pure coal tar.—*Pearsall (Texas) Leader.*

IRRIGATION PROGRESS IN SAN SABA COUNTY, TEXAS.

Judge Allison and E. L. Rector, Esq., returned last Friday from Austin where, on Thursday, they secured a charter for the San Saba Valley Irrigation Company. The capital stock is $360,000. The directors are John Kelly, president; Joe A. Williams, vice president; N. D. Lidstone, treasurer; John Cunningham, W. R. Doran and T. A. Murray, of San Saba, and Stephen F. Demmon, of Chicago. R. W. Burleson is the secretary, and Wm. Allison and E. L. Rector, the attorneys. The charter and franchise fee for fifty years was $250.

Attorneys Allison and Rector said after examining the charters of some other irrigation companies, they decided the charter formulated for our company was the best of all and so filed it without making any changes from that agreed upon in the directors' meeting at home.

The work on the abstracts is long and tedious and is being rapidly pushed.

Engineer Duvall came in last Friday and is looking after some preliminary work. He very kindly furnished the News the following data on the actual plant:

"The dam for the San Saba Irrigation system will have an extreme height of 50 feet. At its greatest depth the base will be 37½ feet; its top width will be 10 feet; its length at bottom of creek will be 300 feet; length on top, 800 feet. Available storage 15,000 acre feet of water.

"On the main ditch it is intended to construct two other storage reservoirs, one of 5,000 acre feet and one 6,000 acre feet, to be held by earthen dams. The main ditch will be 57 miles long. At the head the bottom will be 14 feet. Slopes of sides, 2 horizontal to 1 vertical. Depth of water in ditch at maximum flow, 6 feet. As laterals are taken out the main will be reduced until the lower section will have a bottom width of but five feet with a depth of only 2½ feet.

"There will be 150 miles of laterals and sublaterals from 6 feet bottom width down to 1½ feet and a depth of from 3 feet water down to 6 inches."—*San Saba County* (Texas) *News.*

GASOLINE ENGINES IN IRRIGATING REGION.

J. STONEY PORCHER, TEXAS, IN ORANGE JUDD FARMER.

Be sure to have a good engine. Everyone who has handled gasoline engines knows that some will start every time, and others require much persuasion. This defect is eliminated now by some recent makers. An engine that will start and stop easily must have a mixture of air and gasoline before reaching cylinder. The air and gasoline must be mixed before reaching cylinder, the longer the better.

Now, having a reliable engine, to what use can a farmer put it? In this arid region pumping for irrigation is the most important. This I consider is the severest test that an engine can be put to, as there is no let up, and the demand for power is constant. We start the engine and pump and then go a half mile, perhaps, to see that the water is properly distributed; or when running day and night, go to bed for three hours, get up and see if engine and water are behaving properly, and go to bed again. The engine might stop, but this would be the worst that could happen. There is no danger from fire. If the belt runs off, the governor will hold it. If we need ever so little water, say for hotbed, it is often cheaper to run the engine than haul water, say 50 yards.

Having formerly been an eastern farmer I know the value of securing water, even for gardens, while waiting for rain. An irrigation pump there would be of great benefit. To have an engine in or near the barn would be most convenient. The farmer could cut his feed, if only for one day, or one feeding, grind feed or grain, run separator or grindstone, and saw his own wood.

Pumping for irrigation requires the greatest economy. For some crops it is hardly profitable, as it takes so much water in this dry region to wet an acre. We must use the cheapest power possible and we find it in the gasoline engine, even when gasoline costs from 16 to 18 cents per gallon. The power needed for farm work, such as grinding, cutting hay for ensilage, etc., the farmer would hardly feel it. Of course pumping for irrigation takes more gasoline than for any other work, as it is constant. My five-horse engine pumps from 400 to 450 gallons every minute, with 25 feet lift, costing about 10 cents per hour, or from 50 cents to $1 per acre, according to crop, land, and time of year. I am using a five-horse engine with an Edison-Leland battery, have on another farm a ten-horse engine, exploded by a dynamo. Also a five-horse motor for pumping out the sand in making new wells.

It is the most economical power, especially when you take in the cost of attendance. A farmer must learn to run his own engine, but it will take less attention than in looking after the water and fuel in a steam engine, and as I said before, there is no risk of fire or of being blown up. Since the advent of cheap Texas oil, some claim that a steam engine, run with crude oil, will be cheaper than a gasoline engine. This may be so for large engines and manufactories but for the farmer the care and risk from fire will still be there. The cost of an engineer and fireman for a 50-horse engine may not count, but for a five or ten-horse engine it would amount to as much or more as the cost of fuel.

Manufactories are experimenting with crude Texas oil, and if they succeed the cost of fuel will be wonderfully lessened. However, the success so far is only partial, as the heavy oil is apt to get into the cylinder and gum it. I believe they do very well with some light crude oil. The battery, if used, is cheaper than the burner, but the latter is simpler. By all means do not accept a cheap battery. Keep your temper when she won't go, for it is apt to be your fault. If everything is right and screws set tight, there should be no trouble. I would advise a farmer who wishes to buy an engine to make an agreement with the agent, if there is one in his town, to come to him whenever he is in difficulty, until he learns thoroughly how to run it, and is complete master of the situation. It will take some practice, as one must not only know what to do, but get used to it. I know of 14 gasoline engines in this valley and about the same number on cattle ranches.

CORRESPONDENCE

CLEARWATER, MANITOBA, CANADA, October 30, 1902.

THE IRRIGATION AGE, 112 Dearborn Street, Chicago, Ill.:

Dear Sir—Will you kindly send me a copy of THE IRRIGATION AGE? I have been looking for something of this kind for some time and will subscribe for your paper in the near future.

I would like a few hints on damming a creek with *shale bottom*, or "under-current."

I would also like to know what power a turbine wheel would develop under a five-foot fall of one cubic foot of water flowing through a pipe.

If I were to attach an electric dynamo to above turbine, under above circumstances, what electric power would I get, or would it pay for farm power?

Hoping to hear from you in the near future, I am

Respectfully yours,

GEORGE SPEARMAN,

Clearwater, Manitoba, Canada.

Replying to your inquiry, asking for hints about damming a creek with shale bottom, or under-current, one of the best practical papers on that subject was prepared by Prof. S. Fortier, who now lives at Bozeman, Montana, as a bulletin of the Utah Agricultural Experiment Station. If you will write to Prof. Fortier, it is likely he can furnish you with a copy.

If it is proposed to build an earthen dam, the first thing to be done is to get rid of all of the vegetation on the present ground surface, in order that the dam and the soil on which it rests may have a close union. If there is a perceptible under-current, it may be necessary to dig a trench through this and fill this trench with clay or some impervious material. A substitute for this, which is sometimes used, is the driving of deep piling down to an impervious strata. In building an earthen dam, the front slope should be not less than 3 to 1, and the back slope not less than 2 to 1, with a width of 10 feet on top. It should be built up in horizontal layers of about one foot in thickness, and if these layers can be wet as they are filled in, so that the teams driving across them can puddle the soil, it makes a much better structure.

If the intention is to build a masonry dam, then you will have to go to a solid foundation. The last Yearbook of the Department of Agriculture contains an article on the usefulness of reservoirs, which describes the construction of a number of storage dams built in Colorado. We have requested that a copy of this be mailed you.

In your inquiry about the power of a turbine, you do not give the time in which one cubic foot of water would be delivered. If it was one cubic foot of water per second, you would have theoretically about one-half a horse power. I question whether it would pay to install a dynamo to use this for farm work, as it could only be applied to very light operations.

MANSFIELD, OHIO, October 22, 1902.

THE IRRIGATION AGE, Chicago, Ill.:

Gentlemen—We are today in receipt of a letter from A. H. Garrett, 1913 Washington street, Boston, Mass., who saw our ad. in THE IRRIGATION AGE, and writes us concerning alfalfa huller and machine for threshing castor beans. We can equip him for both the alfalfa and the bean, but Mr. Garrett desires information and detailed estimate of the machinery necessary to prepare, plant and harvest 500 acres of alfalfa, including barbed wire to surround the plantation to keep cattle out. He also desires to know where the most reliable alfalfa seed can be purchased. Kansas and Nebraska produce considerable alfalfa seed, but this year the crop was rather a failure. Will you kindly give Mr. Garrett the desired information, and if you cannot, perhaps you can refer him to the proper authority? Yours truly,

THE AULTMAN & TAYLOR MACHINERY COMPANY,

By A. KALMERTEN, Secretary.

The above inquiry was referred to Hon. W. J. Powell, of Iliff, Colo., one of the largest ranchers and alfalfa raisers in that State, and the following is his reply, which may prove interesting and instructive to our readers:

SPRING VALLEY RANCH, POWELL & BLAIR,

ILIFF, COLO., October 26, 1902.

D. H. ANDERSON, Chicago, Ill.:

Dear Sir—Your favor to hand regarding the information desired. The expense would depend upon locality. Taking our locality as a basis, this is how I would estimate:

Two 3-horse riding plows	$70.00
One 2-horse stirring plow	12.00
Two hand seeders (rotary)	3.00
One disc harrow	25.00
One 4-horse drag (good)	30.00
Posts and wire for fence, 4 wires, posts 21 feet apart, per mile, here	90.00

In sowing alfalfa seed here, if party owns, or can borrow or rent, a grain drill suitable for sowing grain or clover seed, we usually adopt this mode of sowing, as alfalfa seed are very similar to clover; in fact, it is of the same family of plants. We usually plant the alfalfa with wheat or oats, using about two-thirds or three-fourths amount of wheat or oats seed per acre, as where planted alone we use from ten to twenty pounds alfalfa seed per acre. If wanted for hay, the thicker it grows, the better for the hay. If for seed, the contrary. There is also a wagon seeder, costing $10.00 or $15.00, to be attached to wagon bed and hind wheel of wagon, that does excellent work, both for grain and alfalfa seed.

Geo. A. Henderson, Sterling, Colo., deals in alfalfa seed and can generally supply any kind of seed wanted. This information is necessarily vague about cost, etc., of preparing and planting 500 acres of alfalfa, as some kinds of lands can be handled for almost one-half compared with others, but this will give a general idea. If further information is desired, I will take pleasure in trying to give it to you at any time. With best wishes, I am sincerely yours,

W. J. POWELL.

SPOKANE, WASH., November 6, 1902.

THE IRRIGATION AGE, Chicago, Ill.:

Gentlemen—I am trying to find a copy of Flynn's "Irrigation Works." If you know where one can be obtained, will you kindly forward this letter and oblige yours truly,

SPOKANE VALLEY LAND & WATER COMPANY?

By W. L. BENHAM.

CHICAGO, November 9, 1902.

THE IRRIGATION AGE, Chicago, Ill.:

Dear Sirs—Will you please change the address of A. A. Crane from Alta Loma to 703 McKinney avenue, Houston, Texas? He writes that he is much pleased with THE IRRIGATION AGE. He says irrigation is coming to the front in Southern Texas. The drouth there the past season has put the people to thinking. I remain yours truly,

F. P. CRANE.

THE SNAKE RIVER VALLEY.

OGDEN, UTAH, October 31, 1902.

THE IRRIGATION AGE, Chicago, Ill.:

I send you a pamphlet, issued about four years ago; it states fairly all you wish to know about our Owyhee canal and farm. We do not now sell any of the land. I have bought out Mr. Theodore Danilson and am, therefore, the owner of two-thirds of this farm, incorporated under the name of "The K. S. & D. Fruit Land Company," besides owning 1,000 acres of lands adjacent, belonging to me individually.

I cannot well enlarge on what you have already stated in your letter. We raise on an average seven tons of alfalfa per acre. We fed and reared on ten acres of alfalfa, by alternating (*i. e.*, changing from one five-acre lot to another), in one season 93 head of pigs, at an average weight of 130 pounds, at no cost but the alfalfa pasturage.

We can raise by rotating crops (*i. e.*, plowing up the alfalfa after three years) on the same land from 60 to 65 bushels of wheat, 97 bushels of corn, 100 bushels of oats, 300 bushels of potatoes, 90 bushels of barley per acre, always presupposing that the land and crops have good care and plenty of water.

We can raise so much fruit that half of it has to be knocked off to save the trees from being overloaded. The climate is simply perfect—about 300 days of sunshine in a

year; very warm in the summer, but tempered by fine breezes and cool nights; seldom excessively cold in the winter, rarely any snow in the winter, except in the mountains, where it should be. You saw our fruit at Colorado Springs. Where can you excel it? Our prunes were shipped to Liverpool, where only the most perfect fruit is shipped by the Earl Fruit Company.

Now, regarding a specific plan for reservoir on the Owyhee, and other information, quantity of wild land to be reclaimed, I cannot say, as that is the province of the technical gentlemen; but, in a general way, I desire to say that there are large quantities of land subject to reclamation under the Owyhee, as also under the Malheur rivers, which can undoubtedly be made to yield enough water to reclaim 100,000 acres, provided the water be reserved during torrential floods, and during the time when water is not applied for irrigation.

I am now engaged in a survey for a reservoir on the Owyhee, not only to make our own supply more certain, but to reclaim more land. When that survey is completed, I can furnish you additional data, but I wish you to take into consideration other factors—that is, the proper use of water; for instance, in the orchard the proper cultivation of the land will almost do away with the use of water; at least, much reduce its use. Rotations of crops, made obligatory, will mellow the soil; alfalfa will enrich it and thereby cause those phenomenal yields, which almost pass comprehension and stagger the uninitiated—*i. e.*, the tenderfoot. The water companies and farmers must be enjoined not to waste water; perfect systems of measurements of flow and distribution adopted; spraying of orchards should be enforced; intensive farming encouraged. Holdings of an ordinary family should not exceed 40 acres. Sugar factories, drying and canning establishments should be given extra facilities, even if necessary by exemption from taxes, until well on their feet, as witness at Ogden, where beet and tomato lands are worth $300 per acre and farmers are made independent and rich. Cattle and sheep naturally follow the growing of grain and alfalfa.

If possible to further save water, it should be piped; these are observations which occur to me at this time, the result of my own practical experiences.

Another problem facing irrigation is the reclamation of alkali lands, which, when reclaimed, are the richest and strongest lands we have; this requires endurance and energy. The salts, which are the leachings from the uplands, so-called benches, accumulate in excess on the lowlands; that the land can be made tillable is abundantly demonstrated, especially in Utah, and is done by frequent and deep plowing, heavy manuring, the application of chaff and straw, so as to break up the toughness and the stickiness of the soil, making it mellow and powdery, and certain crops which absorb alkali, as white clover and beets.

The richest part of Oregon, in my humble judgment, is east of the Cascades. Yours truly,

FRED. J. KIESEL.

SEATTLE, WASH., September 25, 1902.

THE IRRIGATION AGE, Chicago, Ill.:

I think, with the exception of perhaps the last year or two, I have been a constant reader of THE AGE since its first publication. I am in this line of business, and have been for ten years or more. Am now in charge of construction of what is known as the Wenatchee Highline canal, a canal taking its waters from the Wenatchee river, some eighteen miles above its mouth, carrying the same down to the junction of the Wenatchee and Columbia rivers, and across the river, covering the flat known as the Wenatchee valley. This project, I believe, is without doubt the most expensive and one encountering the greatest obstacles, both in number and difficulty in overcoming, of any canal ever constructed on the coast, the area of land considered. On its route we have two tunnels, one of 850 feet and one of 300 feet; a flume across a canyon, 530 feet in length and 130 feet above the roadway in the canyon; three or four other flumes crossing canyons, none of which are less than 60 feet in elevation and 160 to 500 feet in length; great rock cuts and side hill excavations, and in conveying the water across the Wenatchee river we use a continuous stave-pipe, with steel bands 48 inches in diameter, outside measure, 8,500 feet long, and reaching a point 250 feet below its intake, returning to a point 220 feet, giving it a head of 30 feet from the intake, after which we have comparatively easy construction.

As a matter of comparison, I would like to ask you to furnish me with a description of the most notable canal in Colorado and one in California. Our canal covers only a little over 6,000 acres, at an expense of perhaps of over $150,000 for construction alone. If you can give me the names of the management of two notable enterprises, would like to secure photographs from them, showing their difficult construction.

Hoping that I have not asked too much of you, will await your reply. Yours truly, W. T. CLARK.

Replying to the inquiry of Mr. Clark: The most notable canal in Colorado is the Greeley No. 2, which diverts water from the Cache la Poudre river, a few miles above Greeley. It was among the first canals built in Colorado and was the first to irrigate lands away from the river bottoms. It was built in 1871, but has been enlarged several times since. The success of the Greeley colony largely depended on this canal. It is about forty feet wide and 5 feet deep at the present time.

The Highline canal, also in Colorado, is a more remarkable channel as far as engineering difficulties are concerned. It was begun in 1880. It diverts water from the South Platte river near the mouth of the canyon some twenty miles south of Denver. The canal begins with a tunnel 800 feet long through a mountain and then runs for three-quarter miles on a shelf of rock where the water is carried in a wooden flume. This canal is 40 feet wide on the bottom and 7 feet deep. It carries nearly 1200 cubic feet per second. It is over 70 miles long and irrigates 90,000 acres of land where the water supply permits.

The King's river and San Joaquin canal in California is perhaps as celebrated as any in that state. It does not carry as much water as the Turlock and other canals, but like the Greeley No. 2 has done much toward establishing the advantage of irrigated agriculture in California. It is 32 feet wide and 4½ feet deep and has a capacity of 600 cubic feet per second. It is 67 miles long and serves for the irrigation of 90,000 acres of land.

We can give you more detailed information regarding any important canal should you desire it.

Renew your subscriptions to the IRRIGATION AGE for 1903. Send us in Post Office or Express money order for $1.00.

FARM IMPLEMENTS AND MACHINERY.

The following circular letter relative to farm implements and machinery has been sent out to manufacturers recently by the office of Experiment Stations, United States Department of Agriculture. Manufacturers generally are requested to comply with this request, as it will materially assist this branch of the Government in its new line of work:

DEAR SIR: This Office desires to secure all of the information possible regarding the manufacture of implements and machinery used in agriculture in the United States, the data to be used in replying to inquiries constantly being received, and in the preparation of bulletins descriptive of our progress and of present methods and their influence on our success and future development.

It is believed that the collection of such data and their arrangement and classification in form for convenient reference will be of service to both the makers and users of farm machinery, and your coöperation and aid in making the record complete and authentic are solicited. We would like to secure a catalogue and illustrations of all the farm implements or machines made by your firm and of all publications descriptive of their character and merits. We also wish to prepare a historical record which will show the types of these implements or machines as first manufactured, and the improvements in design which have been made subsequently. To this end, we shall appreciate receiving copies, where you can spare them, of earlier catalogues, circulars, or illustrations showing development of your machines.

As this country is the largest producer and user of

(Continued on page 28.)

NEBRASKA IRRIGATION LAW.

(Synopsis Furnished the Ranch News by Adna Dobson, State Engineer and Secretary Board of Irrigation, Lincoln, Nebraska.)

The first legislation affecting irrigation in Nebraska was passed in 1877, when a law was placed on the statute books authorizing corporations organized for the purpose of constructing canals for irrigation or water power purposes to condemn rights of way and declared irrigation canals to be works of internal improvement.

The act of 1889 covers the subject more fully. Section 1, Article I., reads as follows: "The right of the use of water flowing in a river or stream or down a canyon or ravine may be acquired by appropriation by any person or persons, company or corporation organized under the laws of the state of Nebraska; provided, that in all streams not more than fifty feet wide, the rights of the riparian proprietors are not affected by the provisions of this act."

This act was amended by subsequent Legislatures, but no general irrigation law covering the subject fully was passed until 1895, when the present irrigation law was adopted.

This bill establishes a state board of irrigation composed of the governor, attorney general and land commissioner, who shall elect a secretary who shall be a hydraulic engineer of theoretical knowledge and practical skill and experience, and also one under secretary for each water division. The duties of the State board of irrigation and the secretaries are stated as follows: "It shall be the duty of the State board at its first meeting to make proper arrangements for beginning the determination of the priorities of right to use the public waters of the State, which determination shall begin on streams most used for irrigation, and be continued as rapidly as practicable until all the claims for appropriation now on record shall have been adjudicated. The method of determining the priority and amount of appropriation shall be determined by the said State board, which at its first meeting shall designate the streams to be first adjudicated.

DUTIES OF OFFICERS.

The under secretary shall, under the direction of the State board see that the laws relative to the distribution of water are executed in accordance with the rights of priority of appropriation.

The State board has authority to create water districts within each water division and appoint an under assistant for each water district.

It is the duty of the under assistants under the direction of the State board of irrigation to divide the water in the natural streams of his district among the several ditches taking water therefrom and to shut and fasten the headgate of ditches when in time of scarcity of water, it is necessary to do so. Every person who shall wilfully open, close, change or interfere with any headgate or water box without authority shall be deemed guilty of a misdemeanor, and on conviction thereof, shall be fined in any sum not exceeding $200, or imprisoned in the county jail for a period not exceeding three months.

Each appropriation shall be determined in its priority and amount by the time at which it shall have been made, and the amount of water which the works are constructed to carry: provided, that such appropriator shall at no time be entitled to the use of more than he can beneficially use for the purposes for which the appropriation may have been made, and the amount of any appropriation made by means of enlargement of the distributing works heretofore shall be determined in like manner; provided, that no allotment for irrigation shall exceed one cubic foot per second for each seventy acres of land for which said appropriation shall be made.

Any party or number of parties acting jointly, who may feel themselves aggrieved by the determination of the State board, may have an appeal to the District Court of the county within which the appropriation or appropriations of the party or parties so aggrieved may be situated.

HOW TO SECURE APPROPRIATIONS.

Every person or corporation intending to appropriate waters of Nebraska under the law of 1895 are required to file with the State board of irrigation an application for a permit which shall show all essential facts in connection with the proposed works. On receipt of this application, which shall be in a form prescribed by the State board of irrigation, and upon blanks furnished, the secretary will make an examination of the application, and if there is unappropriated water in the source of supply, and if such proposition is not otherwise detrimental to the public welfare, the State board, through its secretary, shall approve the same. If there is no unappropriated water in the source of supply, or if a prior appropriation has been made, to water the same land to be watered by the applicant, the State board, through its secretary, shall refuse such appropriation. Any applicant feeling himself aggrieved by the action of the State board may take an appeal to the District Court of the county in which the point of diversion is situated.

A cubic foot of water per second of time is the legal standard of measurement of water in this State and fifty miner's inches under a four-inch pressure shall be deemed equivalent to a cubic foot per second of time.

All appropriators are required to maintain suitable headgates and measuring flumes.

Any person, corporation or association hereafter intending to construct any dam above ten feet in height shall, before beginning such construction, submit the plan of the same to the State board of irrigation for their examination and approval, and no dam above ten feet in height shall be constructed until the same shall have been approved by such board.

The right to divert unappropriated waters of every natural stream for beneficial use shall never be denied. Priority of appropriation shall give the better right; those using the water for domestic purposes shall have the preference over those claiming for any other purpose, and those using the water for agricultural purposes shall have the preference over those using the same for manufacturing purposes.

All ditches, canals, laterals or other works used for irrigation purposes shall be exempt from all taxation, whether state, county or municipal.

Under the district law, whenever a majority of the resident freeholders owning lands in any district susceptible to one mode or irrigation from a common source and by the same system of works they may form an irrigation district and the district is authorized to issue bonds to pay for the construction of works and to levy an assessment to pay the said bonds and interest.

SPEECH BY JOHN W. SPRINGER.

President National Live Stock Association, Denver, Colo.
Before the Tenth National Irrigation Congress.

This congress is called to inaugurate the redemption of arid America. Sixteen States with 600,000,000 acres of land are vitally interested in the provisions of the irrigation bill passed by the last Congress. When our bill was being weighed in the balance, and the crucial test was upon the faithful men who for a quarter of a century had been educating the people as to the benefits of irrigation, when the East was objecting to giving away government lands or government money to aid this great undertaking, it fell to the lot of Theodore Roosevelt to administer the allopathic dose of irrigation, which means more to the western states than any measure ever adopted by the American Congress.

Irrigation is our western ignis fatuus, which will draw thousands of landless tenants from the overcrowded East, and tens of thousands from the valley of the Mississippi. The twentieth century is heavy with possibilities. Irrigation is now a fixed fact, and we have $8,000,000 available for immediate expenditure under federal management for an actual demonstration of the practicability of storing the flood waters of the Rocky mountains. The conservation of waste waters is the chief link in what shall be a great chain of lakes, reservoirs and dams, which, during this decade, shall make glad the waste places of the great American deserts. A new empire is to be builded! All hail to the progressive men who aided in its birth, and will, from this congress, direct the first step toward making the wilderness of the West blossom and bloom as the rose.

This proposition, like every other great question confronting us at the dawn of the twentieth century, must be handled by men who do things—progressive men—men who believe in their country, men who believe that the pathway to industrial independence and commercial supremacy lies before us and not behind us. We firmly believe in hitching our wagons to a star where there is light, than to a hole in the ground where there is no light, but a symbol of the old warning "abandon hope all you that enter here," I admire a typical American. I enthuse when I read the history of the struggles and trials and hardships of the leaders of the decades now sweet in memory. It has been a symposium of national successes, and I would not pluck one star from our national diadem. History, however, can never solve actualities. You and I live to-day and it is our province to aid in writing the history of greater successes.

STOCKMEN HAVE HELPED.

The great industry I have the honor to represent before this congress is the live stock industry of the United States. The stockmen of America have aided this irrigation bill during the five years' existence of the National Live Stock Association of the United States. We were the first great organization to wire our approval to the President on his irrigation message to Congress, and we here, now and unreservedly, pledge our best efforts to aid in effecting what we believe will bring more people and more money into the West than all the other measures enacted by Congress in over a hundred years. The stockmen who ride the range—who climb the hills, the mountains; who live along the trails; who follow their flocks and herds looking for water, know better than any other class of men living what the value of water is to a country. We know that the more water we have, the more moisture, and that means more grass, more forage crops and more feed. The stockmen have been the great American pioneers; they have fought the Indians; scattered the wild beasts; annihilated the buffalo; builded ranches on the confines of civilization, and with true, progressive American spirit, left a heritage to their children typified in the beautiful lines:

"Our fathers crossed the prairies as of old their fathers
crossed the sea,
To make the West, as they the East, the home land of
the free!"

Evolution has come to our interests, as well as to every other interest on this continent. The time is upon us for the breaking up of the great ranges. The old free grass and general mavericking days are laid away with the recollections of pioneer days. Unnumbered herds of cattle and bands of sheep are referred to now around the camp fire of the modern outfit as the "boys" tell of other days and other cow punchers and sheep herders. We are yearly getting closer to humane ideas of breeding and fattening and marketing live stock. We have been taught severe lessons that now we must have quality rather than quantity in our flocks and herds. We are prosperous and our values of live stock have increased over $400,000,000 in the five years' history of our organization. Our people are meat eaters, and the consumption continually increases, while production fails to keep pace with our growing population.

We have at last placed on the federal statute books the principle of "the conservation of the waste waters," and this small beginning will work like a little leaven; the conquest with a bloodless revolution of our American wilderness.

We are constantly growing broader in our national life. We have learned to get away from our own dooryard and our own neighborhood. We are no longer circumscribed by the narrow limits of down east; of the coal fields; of the oil fields of Ohio and Indiana; of the wheat belt of the northwest; of the corn district of Illinois, Iowa and Kansas; of the cotton fields of the south or of the fast developing sugar beet districts of Colorado, or the cattle and sheep ranges of the far west. Our national life is too great, too broad, too unselfish; too cosmopolitan; too national. We are all striving for success. We want to grow, expand, advance. We want in fine to go forward!

Woe to that leader who seeks to sidetrack the energies of the American people! Woe to the pessimist who continually predicts clouds, failures and defeat for American genius—he will drop out, down, like the Irishman in Mexico, who, in going down to work in a mine for the first time, became very nervous as the shadows gathered about him. As the bucket dropped lower and lower his fears increased and he yelled, "Lower me up; O, I say—lower me up, or I'll cut the rope!"

NEED NEW LAND LAWS.

At this great irrigation congress, I wish to state another contention of the National Live Stock Association, and that is, that we believe the time is opportune to re-write the land laws of the United States. What was good for our people 100, fifty and twenty-five years ago, when they had the virgin prairies of the east and the Mississippi valley, with their rich loams, will not apply to the arid and semi-arid lands remaining in the far West. We believe the homestead laws should be

made more liberal for the lands that remain. We believe a homesteader should be allowed 320 acres instead of 160 acres, which he could pick from the rich alluvial lands in Illinois, Iowa and Nebraska. The lands of the far west are a different proposition and the government can afford to be more liberal.

Another point our association makes. We believe it in the interest of the homesteader, the settler and all western interests for the government to adopt a policy of exchanging lands to enable them to solidify their ranches and their farms, and put them under a higher state of improvement and cultivation than they would where they only owned every other 160 or every other section of land. Our people are pre-eminently "home-builders" and every inducement should be extended by state and federal government to enlarge the population of the western states.

And now, my fellow-workers—what of the night! Believers in irrigation, are you keenly alive to the superb opportunity just ahead of you, for to no other age has come the same great chance to build a Paradise from the icy hills of Montana to the sand dunes of Arizona, from the plains of Kansas to the orange groves of the golden state. Methinks that that sweet singer, William Bradbury, must have written these wonderful lines after a trip over this vast territory:

"There, on verdant hills and mountains,
Where the golden sunbeams play,
Purling streams and crystal fountains
Sparkle in th' eternal day."

This will be truly a paradise with water—a home where sunshine and contentment will be the chief corner stones, an ideal, a typical dwelling place for free men, for free women and the sweet children a merciful Providence has given them. This, the great American riddle—the utilization of the arid plains—will be solved under irrigation. I wish to sound a note of warning. Do not expect everything of the federal government. It has blazed the way, and its efforts should stimulate every western state to aid this measure by state enactments and state aid. Do not, my hearers, rely upon either federal government or state government. Beneath and above it all, beyond both aids, rely upon yourselves and your own efforts. Individual and corporate aid will accomplish much more than all the governments on earth. Private capital should be induced, encouraged and coaxed to build dams, lakes and reservoirs. All should be protected in their rights.

FIELD FOR CAPITAL.

The great rivers of waters yearly running to waste from the eastern and western slopes of the Rocky mountains will furnish a very inviting field for the investment of capital for the next quarter of a century. Over this wonderful stretch of territory is my dream of the Elysian fields, opened by the intelligent, God-fearing American husbandman. Away and across these sweeping happy hunting grounds of the departed red man of the American fastnesses shall be heard the songs of contented labor harvesting their crops underneath the snow-capped peaks of the Rockies; not watered as was the Eternal city by a giant aqueduct built by slave labor under the lash of the Cæsars, but a promised land—at home, our home, with streams clear and pure from God's great storehouse in the hills; the waters from the melting snows, from the mountain streams, pure as the blueness of the sky overhead, is our supply for rich and poor alike.

For this new Utopia shall rival the old Arcadian settlement, styled by Longfellow the home of the happy. The poet tells us of Arcadia that irrigation was the sine qui non of their tranquillity, for he says:

"Dikes, that the hands of the farmers had raised with labor incessant,
Shut out the turbulent tides, but at stated seasons the flood-gates
Opened and welcomed the sea to wander at will o'er the meadows."

The history of these American plains has been written in the best blood of the American pioneers. In a part of this land, the old prophet, Brigham Young, taught his footsore pilgrims to store the mountain water and redeem the deserts, and the faithful followed on and obeyed his injunction of "Live and help live."

Beyond these rocky fastnesses dwell still the descendants of Montezuma—in a land flowing with milk and honey. They have conserved every little stream and made the barren mesas bear fruit a hundred fold, and the wandering Spaniard of hundreds of years ago exclaimed when in sight of the Mount of the Holy Cross: "Sangre de Christo," and the mountains were so named.

Aye, on and away across the San Bernardino mountains we drop into the orange groves of the Pacific, the tropical orchards where the lime, the olive, the pomegranate, the lemon, the orange, the date grow amid hedges of roses and wide fields of lilies. As I drove over the mountain roads surrounding the superb valley of Redlands, Pasadena and Riverside, and beheld below me the wheat fields yellow for the harvest, the orchards with every kind and variety of fruit, free for the picking, and inhaled the odors from hedge and garden and meadows, with songs of the birds and a mellow sunlight over all, while old San Bernardino mountain, whose craggy peaks were white with everlasting snow, formed a picture that must have inspired the poet when he sang:

"On the other side of Jordan,
In the sweet fields of Eden,
Where the tree of life is blooming.
There is rest for you."

Here in this matchless territory of the west, surrounded by such environments as I have tried to depict, will grow, expand and prosper the American Utopia, not ideal, but everlastingly real, with millions of happy American citizens, with modern comfortable homes, and with people with a charity born into them as wide as our domain, and with characters as strong as our national life.

THIRTY YEARS OLD.—The Christmas (December) number of *The Delineator* is also the thirtieth anniversary number. To do justice to this number, which for beauty and utility touches the highest mark, it would be necessary to print the entire list of contents. It is sufficient to state that in it the best modern writers and artists are generously represented. The book contains over 230 pages, with 34 full page illustrations, of which 20 are in two or more colors. The magnitude of this December number, for which 728 tons of paper and six tons of ink have been used, may be understood from the fact that 91 presses, running 14 hours a day, have been required to print it; the binding alone of the edition of 915,000 copies representing over 20,000,000 sections which had to be gathered individually by human hands.

(Continued from page 23.)

farm machinery in the world, there is a large opportunity for investigation by this Department of this branch of our development. It is desired to receive help in it from every source and we shall appreciate your opinion as to its usefulness, as well as any suggestions which may occur to you as to how we can most effectively make this information of service.

Sincerely yours,

Approved: A. C. TRUE,

JAMES WILSON, *Director.*

Secretary of Agriculture.

A Missoula, Montana, correspondent says: While no definite plans have yet been decided on there is now under discussion a scheme for the construction next season of a large irrigating system that will cover a considerable portion of the land on the bench across the river south of Missoula. One large canal has been built this summer by the Orchard Homes Company. This is nearly finished and will cover a large tract of land. It is one of the largest ditches in this part of the State and will result in the reclamation of a large tract that is now almost entirely unproductive.

The Kansas State Historical Society will hold its thirty-sixth annual meeting in the State Capitol, Topeka, on Dec. 29, 30, 31, 1902. One hundred dollars will be given in premiums for exhibits of fruit. Programs will be issued soon.

THE IRRIGATION AGE

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A monthly illustrated magazine recognized throughout the world as the exponent of Irrigation and its kindred industries. It is the pioneer journal of its kind in the world, and has no rival in half a continent. It advocates the mineral development and the industrial growth of the West.

EDITORIAL

WHY? **If the National Irrigation Association is a national organization for national good, why should the list of its members be held as private property by Geo. H. Maxwell or any other individual? The editor of the IRRIGATION AGE asked Mr. Maxwell for a list of the members and he declined to furnish it, giving as an excuse that he feared it would possibly fall into the hands of enemies of the cause. What Cause? Why should he fear to have the list made public? Is he or his associates any more the friends of irrigation and National Aid Laws than the rest of us? Answer, Mr. Maxwell.**

"George." Editor Melick of *The Pasadena* (Cal.) *News*, in writing a defense of George H. Maxwell, informs us that he was in such close touch with the people of the White House that the President referred to him as "George." What rot, Mr. Melick, what rot.

C. E. Wantland. Through a mistake a portrait was shown in our October issue under which was the inscription, C. E. Wantland. The halftone shown was of Mr. McCune, of Colorado.

We have secured and are showing herewith a true likeness of Mr. Wantland, who is general agent at Denver and Salt Lake City for The Union Pacific Land Company, also publisher of the well-known journal, *Ranch News*.

Irrigation Congress. The Eleventh National Irrigation Congress will be held at Ogden, Utah, September 8, 9, 10, 11, 1903, and it is predicted that this will be the greatest meeting in point of attendance and results in the history of the congresses. Full information concerning subjects to be discussed, accommodation, rates, etc., etc., may be obtained later by addressing Mr. Fred J. Kiesel, executive chairman, Ogden, Utah.

Edwin F. Holmes. In this issue will be found an artiele on the Eleventh National Irrigation Congress by Edwin F. Holmes, president, of Salt Lake City. Mr. Holmes advises state irrigation congresses to be held annually and that each State Congress appoint delegates to the National Congress. This is a good suggestion and should be immediately acted upon by states having no organization of that kind. The IRRIGATION AGE will be pleased to chronicle any move in that direction by any of the states.

A Question. Would those interested in irrigation matters prefer to know that the government receives its information of the needs of the arid section from a discussion of the matter before a regular meeting of the National Irrigation Congress composed of men who are directly interested in this subject, or from resolutions framed by the National Irrigation Association composed of merchants, manufacturers and others who receive their knowledge of the situation from one individual whose only claims to recognition are assumption and a large sprinkling of personal ambition? In a national congress no one individual can go very far astray

as was shown at Colorado Springs when the National Association representative tried to kill the Congress by merging it with the Trans-Mississippi Congress.

An Arizona Opinion. In a recent letter from one of the friends of the Irrigation Congress whose home is Arizona we quote the following: "Meanwhile I think your little editorial in which you announce that he (Maxwell), has refused to give the names of the members in his association is one of the strongest things brought against him, and I hope in your next issue you will reiterate that inquiry. Maxwell is posing as the representative of 2,000 members and is attacking the Department of Agriculture as the representative of those men. In that case we want the list of members; we want to know the receipts and disbursements of this association; we want to know when Mr. Maxwell was ever authorized to carry on this warfare. Any association which claims to be public and to attack public officials, should make all these matters public.

San Francisco Call. The San Francisco Call, in commenting on Mr. Geo. H. Maxwell and his ambition in an editorial in a recent issue, has the following as a finishing paragraph:

"This brief review of the work to be done, and of the compensative accommodations that will be necessary negatives at once the ambitious aspiration that Mr. Maxwell's or any other private association may have to take to itself the expenditure of the twenty million dollars or more that will be devoted to irrigation under the law. It must be a Government concern. The compensation of those whose lands will be disused and whose irrigation systems will be destroyed, must, of necessity, come out of the irrigation fund, and in that aspect alone it is evident that only the Government can be permitted to deal with that phase of the problem. A glance at the rest of the work suffices to convince any reasonable man that only the Government has the competent facilities to deal with the whole question."

Mr. C. G. Elliott. Mr. C. G. Elliott, C. E., formerly owner and publisher of the *Drainage Journal,* which has been merged with the IRRIGATION AGE, contributes an interesting article on Irrigation and Drainage in the Fresno district, California, which appears in this issue with illustrations. Mr. Elliott has been called by the government to act as expert in drainage investigations for the Department of Agriculture at Washington. The selection of Mr. Elliott for this work reflects credit on the department officials, as Mr. Elliott is eminently qualified to perform this work. It will be Mr. Elliott's duty to answer all inquiries and give advice upon the subject of drainage of farm and public lands. This is a new position made necessary by the great number of inquiries for information coming to the Department of Agriculture and as well by the call for drainage investigations in the irrigated territory of the country.

This appointment necessitated the sale of the *Drainage Journal,* which had been built up to a commanding position by Mr. Elliott and that journal was absorbed by the IRRIGATION AGE. A regular drainage department will be maintained by this publication, to which Mr. Elliott will be a regular contributor.

Colorado River. THE IRRIGATION AGE received a call in December from Mr. F. H. Newell, chief hydrographer, U. S. Geological Survey, who was on his way West to look after work being done on the Colorado river preliminary to the gigantic reservoir systems contemplated along that stream, whereby at least one million acres will be reclaimed between The Needles and Yuma, or the international boundary. This will be the largest project of the kind ever undertaken in the United States and will, with other work contemplated along that stream, be equal in magnitude to the famous Assouan dam recently completed by the British Government on the Nile. Mr. Newell states that his department have about one hundred engineers now at work on both sides of the river below The Needles, both in California and Arizona, and that he will start in at the first mentioned point and drift down as far as Yuma, studying conditions along the route. The engineers engaged in the work will investigate dam sites, going down to bed rock at such points as may seem available for that purpose. THE IRRIGATION AGE will regularly post its readers on the work being done in that section. In this connection it may be well to say that there is now in course of preparation an extended article on the Assouan dam in Egypt by the pen of Prof. Clarence T. Johnston, assistant chief, Irrigation Investigations U. S. Department of Agriculture. This article will be splendidly illustrated and will be the most complete description of this project ever published.

Three of Them. Many, many years ago, or perhaps it was not so many, there lived in Philadelphia a man, J. Wilford Hall by name. One day Wilford discovered that the essential hypotheses upon which modern physical science is based are all wrong. So he began forthwith to publish a magazine in order that the world might be set right. And this magazine, in honor of himself, he called *Wilford's Microcosm.*

After Wilford had run his course and had subsided, the world had a weary wait of several years before it enjoyed another such a treat. Then came, not two years distant from our own time, H. Gaylord Wilshire, a young man whose worldly possessions were many, but who found that in spite of that fact there were spots here and there on the surface of the globe wherein his name had never been heard. So he set about to correct a state of affairs which he regarded as cruelly wrong, and after testing the efficacy to that

end of open letters to men of note, bill boards, and hired halls, he learned wisdom, and made arrangements so that to this day all who will may peruse the pages of *Wilshire's Magazine.*

And now, within the calendar year, it has come to pass that another, in the exuberance of his self esteem, having found that small capitals at the heads of printed columns for which the deluded members of the National Irrigation Association were paying, and that giant capitals on imposing looking circulars, and an exceedingly liberal interlardation of his name in hand-me-down interviews and editorials, did not, any one nor all of them, suffice to render him the measure of notoriety which he considered his due, has burst upon us with *Maxwell's Talisman.*

MR. C. E. WANTLAND,
Denver, Colo.

Maxwell's Aspirations. Mr. Maxwell attempts to discredit State control of water on the grounds that local politics affect the efficiency of an irrigation administration. Recently he has become fond of such terms as "Political Boards of Control," "Political State Engineers," etc., referring to such institutions in Wyoming and Nebraska. If he were better acquainted with the work of these boards or if he knew how carefully the members were selected as to fitness and experience he would not have fallen into error. To defend his "Home Rule" policy he has tried to convey the impression that these officers receive appointment wholly through political preferment. We defy him to select a single member of a board of control who is not fully qualified by experience and training to carry on the work entrusted to him. Mr. Maxwell can satisfy himself on this point and he must then find some other argument to warrant his stand against this kind of state administration. If his "Home Rule" policy were carried into effect local politics would be more liable to interfere with a just distribution of water than is the case under existing conditions. Corporate interests would have greater power to control the water supply and force small irrigators to the wall unless they were protected by State laws affording equal protection to all. It is true that there would be great opportunities for such a man as Mr. Maxwell in representing large interests in the litigation which would be sure to follow the adoption of a "Home Rule" policy.

It may be that Mr. Maxwell hopes all supervision to finally come from Washington. It may be that he has aspirations to be in charge or to be placed where he may dictate to those entrusted with the work. That the few politicians at Washington might be easier for him to control than the many State officers where irrigation is well understood, is probably true. The recent irrigation act, which was alternately supported and opposed by Mr. Maxwell and his propaganda, finally became a law. It was passed through the united efforts of western statesmen and it is doubtful whether or not Mr. Maxwell's influence greatly affected the final vote on the measure. The same men who fostered this bill are still in Congress and we believe they will continue to stand by their own State institutions and do their utmost for the irrigator through national legislation.

A Live One. When a man dies and his mortal remains are laid away in the earth the world at large forgets him, his friends buy a few flowers, heave a sigh or two as they leave the graveyard and then return to their daily avocation of tearing each other to pieces in a buisness and social way, and give very little thought to the good qualities of those who are gone or those who are living, with whom they are in daily contact. It is interestng to study living people, the others should be left for medical students.

The way to figure out the per cent of goodness in your fellow men is to stand them up in a row in your mind's eye, and learn who in the lot go over fifty per cent to the good and then keep in close touch with those who scale fifty-one per cent or better.

In looking at an imaginary line of men recently, one figure stood out prominently, as considerably above the half way mark, and on examining the tag the writer learned that it read, Clifford F. Hall, president of the Implement Trade Journal Co., Kansas City, Mo. "Cliff" as he is known to his friends was born in Rochester, N. Y., in 1855, and drifted west with his parents and after a diversified and devious early course learned the printer's trade which, as he says, is the best thing that he ever did, as it gave him an excuse for living and eventnaly led him into a branch of journalism which he thoroughly enjoys and in which his talents are employed to a good purpose.

Mr. Hall has been conducting the *Implement Trade Journal* since 1889 as president of the company and

principal owner. He is one of the shining lights in the field of implement trade-journalism, original, witty, forceful.

Mr. Hall aspires to make the *Implement Trade Journal* one of the greatest trade papers in the world and that he will win out, his friends have no doubt. In discussing this matter wth friends recently he made the following statement:

"It may sound bold and presumptuous, but I believe that I can, with the able force now supporting my efforts, in the course of a few years, demonstrate that the implement trade paper of to-day is but a shallow makeshift that not one of them comes anywhere near being

MR. CLIFFORD F. HALL,
President Implement Trade Journal Co., Kansas City, Mo.

what a representative dealers' paper should be, and that's what all of them purport to be and on the strength of such a claim gain advertising patronage. In a field where advertisers discriminate so lightly it has been comparatively easy for "most any old thing" in the shape of a trade publication to get along, but it will not be so easy in the future. We expect to advance the Journal to a weekly, beginning with January 3, 1903, and we hope to do much thereafter toward raising the standard of papers of this class."

In presenting a likeness of Mr. Hall we gently refrain from comment further than to say that he looks his best in an evening suit.

Home Rule?

Mr. George H. Maxwell, who pretends to direct the policy of the Government in irrigation matters, has recently delivered an address at Omaha, which, unfortunately for his reputation as an authority, has been given some publicity through the Omaha papers and a periodical of Washington, D. C., "Forestry and Irrigation." In this address Mr. Maxwell took occasion to criticize the state engineer's office already created, to warn law makers of the dangerous character of such officers and to arouse a feeling of distrust of State control of streams. The arguments he presents do not make clear his reasons for taking the position he attempts to defend, hence we must presume that he has some ulterior motive, which, if disclosed, would not strengthen his case. That the States which have adopted the best water laws and have employed efficient irrigation officers have afforded the best protection to the water user and have reduced litigation in the settlement of rights to a minimum, is an established fact. Mr. Maxwell understands this as well as any one and it is difficult to understand how in the face of such evidence he can advocate "home rule" as he calls it, instead of State control. What does home rule mean? It means that the rights to use water from every small tributary would be settled under a different procedure. When the rights were adjudicated each tributary would have distinct rules and regulations for carrying the decree into effect. As water is used from the tributaries the main stream is effected. How would Mr. Maxwell settle the rights on the main streams? As it is, county boundaries have been disregarded in the settlement of rights to use water from a stream flowing through several of these small political divisions. It is plain that interstate streams will soon have to be treated under a broader code of water laws than now exists among the arid states. Let no one be deceived by believing that when the time comes for the settlement of these rights generally, the States will fail to get together and adjust their differences. What could they do toward a just division of the water if each were divided into many small districts each enjoying "home rule"?

That the State Engineer's offices are not what they should be in all cases is not disputed, but their shortcomings cannot be attributed to the officers themselves, but to the State Legislatures which have to give ear to those who profit by the existing chaos as well as those who seek reform. Nevertheless, the sentiment in favor of the creation of central offices of record is growing and this winter will see a number of the western states falling in line and establishing offices where the proposing investor and the government engineers in charge of the construction of irrigation works can become acquainted with the flow of the streams, the extent of diversion therefrom and the area and location of the land irrigated along each. Supposing that each State could already furnish this information to the Government construction engineers. An inspection of the records of these offices would disclose to them the facts which they must secure before deciding upon the location of irrigation projects. In addition private enterprise could become acquainted with the undeveloped districts of each State and the irrigators along the various streams could easily satisfy themselves whether or not enough unappropriated water remained in the tributary supplying them to warrant them in extending canals or building storage works. Where States have not provided such offices this kind of information is not available. Neither the Agricultural nor the Interior Departments have collected minute details of the irrigation development along a single western stream. The

census bureau has largely depended upon these offices where they exist and where they do not the labors of the special agents have been greatly increased. While the statistics of the census bureau are valuable as far as they go, they can be considered as but a summary of a small part of the facts which the State Engineer's offices should contain. Where shall we turn to find the volume of unappropriated water, the location of the land already irrigated and the character of the rights which have accrued?

As an example let us take two adjoining farms in the Yakima valley in Washington. Suppose one to be located under a canal and the other just above so that it cannot be watered. The land of the dry farm would probably be worth $1.50 per acre and could be used only for grazing purposes. The irrigated farm would sell for $75.00 per acre before the sage brush were removed. Irrigation makes the difference. The added value of $73.50 per acre must all be attributed to water. As soon as the settler obtained his patent from the Government, a record was filed with the county clerk which describes his land, and whenever the title passes into other hands the record is changed so that it shows at all times who is in possession. But the value of the land depends on whether it is irrigated or not. Where is the record of the water right? Nothing of the kind exists in Washington. The people of the irrigated districts of the State appreciate the value of such records and if their influence were felt in the legislative halls as it should be, a State Engineer's office would have long since been created. And yet a man who represents himself to be the leader in formulating policies for the development of the arid West has instituted a campaign against further reform in State irrigation law.

The experience of the West in irrigation matters has been dearly bought. The price has been paid in the courts, and Mr. Maxwell has realized his share of the profits. The time has arrived when a change must be made and we believe that the States having no fully organized offices in charge of irrigation will profit by the example of those that have gone before and shown that only by wise laws justly administered by the States themselves can the irrigator be protected and the public be kept informed as to the character and extent of irrigation development.

AT SET OF SUN.

If we sit down at set of sun
And count the things that we have done,
And counting find
One self-denying act, one word
That eased the heart of him who heard,
One glance most kind
That fell like sunshine where it went,
Then we may count the day well spent.

IRRIGATION AND DRAINAGE IN THE FRESNO DISTRICT.

C. G. ELLIOTT.

Starting a vineyard in the raisin district of Fresno county, California, requires more careful attention than its subject culture. The small cuttings are planted where it is desired to have the vines grow and the soil about them must be irrigated frequently enough to keep it moist near the surface or they will not root readily. A neglect in this part of the work will result in the premature drying up of the young plants and the loss of a year's time in the starting of the vineyard. The planting of previously rooted vines, while accompanied with greater certainty in securing a stand, is not regarded with favor by experienced raisin growers. It is claimed that cuttings rooted in

MR. C. G. ELLIOTT, C. E.,
Expert in Drainage Investigations, U. S. Dept. of Agriculture.

place send out direct from the cutting individual and independent roots which grow downward and become established at greater depth and with more permanence than vines which are started from rooted cuttings. The reason given for this is that transplanted roots are necessarily broken or trimmed, from the end of which new roots start in clusters and grow with a tendency to spread rather than at once to seek nutriment and moisture from the lower soil.

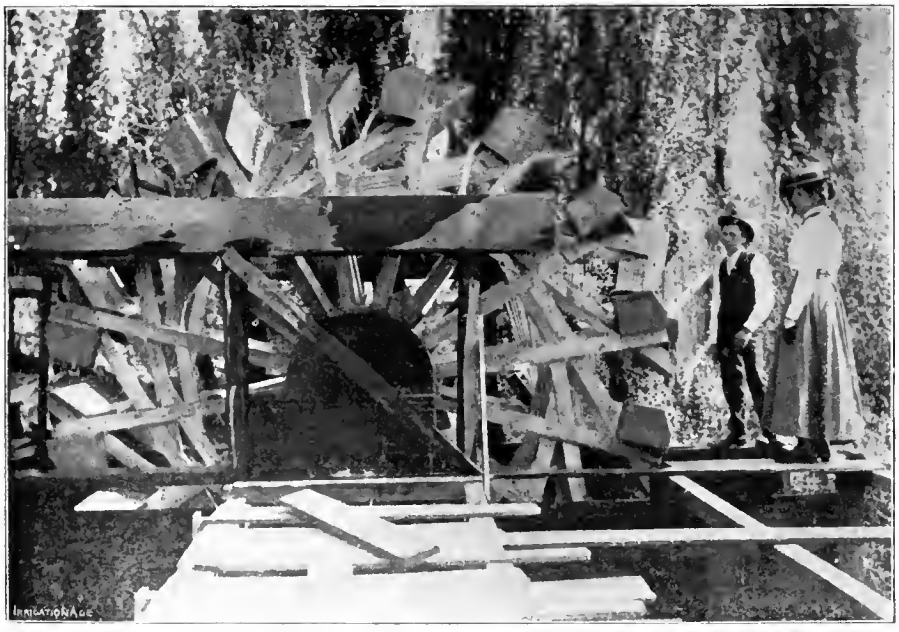
It has been observed in recent years that adult vines and trees in the older fruit belts require but a

fraction of the irrigation formerly found necessary because the water has filled the lower soil to within a few feet of the surface and furnishes sub-irrigation. The little plants, however, must be watched over and nursed by irrigating and cultivating them frequently during the first and second years. Some lands in the

PUMPING PLANT OF R. W. BRISCOE,
Near Malaga, Cal.

Fresno fruit district are not easily reached with ditch water by gravity and recourse is had to methods of pumping so that newly planted trees and vines may be watered as frequently as necessary. Wells are now drilled or bored and a bountiful supply of excellent water for irrigating purposes is found at depths where once there was none.

The writer witnessed the operation of a little pumping plant which supplies the water for the new vineyard of Mr. R. W. Briscoe near Malaga, Cal. The



PUMPING WHEEL, SUNNY SIDE FRUIT RANCH,
Near Fresno, Cal.

well is bored fifty-six feet deep and cased with twelve-inch casing. A six-inch centrifugal pump is set in a pit directly over the well and ten feet below the surface of the ground. A gasoline or oil engine located as shown in the cut connected by belt to the pump in the pit furnishes the power, and may be started at any time that it is desired to use water on the field. The water rises in the well so that when the pump is running at full speed it lifts water thirty feet and throws from one thousand to twelve hundred gallons of water per minute at a cost for fuel oil of six cents per hour. The well is located near the highest point on the two hundred and forty acres which it is intended to irrigate. Water can be easily lead over the land from this point, thus avoiding the expense of constructing independent laterals from the supply ditch to the vineyard. The engine runs with slight attention from the irrigator, making the plant thus equipped both efficient and economical, considering the work performed. Generators for use on gas engines are now furnished with them, by means of which crude oil as it comes from the wells may be used, making the cost of running an engine much less than when gasoline or the distillate is used. The abundance and consequent low price of California crude oil has greatly simplified the fuel question, making it the most convenient as well as the cheapest fuel known. Mr. Briscoe regards this method of obtaining water for irrigating purposes as highly satisfactory. As to the permanent supply of water from so small a well there may be some question should pumping be commonly practiced in a limited territory.

Knolls or small tracts which are too high for irrigating from the ditches are found on some fruit ranches. They are irrigated in some instances by water raised from the supply ditches by a large water wheel, to which is attached buckets which empty themselves into a side trough or small flume which conveys the water to the more elevated ground. The wheel is adjustable to the height of water in the ditch, and of course raises water without expense after it is once installed. This plan is old and is efficient where only small quantities of water are required, and a supply ditch with the necessary check or drop is accessible.

The rise of water through the sub-soil, which has been incidentally alluded to as providing sub-irrigation, is a phase of the water question which has been gradually forcing itself upon the attention of the fruit growers of Fresno county. While the gradual rise of water looks like a great help to the cultivator, and is, under certain limitations, yet where the rise is unchecked, it has resulted in the depletion of once valuable fruit farms. After sub-water rises to such a height as to be available for sub-irrigation, it does not remain at that desirable level, but continues to rise to such an extent that the available depth of soil is lessened, and the water containing alkali in solution being evaporated from the surface, leaves the solid alkali at or near the surface. This process, going on for some time, surcharges the surface soil to an injurious extent, even going so far as to destroy every valuable plant, and that, too, in the face of the most persistent efforts of experienced fruit culturists to prevent it. The annual rise and fall of three or four feet in the position of

the water table is a fact sustained by observation. Some of the county roads are systematically sprinkled with water which is obtained from shallow tubular wells which have been sunk at convenient points along the road. Their supply is the seepage which percolates through the soil from ditches and from the run-off of irrigation water. The tank wagons used for sprinkling are fitted at the rear end with a small gasoline engine and pump, by means of which the water is pumped from the wells into the tank. It is no uncommon sight to the passer by to see a four horse tank wagon standing by one of these wells with engine and pump working at full speed until the tank is filled. This is another instance of the pumping process adapted to the demands of the situation.

The reduction of the level of the soil water throughout the older fruit growing area is the problem which is now occupying the attention of many vine growers in the Fresno district. The Office of Experiment Stations of the Department of Agriculture has had surveys made during the past summer under the direction of Prof. O. V. R. Stout with the view of recommending some feasible drainage plan. This work is nearing completion and involves the drainage of twenty-five square miles of some of the finest fruit country of the State, and valuable data for the improvement of a much larger area. This is a country first desert, then made productive by irrigation, but now suffering from seepage from canals and over-irrigation. That such reclamation can be effected is reasonably well demonstrated. As in every new project there are many details of economic importance which must be worked out to the satisfaction of land owners before a practical demonstration on a large scale can be made. The intimate relation existing between irrigation and drainage is becoming apparent to every careful cultivator of irrigated land. If the seepage of water from canals cannot be prevented, or the use of water so controlled that there will be no waste, then provision for drainage must sooner or later be made in places where the natural condition of the lower soil does not afford ample facilities for carrying away surplus water.

SINS OF GENIUS.

A wise man who had studied long
  Desired to achieve renown;
He sought attention from the throng,
  But did not play the crank or clown.
He trusted to his work alone,
And went unnoticed and unknown.

At last he donned a gaudy coat
  And wore a hat with spreading brim;
He tore the collar from his throat
  And people stopped to notice him.
He let his hair grow long and made
Men wonder at the part he played.

Thus showing eccentricities
  That often made him blush for shame,
His work took on the strength to please,
  The world was busy with his name.
That which before had won no praise
Served now to gladden and amaze.

—*Chicago Record-Herald.*

BREATHING WELLS OF NEBRASKA.

In a recent paper published by the United States Geological Survey, on wells and windmills in Nebraska, mention is made of the interesting phenomena of the breathing or blowing wells which are found distributed throughout a large portion of the State of Nebraska. These wells are of the driven type mostly in use upon the plains, but are distinguished from those of ordinary character by a remarkable and unexplained egress and ingress of currents of air which produce distinctly audible sounds and give the names variously applied to them of breathing, sighing, blowing, or roaring wells, according to their characters in different places. The air currents are readily tested with flames of candles, or by dropping chaff or feathers into the well tubes. There are periods when these wells blow out for several days, and equal periods when their air currents are reversed. It has been observed that the blowing occurs with changes of the barometer. Some wells are found to be most audible when the wind is from the northwest, with a rise in water level; but with a change of wind, air is drawn in and the water is observed to sink. During the progress of a low-barometer area over one of these regions, wind is violently expelled from the wells, with a noise distinctly audible for several rods. Professors Loveland and Swezey, of the University of Nebraska, have made observations on a well of this nature in Perkins County, and found that its breathing periods were exactly coincident with the barometric changes.

The citizens of the region have attempted many explanations of the wells. Some have reasoned that the blowing is probably due to the liberation of gas produced from petroleum, and that as petroleum is a natural distillation from great coal fields, there must be an abundant supply of the latter mineral beneath the surface. Fortunes have been staked upon this deduction and much time consumed in a fruitless search for coal. Others have noticed the change of current which some wells show every twelve hours, morning and evening, and have thought that this regular oscillation was due to a tidal action of the sheet of water, erroneously considering the latter as a great subterranean lake. The phenomena are most frequently attributed by scientific observers to atmospheric pressure, which, though probably exerting great influence, is not necessarily the whole cause.

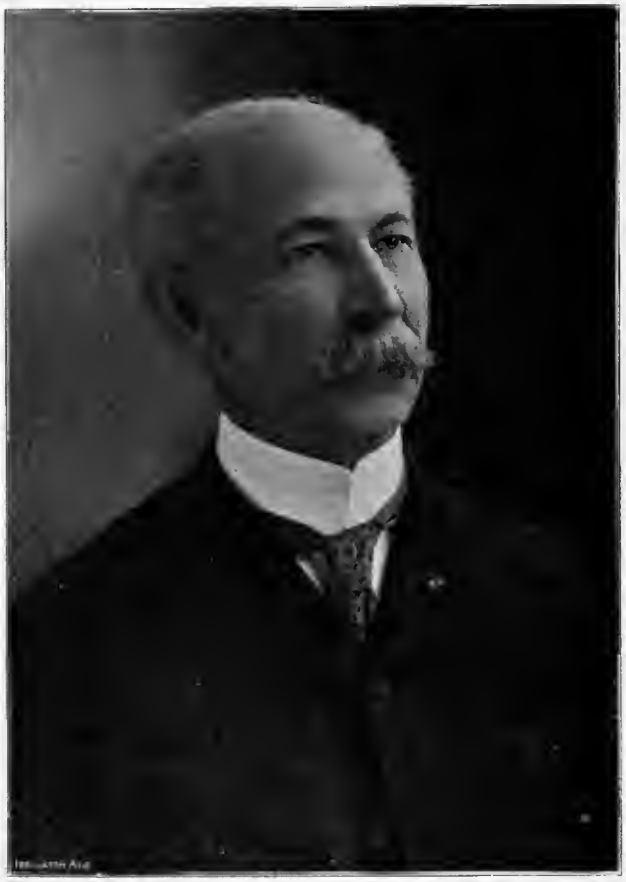
The material through which the wells are driven may throw some light on their peculiarities. In southeastern Nebraska a layer of dense limestone about 4 inches thick lies beneath 50 to 100 feet of subsoil. Below the limestones is found water-bearing gravel. When the limestone covering the water-bearing beds is penetrated water under slight pressure rises about 1 foot. The water-bearing layer is very porous and must always contain more or less air. As the air above and the air inclosed in the gravels below are alike subject to the fluctuations of the barometer, it follows that if the surface air is rendered less dense the air below will pass out through the well openings until equilibrium between the rarer air and denser air is established, and the opposite effect will follow during a period of high pressure. Still, this explanation, plausible as it is, hardly accounts for the force with which the air is expelled from some of the wells, and a more comprehensive study of the problem is needed to satisfactorily explain all the phenomena.

THE ELEVENTH NATIONAL IRRIGATION CONGRESS.

BY EDWIN F. HOLMES, PRESIDENT.

The Eleventh Irrigation Congress to be held in Ogden, Utah, next September, is destined to become one of the most important, if not the most important, meeting of that body from the time of its inception as a Congress of Irrigators and there will be present at that time a notable gathering of representative people from all over the country, as there was at Colorado Springs for the tenth session of that Congress.

There are already under way plans and arrangements for the perfect accommodation of delegates and guests, and in every way we hope to show our appreciation of the great honor done to Utah by holding the Congress in that state, the birthplace of the irrigation movement in the United States, and which movement we hope to see grow and develop to a remarkable degree, not only in the arid and semi-arid sections, but wherever the soil is cultivated in this country, believing that even where large crops are now raised without irrigation, even larger crops may be grown with irri-



COL. E. F. HOLMES,
President Eleventh National Irrigation Congress.

gation, and the value of every acre so treated to have a largely increased value in producing crops.

We earnestly recommend that State Irrigation Congresses be formed in every State, to look after the particular interests of that State, provide maps of irrigation districts, together with lines of canals built and to be built. Compiling statistics as to the work accomplished each year; locating possible reservoir sites, keeping lists of all parties interested in the great movement, and all matters of general interest in the work. The National Congress of the future to be composed mainly of delegates from these several State organizations, together with such others as may be appointed, thus meeting upon a common ground for the exchange of ideas in the development of the work from year to year, to learn of improved methods in the use of water, and its more economical distribution to the benefit of all parties interested in this great movement. Let each State congress possess itself of a library of current publications on the subject of irrigation and forestry, which is so closely allied to the main question

MY SKIES ARE SELDOM GRAY.

I've had my share
Of carking care,
  Of fickle Fortune's frowns;
I've braved and borne
The cold world's scorn,
  And had my ups and downs.
Yet I can still
A ditty trill
  Or sing a roundelay;
For though I hold
Nor lands nor gold,
  My skies are seldom gray!
The stress and strife
Of toilsome life
Have taught me one glad truth—
Not he who must
Crawls in the dust,
  But he who will—forsooth!
And so I sing
My song, and fling
  My load of care away;
For though I hold
Nor lands nor gold,
  My skies are seldom gray!
I would not give
A fig to live
  Divorced from fret and moil;
The bread I eat
Is rendered sweet
  Because of daily toil.
And so I still
A ditty trill—
  A blithesome roundelay;
For though I hold
Nor lands nor gold,
  My skies are seldom gray!

—*James B. Naylor, in National Magazine.*

A-MERRY CAN.

"I can fly kites, oh, awful high,
Away up higher than the sky!"
  Thus Bobbieboy began.
"You can!" said I, with quick surprise
At Bobbieboy's indignant eyes.
  Cried he, "I'm not a can!"

Then laughing at his queer mistake,
I said "My word I never break;
  So, Bobbieboy, my man,
A 'can' you are, a 'can' were born,
But yet a 'can' we do not scorn—
  For you're A-mer-i-can!"

—*Washington Star.*

REPORT OF IRRIGATION INVESTIGATIONS BY SECRETARY WILSON.

The portion of the report of the Secretary of Agriculture which deals with irrigation describes what the Department has been doing during the past year, and incidentally brings out many facts of general interest. Interest in these investigations, which are a part of the work of the Office of Experiment Stations, is constantly increasing and has been stimulated during the past year by the growing desire of the arid States for laws and conditions which will secure the largest and best use of the water supply, and in the humid region by the drouth which prevailed throughout the middle West in 1901 and in the South during the present year. As a result, the requests for information and advice have been more numerous than ever before, and it was only through the increased appropriation made by the last Congress that the department has been able to comply with the demands made upon it.

Referring to the need of better irrigation laws, the Secretary says that no branch of the Department's irrigation work has received more cordial recognition than its studies of legal and sociological questions. A number of the arid States are co-operating with the Department in these studies and two have made special appropriations to extend them. The question as to how much of the water of Western rivers has already been appropriated under State laws, the nature of the rights which have been acquired, the conflict which exists between riparian rights and rights acquired under the doctrine of appropriation, are some of the problems which confront irrigators in these States. A settlement of the rights which have become vested is needed to show how much water remains for future appropriators and to relieve farmers under existing ditches from anxiety and give to a State a safe foundation for future development. To the litigation over water rights within States there has recently been added important suits over interstate rights, the one of Kansas against Colorado being the most conspicuous. The law providing for the Department's investigations provides first of all for an investigation and report on the laws affecting irrigation and the rights of riparian proprietors. Under this, an investigation of interstate rights is now going on, the results of which will be watched with much interest.

The report of the Secretary brings out the fact that drainage is becoming an important problem in the older irrigated districts. Two drainage surveys were carried on during the past year; one in the valley of Kings River in California, under the direction of Prof. O. V. P. Stout, and another in Colorado, which was carried on by Mr. C. G. Elliott, agent and expert, under a co-operative arrangement between the State Engineer's office of Colorado and the Office of Experiment Stations of the Department. The owners of lands which have become swamped by too much water will be encouraged by the results thus far secured, the Secretary reporting that they show that it is not only possible to remove the surplus water and restore large areas of land to cultivation, but that the water which comes from these drains can be used for the irrigation of other lands.

The Secretary's report shows that much interest is being given to irrigation in the humid States, especially in the South, where the irrigation of rice has proven exceedingly profitable, and where important experiments are being carried on to determine the value of irrigation as an aid to market gardening. The fact that the Department has in its employ a number of irrigation engineers who have had wide experience in the West has resulted in a saving of large sums of money to those who were putting in pumping plants. This has been done by correcting a tendency to put in pumps of too small capacity to be of any real service.

He also calls attention to the changes in farm life and farm work which have come about through the inventions of machinery and its extensive use by American farmers. The United States the greatest manufacturer and user of farm machinery in the world, and the changes which have come about through their invention have made almost as radical a revolution in farming operations as has been wrought by the substitution of machinery for hand labor in manufacturing. Among the complex machines which the farmer has to operate today are combined harvesters and threshers, traction engines, automobiles, power machines for harvesting corn, for shucking the ears and shredding the stalks, and recently dynamos operated by electricity have been added to the agencies employed to do farm work. These facts, in connection with the increasing demand for more efficient labor-saving tools, the growing scarcity of farm labor, and the organization in foreign countries of institutions for the systematic study and improvement of farm machinery, make it, in the opinion of the Secretary, important that we should not longer neglect this field of inquiry, and provision for carrying this out in connection with the irrigation investigation is recommended in the Secretary's report. In his estimates submitted to Congress, the Secretary asks for an appropriation of $75,000 to continue the investigations in irrigation and agricultural engineering.

Colorado will get $3,000,000 for the arid land reclamation fund and work will commence in this state next spring on the two great projects under the reclamation law. This is the quiet hint that has gone forth to irrigation experts and those interested in what Colorado will get as its share of favors under the new law. The report of Secretary Hitchcock, which was issued last week, and which is so highly favorable to the projects under the new law and the supplementary reports of Hydrographer Newell and others show that all doubt as to the plans being carried out is now at an end.

That Colorado will get a large amount of the money that is to be expended seems certain. There will be about $8,000,000 on hand when the experiments begin next spring, and of this sum Colorado will get about $3,000,000. It is pointed out that there have been seven different sites recommended in all of the western states. Of these, two are in Colorado. They are the Pawnee Pass and Gunnison sites, and it is now considered certain that both these projects will be favored and utilized by the federal government. It is also felt that Colorado offers greater advantages and has already shown such advancement that two sites are needed in this state. The surveys will be completed this winter.—*Denver Times.*

"Sympathy is the cheapest graft that ever looked over the hill; its got every other con game skinned to death, and a guy in a tight pull takes chances o' breaking his neck over it every time he opens his mouth."—*From "The Ragged Edge," by John T. McIntyre, McClure, Phillips & Co.*

A GREAT ENTERPRISE.

The Pueblo (Colo.) *Chieftan* of a recent date contains the following:

"If the present plans of the Colorado Fuel and Iron company materialize, over ten thousand acres of the most fertile land adjacent to Pueblo that has for years been considered range and grazing land and which is supposed to have millions of gallons of petroleum under it, will be made to bloom and blossom like the rose and will be the homes of thousands of people. The entire section of Pueblo county known as Boggs' flat, together with miles of land southwest of Pueblo, will be put under one of the largest ditches in the world and by means of a system of reservoirs, which will hold the flood waters of the Arkansas river, it will be supplied with water.

So quietly have the plans for this big undertaking been consummated that even the most enthusiastic irrigationist and the closest student of the arid land question have known nothing about them.

For carrying out this irrigation plan the Colorado Fuel and Iron company desired the waters from the Twin Lakes reservoir, and its officials have for some time been in consultation with the attorneys of the company that owns them looking to a purchase, saying they wanted the water for the Pueblo steel works. The company said it could not furnish water, as there was no way to transfer it from the lakes near Leadville to Lake Minnequa and the adjacent reservoirs of the company.

One of the largest irrigation ditches in the state was planned for this purpose, and surveyors are working on the right of way. Three surveys have already been made. They leave the river at Canon City and proceed southwest along the bluffs to near Pueblo. The first one made was too far south. The second was too crooked; the third passed through school lands and the state would not permit its construction. The fourth one will probably be adopted.

The men are now at work on it. Leaving the river at a point west of Canon City, it proceeds along the bluffs to the second mesa between Pueblo and the St. Charles river, where it empties into Salt Creek and the new reservoirs of the Colorado Fuel and Iron Company and ultimately into Lake Minnequa. Plans may also be drawn for a ditch connecting the lake with the Bessemer ditch so that when water is low in that ditch it may be supplied by the Colorado Fuel and Iron company for a nominal sum.

Where the ditch will leave the Arkansas river will be one of the finest dams and irrigation schemes ever tried in the west. It will be much on the order of the big dam which catches the flood water of the St. Charles river and carries it to the new reservoirs of the company. The water in the river is more than appropriated. For this reason the ditch can not be built out into the stream to secure any of the constant flow. A large dam will be built which will permit the normal flow to be kept in the bed of the river, but when a flood comes the extra water (to the capacity of the ditch) will be diverted.

Along the ditch for storage purposes will be constructed four magnificent reservoirs. This flood water will be stored in them and a constant flow given the ditch for irrigation purposes. Billions of gallons of water will thus be stored west of Pueblo, and the Arkansas valley will not suffer from a scarcity of the water supply as has been the case in the past.

Half of the supply of the Twin Lakes reservoir, it is stated by an official, has been arranged for, and when the water in the river is low it will be turned in and given to the company through the new ditch.

A large new reservoir, almost the size of the Twin Lakes, has been planned and is being constructed near Leadville. The water stored there will also act as a supply for the new ditch.

Hundreds of wells will be sunk in the low lands and the underflow, which is greater than the natural flow of the river, will be tapped through artesian wells, and the water used as a supply for irrigation purposes in the lands below the ditch during the dry season.

While the Colorado Fuel and Iron company will directly benefit from the construction of the ditch, in that it will make thousands of acres of its land now non-productive capable of cultivation, and thus enhance its value, it will also do the same for thousands of acres of private land and government land.

For Pueblo, however, the greatest advantage to be seen in the construction of the new ditch and system of reservoirs is the fact that it insures to the steel works what it must have—a water supply for all time to come. In the past it has been threatened with a water famine, but when the new system of reservoirs are in operation there will be no further danger from this source.

Besides the lands of the Fuel and Iron company southwest of Pueblo, which will be placed under irrigation, what is known as Boggs' flat, a level piece of ground containing nearly 10,000 acres, will be most benefited. It will all be under the ditch and for a nominal sum water can be secured for it. The new ditch will do for it what it was thought the state canal, planned years ago, would do. Some of this land is owned by private parties, but most of it belongs to the government and can be entered upon. When the state ditch was planned it was taken up, but when it fell through the pre-empters and homesteaders failed to prove up and much of it reverted to the government. A year ago when the oil fever struck Pueblo and so many companies were formed it was again filed upon, but for the purpose of boring for oil. The Pueblo Oil Wells company was the only company to sink a well, and so far it has not struck oil, though two wells have been sunk to a considerable depth. Because no improvements were made and no wells sunk it is thought the land will again revert to the government and be open for entry.

The result of constructing this ditch and large system of reservoirs can hardly be comprehended. It means that the entire country for miles southwest of Pueblo, reaching almost to Canon City, will be farmed and where buffalo grass now grows will be waving fields of alfalfa and grain, where the long cactus rears its head will be beautiful trees, and where the rabbits and gophers have their holes herds of cattle will be fattened each year and bring to Pueblo county thousands of dollars in revenue.

THE COW SLIPS AWAY.

The tall pines pine,
The pawpaws pause,
And the bumble-bee bumbles all day;
The eavesdropper drops,
And the grasshopper hops,
While gently the cow slips away.

—*From "Ben King's Verse." Copyrighted.*

HAGUE'S PEAK GLACIER.

A body of frozen snow and ice more than 30 feet high, with a number of crevices that show it to be more than thirty feet thick, and extending for nearly 3,000 feet around an amphitheatre, is one of the inexhaustible sources of water supply for the farmers of northern Colorado, who are under ditches that tap the Poudre river.

This immense glacier lies on the top of Hague's peak, eight miles northwest of Estes park in Larimer county, Colorado. It is at an altitude of 12,000 feet above sea level and 2,500 feet above timber line. It requires three days to travel after leaving the park, and then three hours of steady climbing on foot before the great deposit of everlasting snow and ice is reached.

From this topmost summit of the continental divide the vision rests upon a scene of utmost grandeur. To the West is presented the entire great North park basin, and beyond to the North, the grazing lands and fertile fields of southern Wyoming. So clear is the atmosphere that trains on the Union Pacific going through Sherman, Wyoming, fifty miles away, can be plainly seen.

HAGUES PEAK GLACIER.

The top of this glacier is composed of better than 200 feet of frozen snow, and the remainder is ice to a lake of crystal purity and covering about six acres. From the lake the water starts down into the North Poudre river and to the arable lands along its course.

The glacier was discovered in 1871 by Professor Hayden and party of the United States Geological Survey. With this party was F. E. Baker, a photographer, now a resident of Greeley. Very little exploitation was given the matter, but Mr. Baker always bore it in mind, satisfied that some day, when the soil producing possibilities of northern Colorado were brought under a system of development by irrigation this particular source of supply would be a good thing to file on. At the time of the discovery no photographs of the wonder were taken. Since irrigation has been given more attention Mr. Baker, about three years ago, decided to take some action relative to the glacier.

The first attempt to photograph the glacier was made at that time. It failed, for a cloud settled over the scene, and not being prepared for such a condition, and not knowing how long it might last, he gave up the work. The next year two storms of rain and snow came up within a few days of each other, and he was forced out. Last year he went up in the month of July and secured the photographs herewith presented. He will go out again this month, do some surveying for a reservoir site, also to look into the feasibility of turning the waters on the continental divide west of Hague's peak from the western slope back into the Greeley district.

The energetic irrigationists interested in the North Poudre Irrigation Company, of which B. D. Sanborn is president, are back of this enterprise, to add to their already excellent plans for the reclamation of thousands of acres of the soil of Weld county, changing them into productive farms, and thereby increasing the stock feeding industry of that section. The feature about this company's enterprise is that, in the first place, there is much local capital interested and they are spending their money freely to get it into shape.

The Fossil creek reservoir can be taken as an instance of their push. This is a natural reservoir site located in Larimer county, and one of the fourteen owned by the company. It will cost about $250,000 to put in shape. It will have the largest earthen dam of any reservoir in the State—one-half mile long and forty-eight feet high. The reservoir covers 750 acres. When the fourteen reservoirs are filled they will have water enough to cover 70,000 acres one foot deep.

The company found that its water supply was unreliable because of the priority of Weld county ditches, and therefore the headgates of the North Poudre canal would be closed early in the season as soon as the floods were fairly over. To overcome this grave objection the company built the Fossil creek reservoir, thirty miles lower down on the stream where the water was abundant, and the unappropriated winter supply sufficient to fill one of the largest reservoir basins in northern Colorado. This reservoir is now completed.

SATISFACTORY WORK FROM GASOLINE ENGINES.

J. M. HENDRICKS, NEW YORK, IN ORANGE JUDD FARMER.

I have had in use on my farm for over two years a gasoline engine of 2½ horse power, the cost of which was $135. My experience with it has been very satisfactory. I was a little sceptical at first about its power; also somewhat shy of gasoline; but when I got the engine, put it up, and saw it work, all fear was dispelled. It did more than the manufacturer claimed for it. It has cost me only 25 cents for repairs, and the machine does not seem to be worn at all.

Pump water from a bored well over 100 feet for all uses on a 300-acre farm. I keep considerable stock. The engine does it with ease. It has converted a dry farm into one amply supplied with water, without the bother and expense of ditches. I have a large box 14x10 feet and 1 foot deep, lined with zinc. It holds about 14 barrels of water and I can and do have fresh and pure water for my stock that any city may envy. To pump this water by hand would be impossible; and, with a wind engine, it would be too warm in summer and too cold in winter, as you need to keep a supply on hand.

I use wood altogether for fuel on the farm. The engine attached to a 24-inch circular saw does it all. I am nearly 60 years of age, and in eight minutes after I light the burner I will be sawing wood; and in two hours I will have more wood for the stove than four men could cut in a day, and with little labor to me. We also grind bone for fowls. If we have a large washing, by using another attachment we make the engine do it. It will crush and grind feed; in fact, you can utilize it wherever you have need of power.

The work mine has to do costs me about 3 cents per day. I get six gallons of gasoline every three weeks. I have an airtight metal can and pay 13 cents per gallon. It would be cheaper possibly if bought by the barrel; but it evaporates too readily from a barrel, and the five-gallon can is easier to handle. If I were to use the engine ten hours at its full capacity, the cost would be about 33 cents. But no farmer has use for it continuously. It is the cheapest power known. It is cheaper than my horse feed, not counting the gearing up and hitching up, and a hand to mind the horses. Then, too, the engine will pull, no matter how you crowd it. It will just pump itself a little more gasoline and cough away. It consumes gasoline according to the work it does.

There is no danger without willful carelessness. The engine for its own use has to pump gasoline up hill and pumps it only as it is needed. If it should by chance pump more, there is a tube to allow it to run back into the tank. For still greater safety, if four or five charges should be exploded, the exhaust is sufficient for it. After you start the engine and regulate it, you do not need an engineer. It runs itself, and will run as long as there is gasoline in the tank.

I never made a better investment in machinery. Other machines I use in their season. I use this engine all the year. A great many farmers and some from a distance have come to see it work, and all were well pleased. Some of them have purchased engines. A good way for many farmers to use them would be to bolt them on a truck to be used anywhere on the farm. I have mine stationary in a small well house, and have it so arranged that I can change from one job to another in from not more than two to three minutes' time. I think every well-managed farm is not complete until there is a gasoline engine upon it and rigged for work. Why chop wood, pump water, turn the grindstone, grind your apples for cider, grind your feed for stock the old way, and by hand, when you can have a power that will do it for you, and cheaper than you ever did it? Help on the farm is getting scarce everywhere.

The third annual report of the irrigation investigations of the office of experimental stations, United States Department of Agriculture, made under the direction of Elwood Mead, says that averages of measurements, embracing nearly all of the arid states, show that during the past three years enough water was turned into the heads of ditches during the irrigation season to cover the land irrigated to a depth of 4.45 feet, or, stated in another way, 4.45 acre feet of water were taken from streams for every acre of land irrigated.

CANYON LA

George W. Bowman and a number of capitalists associated with him contemplate the reclamation of a considerable area of fertile lands at Socorro. The company will purchase 1,840 acres of bottom land stretching eastward from the Cocorro depot. It is fertile land but undrained. About 340 acres will be reserved for a townsite and park and the remainder after it is drained, will be plowed and irrigated from the Rio Grande and set out in staple crops. The company is also negotiating for the purchase of the Socorro Fire Clay Works from Edward Dodd, of Albuquerque. An electric light plant and water works will also be put in.

The Eartham Electric Company of Denver is erecting a 150 horse power pumping plant at Las Cruces that will furnish water to orchards during the dry season. The project is considered a feasible and profitable one. —*Santa Fé New Mexican.*

CANYON LANDS NEBRASKA.

[See Illustration.]

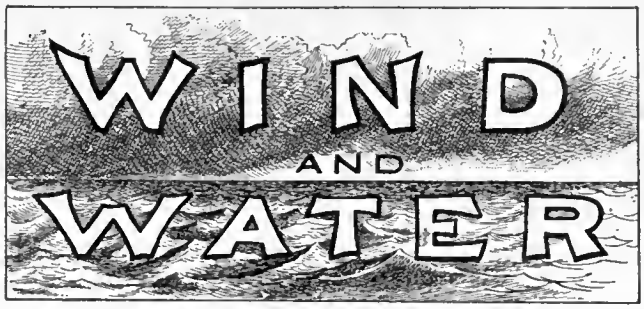
Nebraska is not a new state, yet settlement is barely started. As many more people could go into the state as are there today, and if it were not for the census enumerator it would hardly be noticed that any increase had been made. There are thousands of acres in the State without a settler. Yet finer grazing lands have never been located than these same acres. They have been passed over during the rushes of the past because lands were looked for which could be farmed as the lands of Illinois, Michigan and Ohio were farmed.

That greater wealth could be produced from these grazing lands, through the intelligent handling of stock, than was ever dreamed of in farming, did not occur to these early seekers of homes. They were following in the beaten paths marked out by their fathers. The only purpose they conceived for which the land was created was to raise corn, wheat, oats, and rye, and where these things could not be raised, to their notion the land was worthless.

)F NEBRASKA.

As time passed on these people, who sought to convert the wild lands of the West into growing fields of corn and wheat, gave up their missionary labors. Many of them returned to the place from whence they came, with their original capital converted into experience, while others learned the lessons which nature taught. They understood that these plains were created as the basis for the meat supply of the country, and lost no time putting into effect their newly acquired information. These people can yet be found in all portions of the Great West, and without exception they are prosperous. They are the most enthusiastic boomers the country has. They know, for they have passed through all the trials, and there is nothing like experience to convince one of an error.

Nebraska opportunities are being made known. Many people from Iowa, Illinois and other states have been investigating western Nebraska, and particularly along the Union Pacific Railway line.



WINDMILL AS A CIVILIZER.

Appliances for Irrigation—The Rain-Makers Must Go—Utilization of Windmills to Provide Power —Their Uses on the Farm.

The time was when a windmill was a curiosity. Occasionally some crude affair would be found in some localities, an imitation of those used in Europe, the miller and his family occupying a tower, with great arms extending from the tower to receive the force of the mill, and the wheat being ground on the lower floor in all seasons. The progressive spirit of the Americans, which allows no escape from enterprise, reached into the domain of windmills, however, and gradually changed the entire method of construction and use. To-day the windmill is seen on all farms where progress and intelligence rule, and it is as much the portion of the complement of the well-regulated farm as the wagon, the reaper or the harrow, being, in fact, an indispensable adjunct to success.

Perhaps we might safely assert, without exaggeration, that the windmill can be applied to a greater number of uses than almost any other appliance that can be attached to the farm. It is restricted to no section, and is as serviceable on a small plot, proportionately, as on the largest farm. It is the "general servant" of the farmer, faithful at all times, working at all hours, day and night, and tirelessly performing its duty without the necessity of an engineer, driver or guide. It entails literally no cost for labor, seldom requires repairing and stands at its post of duty like a sentinel on guard during all seasons to assist the farmer and lessen his work. It fills his reservoirs, supplies an abundance for stock, and also provides water for household of the purest kind to be had; gives power for its grinding mills, and may even be made to light his house with electricity. It is a source of wealth, and its application to service is almost without limit.

Geared mills are the power producers. While we must give some consideration to the pumping of water, it is with due regard to the new fields now opening for windmills. But the real labor-saving windmill is that which is geared, and which can cut the feed, grind the grain, reduce the straw, hay, etc., to shreds, and save time and labor of both men and teams. The farmer who drives miles to have his feed ground allows others to do for him what Nature volunteers to perform without cost; and incurs an expense for hauling and labor of himself and his animals when he can, at all times, under shelter, and at all seasons of the year, do for himself by using the untaxed forces of Nature, which are free and without price to all who will avail themselves of the opportunities offered. The cheapest, easiest and most feasible appliance of power is the geared windmill.

The windmill also brings into requisition other implements and appliances, for every farmer who has a windmill seeks to derive the greatest benefit from its

capacity to assist him. Instances have been known in which windmills have been used in connection with water power, being made to assist in adding to the volume of water in ponds during the periods of drought, such water, however, being conserved for occasional use. And there are hundreds of barns complete with belting which, during favorable winds, are busy with the work of several implements that are being operated at the same time.

There is one advantage derived from the windmill which is paramount to all others, and that is its low cost. It may be truly claimed that the power costs nothing. There may be better sources of power and greater capacity, but the item of cost must always receive the first consideration. The comparison of windmill power with that derived by some other methods must be made upon a standard of cost. And, it may be added, that while the cost of power is nothing—harnessing the winds—the cost of a windmill itself, owing to invention and improvement, is insignificant, considering the great service it performs.

It is not within our province here to describe methods of making reservoirs for the storage of water, but it is not out of place to call attention to the matter of securing water for crops. It is not every location that is favored for irrigating with canals, and the windmill is the agent that must be used by some. As a well-known manufacturer states, how much in water, in addition to the rainfall, is required, has not yet been fully determined for any kind of crop. Taking the generally accepted amount of 24 inches of rainfall as the necessary amount of water to mature a crop, it is only necessary to deduct the average annual rainfall from 24 and the difference will be the amount to be supplied. When the rainfall during the year equals 12 inches, then 12 inches more must be supplied; and where the rainfall is 18 inches, the remaining about to be supplied is 6 inches, and so on. One acre of ground requires 27,000 gallons of water to cover it 1 inch deep, and this amount, multiplied by the number of inches necessary to add to the rainfall, so as to make up the required 24 inches, will give the number of gallons per acre of water to be pumped. But due allowance must be made for leakage through the bottom and walls of the reservoirs, and leakage and loss in ditches and evaporation, all of which amounts to a great deal in the aggregate. About 250,000 to 325,000 gallons of water will probably mature one acre of any crop when the average rainfall is 12 inches or more. A pump with 6-inch cylinder should supply 1,000 to 2,000 gallons per hour, and will probably supply water to irrigate 5 to 10 acres. A pump with 8-inch cylinder should supply 1,800 to 3,600 gallons with wind at 15 to 30 miles velocity, and will supply water to irrigate 20 to 40 spring crops.

When general crops are grown, so that the pump works the year round, twice the amount of land can be irrigated. Smaller mills can operate pumps in shallow wells, while it will require mills of larger size to operate the pump as the depth of the well increases. The same mill will operate more than one pump, as the force of wind increases from 15 to 30 or 35 miles velocity, and the added pumps, reinforcing the first one, increases the amount of water pumped, so that a great deal more land can be irrigated than where only one pump is employed. Water supply and how to obtain it is a problem but little understood. Open wells and well points are contending for preference.

Market gardeners are now using windmills, and they find that by the control of the moisture they can produce enormous crops. The beautiful lawns that often become parched during dry seasons are kept green and inviting by being independent of the rainfall. Every country house may have its water from garret to cellar, and any field on the farm may be supplied with an abundance for stock. Rainmaking experiments are no longer a necessity, and future crops may be larger and produced at less cost. The windmill can banish all danger of famine in any section, enable man to store his supply of water when it is most plentiful, and increase the comforts of all classes.

The general use of windmills increases the improvements of every department of the farm, and also increases the capacity of the farm itself. Larger numbers of stock can be supported, as greater supplies of water and greater abundance of food can be provided. The moderate cost of a windmill permits of the use of any number of them, as may be required. The protection against loss of crops increases the profit, and leads to the introduction of other implements. Larger crops demand more wagons, plows, cultivators, cutters, grinding mills and other accessories. The wind is made to do the work that cannot well be performed with any other agent, and Nature's power is utilized for grinding the food and bringing the water from lower depths to be applied where most needed on the surface. There is not a village or town that cannot be benefited with windmills. Every citizen can control his water supply, and free himself from the pollutions of rivers and the dread of disease. Health depends upon the conveniences and facilities for obtaining pure water. It serves not only as a drink, but is also a constituent of nearly all foods. It can be obtained from open well or deep down below the reach of pollution, through driven wells, which serve as barriers to the entrance of the solutions from the surface. The farmer is not alone the interested beneficiary ot the windmill, for the merchants, the retired manufacturers, the schools, the colleges, asylums, health resorts and the people in general may resort to its use and take advantage of its benefits.—*Export Implement Age.*

THE ADVANTAGES OF A WELL.

Irrigation by water from a well if the latter yields, even a small flow of 15 gallons per minute at a moderate depth from the surface, possesses certain advantages over that from a gravity supply, in spite of the usually greater annual cost of lifting the water by machinery. The well and the source of water are, as a rule, under the individual control of the irrigator. It is not necessary for him to combine with other men and to invest large capital in a complicated and uncertain undertaking before he can receive any benefit.

It is often possible for the farmer to dig or drill the well himself, or have it dug at small cost, and he can purchase, sometimes on credit if necessary, the machinery, windmill or pump for bringing the water to the surface.

Being under his own control, he can apply the water whenever in his judgment the plant needs it, not being compelled to wait his turn, or take water at inconvenient times, whether day or night, according as it may be allotted under a large irrigating system. The well should be dug or drilled on the highest point of the land if possible.

BOTTLING UP COLORADO FLOOD WATERS.

SUCCESSFUL STORAGE RESERVOIRS—CAPACITY LARGE—WILL IRRIGATE LARGE AREAS.

Colorado is having its first practical experience with flood reservoirs, and the experience is certainly encouraging. The thorough utility of such reservoirs appears to be fully demonstrated. The results, too, go far toward proving the wisdom of the recent national irrigation legislation. Storage reservoirs are not a new thing in Colorado. But it was not until recently that distinctive flood reservoirs were constructed. The reservoirs of previous construction were designed to be filled through the channels of regular irrigating ditches, and were filled at such times as the ditches were not in use for direct irrigation. They were filled principally during the non-irrigation season. But this season is not usually one of floods; so the process was quite slow and sometimes unsatisfactory.

The flood reservoir, however, is constructed in the bed of some small stream, so that primarily it will have a water supply of some sort. Then in addition it has a supply canal leading from some large stream, so that when there happens to be a surplus of water in that stream, this surplus may be collected. If a ditch of this kind is not practicable, a lateral or branch leading from the main irrigating ditch of the system to which the reservoir belongs is substituted. Thus, good advantage may be taken of any flood that may occur.

The best examples of flood reservoirs in Colorado are those of the North Poudre irrigation company in Lorimer county. These were constructed during the winter and spring of 1902. With these and the reservoirs already in existence, the company has a system with a combined storage capacity of nearly 3,000,000,000 cubic feet of water.

The larger of its flood reservoirs is the Fossil creek reservoir, situated about ten miles southeast of Fort Collins. This reservoir has a storage capacity of 550,000,000 cubic feet of water. It was completed in the last of May and very little water was received in it until September 20 and 21, when the long drouth in Colorado was broken. Within 40 hours nearly 7 inches of rain fell in the Poudre valley. Then the flood reservoirs began to tell their story. The Fossil creek reservoir receives the entire flow of the stream whose name it bears. It also has a large supply ditch leading from the Cache la Poudre river. Within 24 hours after the storm began the water in the reservoir rose 14 feet, indicating a gain in water held of 44,000,000 cubic feet. October 10 the water had risen to nearly 24 feet, and the amount of water received from the beginning of the storm up to that date was 300,000,000 cubic feet.

In the other storage reservoir of the company a like saving was made, so the company has stored away as the result of one storm 600,000,000 cubic feet of water for next season's irrigation. It is the opinion of the company that all of its reservoirs will be filled to their utmost capacity long before the next irrigation season opens.

The value of the water already saved by this company can be approximated when it is stated that it is sufficient to irrigate nearly 14,000 acres of land for an entire season.

Renew your subscriptions to the IRRIGATION AGE for 1903. Send us in Post Office or Express money order for $1.00.

Pulse of The Irrigation Industry

The White Mountain Irrigation Company, with a capital of $250,000, has been incorporated at Santa Fe, N. M., by Frank W. Parker, Martin Lohmann, Joseph N. Bonham, Gilmore Friend and James P. Mitchell. A large storage reservoir is to be erected near Talarosa, Otero county, and a ten miles canal will be constructed. The company will have its headquarters in Las Cruces, Dona Ana county.

It is very sad to see that even New Mexico's irrigation works are passing from the wooden period to the cement era, like those of California, long before there is any sign of it in Colorado. The Pecos Irrigation Company is about to have the wooden flume crossing the Pecos river six miles above Carlsbad replaced with a permanent concrete structure at a cost of $50,000. Kansas, and fifty men will be at work three months. This is the kind of works we can have in Colorado when we get around to it, the cement being made at the new Colorado factory at Portland which began operations this week.—*Chieftain, Pueblo, Colo.*

Editor Trickey of the Pearsall Leader is still preaching irrigation but it appears to be as if his argumental drill had struck nothing but the granite stone of indifference to that all important question—*Uvalde Leader News.*

This is where you are mistaken, brother. There are at least ten men in Frio county putting in irrigation plants and several others will go to work with the same intention in the next few weeks. The Leader is drilling in soapstone now, we are keeping the mossbacks cased off and now and then we strike pure water and feel encouraged for a few days. Granite rocks get in the way occasionally, but we keep on with the drilling and work that much harder. Now and then a progressive farmer comes in and with cheering words shows his appreciation, helps us, so to speak, keep the drill sharp and ere long we hope to strike artesian water.

Keep it up, Mr. Trickey, don't allow anything to discourage you so long as you know you are on the right track.

The famous Arrowhead reservoir site near San Bernardino, California, with all its tributaries, tunnels and canals, has been offered for sale to the government and the department of the interior has asked for an exhaustive report upon the condition of the property, its description, the cost and character of the work so far accomplished and approximately the cost of completing the gigantic undertaking, together with a statement as to the number of acres which would be directly brought under cultivation through its completion. The company is composed of Cincinnati capitalists, who had planned an immense reservoir high up among the mountains above San Bernardino valley to impound billions of gallons of water pouring from an almost limitless watershed and use the water upon the thousands of acres of rich fruit lands in the valley. For ten years work has been going on. Cement canals miles in length have been built and a high impounding wall of concrete is over half completed, the outlay so far running above

the million mark, but the project seems no nearer completion than five years ago—in fact the company has been chiefly pouring out gold to keep the work so far done in repair. Should the government secure the property and complete the reservoir a very large acreage could be placed under cultivation.—*Denver Field and Farm.*

The following communication from the pen of O. V. P. Stout recently appeared in the Omaha *Bee* under the heading, Mistakes made by Maxwell.

Omaha seems to have been chosen by Mr. George H. Maxwell, otherwise the National Irrigation association, as a center from which he will hurl his thunderbolts. An address delivered by him there not long ago has been placed in the hands of western editors and has to some extent been quoted. This address attacks the system of state control and administration of public waters which is in force in our own and some neighboring states. In making this attack, he absolutely ignores the facts which serve to intrench those laws in the favor of those who have acquired or who expect to acquire water rights under them. He undertakes to prejudice the minds of those who may not be fully informed, using to this end such terms as "a corps of state ditch tenders appointed by state officials." He states that the system in force "puts the control of the distribution of the waters of a state in the hands of a great political-irrigation machine, controlled by the state politicians," and presumably expects no one to recognize the fact that a similar statement might be framed in regard to any of our affairs the administration of which is intrusted to state or national authority.

He takes up "home rule in irrigation" as a "slogan," and with the same abandon which he assumes when he assured the delegates to the irrigation congress at Colorado Springs that when the government built its reservoirs and irrigation works, there would be "plenty of water for everybody," he now brushes aside all difficulties in the way of a system of water administration which would permit "every drainage basin, every irrigated community, every canal system, and the whole body of irrigators on any stream" to "control its or their affairs" independent of any central state authority. On this point, does it seem that the local control of the North Platte and Platte rivers would be simpler than the present state control? Mr. Maxwell must imagine that nothing would be easier than for the people of Scotts Bluff county and those living several hundred miles nearer to the mouth of the river to get together in the town meeting and fix up their affairs.

He speaks of the "complicated code of state laws," in the face of the fact that the more completely the element of state control of streams has been embodied in the constitution and statutes of the irrigation states, the more simple and inexpensive is the process of adjudication of priorities of right to the use of water and the more definite and secure are those rights.

Mr. Maxwell says that the codes of state water laws "would complicate and retard beyond calculation the operations under the national irrigation act," and, further, he limits what the states should do in this matter to the establishment of "a few fundamental principles by constitutional amendment and judicial decision."

President Roosevelt says that a majority of titles to water in the west already "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 time of scarcity."

Note the radical departure of Mr. Maxwell from the opinion entertained by the president in regard to the desirability of judicial decisions as a foundation for water rights. Moreover, who can doubt that Nebraska and Wyoming were foremost in the mind of the president when he noted that there were creditable exceptions to the general rule that states had failed to provide efficient laws for the distribution of water.

In Mr. Maxwell's own state of California his program has been ignored. There a representative commission, composed of three leading members of the California bar and some of the foremost economists and engineers of the state, headed by a chief justice of the supreme court, has framed a bill for putting into effect a law in that state which follows precisely the lines which Mr. Maxwell condemns.

There are now indications that a campaign has been inaugurated which will center around the legislatures of those states which have not as yet reached firm ground in respect to irrigation legislation. This campaign will be one of agitation and misrepresentation, having its origin in private selfishness and personal spite, and will be directed to the end of preventing that dispassionate and unprejudiced study of what has been accomplished and the lessons which have been learned in other states and other countries, and which should precede any wise move in the formulation of irrigation laws. The campaign will have the support of every lawyer of that class which has everything to gain and nothing to lose by the creation of conditions of chaos and anarchy in those states. O. V. P. Stout.

President Roosevelt made the lollowing reference to irrigation in his annual message:

Few subjects of more importance have been taken up by the Congress in recent years than the inauguration of the system of nationally aided irrigation for the arid regions of the far West. A good beginning therein has been made. Now that this policy of national irrigation has been adopted, the need of thorough and scientific forest protection will grow more rapidly than ever throughout the public land states.

Legislation should be provided for the protection of the game, and the wild creatures generally, on the forest reserves. The senseless slaughter of game, which can by judicious protection be permanently preserved on our national reserves for the people as a whole, should be stopped at once. It is, for instance, a serious count against our national good sense to permit the present practice of butchering off such a stately and beautiful creature as the elk for its antlers or tusks.

So far as they are available for agriculture, and to whatever extent they may be reclaimed under the national irrigation law, the remaining public lands should be held rigidly for the home builder, the settler who lives on his land, and for no one else.

BUILDING OF HOMES.

In their actual use the desert-land law, the timber and stone law, and the commutation clause of the homestead law have been so perverted from the intention with which they were enacted as to permit the acquisition of large areas of the public domain for other than actual settlers, and the consequent prevention of settlement. Moreover, the approaching exhaustion of the public ranges has of late led to much discussion as to the best

manner of using these public lands in the West, which are suitable chiefly or only for grazing.

The sound and steady development of the West depends upon the building up of homes therein. Much of our prosperity as a nation has been due to the operation of the homestead law. On the other hand, we should recognize the fact that in the grazing region the man who corresponds to the homesteader may be unable to settle permanently if only allowed to use the same amount of pasture land that his brother, the homesteader, is allowed to use of arable land.

TO STOP TRESPASSING.

One hundred and sixty acres of fairly rich and well-watered soil, or a much smaller amount of irrigated land, may keep a family in plenty, whereas no one could get a living from 160 acres of dry pasture land capable of supporting at the outside only one head of cattle to every ten acres. In the past great tracts of the public domain have been fenced in by persons having no title thereto, in direct defiance of the law forbidding the maintenance or construction of any such unlawful inclusure of public land. For various reasons there has been little interference with such inclosures in the past, but ample notice has now been given the trespassers, and all the resources at the command of the government will hereafter be used to put a stop to such trespassing.

In view of the capital importance of these matters, I commend them to the earnest consideration of the Congress, and if the Congress finds difficulty in dealing with them from lack of thorough knowledge of the subject, I recommend that provision be made for a commission of experts specially to investigate and report upon the complicated questions involved.

The largest irrigation project in the United States, and the third in scope in the world, has been launched in Salt Lake City. Although local capital is largely interested, the land to be reclaimed is along the Snake river, in Idaho, and the tract is 271,000 acres in extent.

The principal shareholder in the new company is F. H. Buhl, of Sharon, Pa., who has purchased control. The other principals in the deal are S. B. Milner and Frank Knox, Salt Lake City capitalists, and I. B. Perrine, a wealthy ranch owner at Blue Lake, Idaho.

The scheme includes the building of two immense canals, the development of horse power at Shoshone Falls, and the building of an electric railroad forty-five miles long from the Oregon Short Line railroad at Shoshone to the two towns. The land is to be taken up under the Carey act, and a contract for its reclamation has already been made with the state of Idaho.

The area to be recovered includes the tract which was set aside a couple of years ago for a national park, because of its beautiful scenery. Pressure was brought to bear on the interior department to rescind the order, and this was done.

The Twin Falls Land and Water Company was organized and arrangements entered into for the reclamation of the land, but the project was left to slumber until recently. A deal was closed today, however, by which Mr. Buhl and his associates will put $1,500,000 into the project, building the two canals and making valuable for agricultural purposes an area of land one-third as great as the entire state of Rhode Island.

Under the terms of the Carey act, this land must be sold in tracts not greater than 160 acres each.

TO HARNESS THE COLORADO.

COLORADO RIVER WATERS MAY BE UTILIZED.

One of the most ambitious schemes conceived by prince, potentate or capitalist, now or ever, is an engineering feat by which it may be practicable to harness the great flow of the Colorado river as it passes through Colorado, Utah, Nevada, Arizona and California, utilize the water for irrigating vast areas of desert, and incidentally create 200,000 or 300,000 acres of new land by scientific guidance of the stream so that it will deposit its alluvium or sediment as desired by man and, likewise create vast electrical power, says the Denver *News*.

The Colorado has never been considered a stream whose waters could be utilized to a great extent for irrigation, but Arthur P. Davis, who has spent several months in a careful reconnoissance of the situation, presents a plan of startling proportions. Mr. Davis is one of the best known hydrographers of the United States geological survey, and was detailed as chief hydrographer of the isthmian canal commission. In speaking of his recent reconnoissance, he said: "The great Colorado river is the largest stream, both in drainage area and discharge, that lies wholly within the arid portions of the United States. It is formed by a junction of the Green and Grande rivers, rising in Wyoming and Colorado, respectively, in regions of heavy rain and snowfall. Only a very small part of the flow of the Colorado has yet been utilized for irrigation. Through most of its courses this river and its tributaries flow at the bottom of profound canyons, from which it is impossible to divert them upon irrigable lands. If its water could be fully utilized it would irrigate vast areas of rich land."

POWER IS LIMITLESS.

Measurements made in Arizona show that the river sometimes discharges as low as 3,000 cubic feet per second. Its maximum discharge is unknown, but Mr. Davis states that it probably exceeds 500,000 cubic feet per second, or the incredible amount of 2,250,000,000 gallons per minute, enough to water 20,000 acres one foot deep in twenty-four hours.

The river is navigated for several hundred miles from its mouth by flat-bottomed, stern-wheel boats, but this is so difficult, owing to the shallow, changeable channel, that wagon transportation is preferred wherever it is possible. In times of high water the current is very swift.

The development of the mineral resources, in which the country tapped by the Colorado is very rich, is greatly hampered by the heavy cost of power and the lack of transportation. Mr. Davis believes that this proposed plan of storage reserves will completely solve both transportation and mining.

All the land that can be irrigated from the lower Colorado can be regarded as having a semitropical climate where the growing season for most products continues the year round, the requirements for water, however, being probably double in the summer season over those of the winter. It is believed that with proper regulation the Colorado river will be able to furnish a continuous stream of water for industrial use, varying from 10,000 cubic feet per second in winter to 20,000 cubic feet per second in summer in dry years, and allowing the great floods of wet years to speed on to the sea as at present. This will be sufficient to irrigate 2,000,000 acres of land.

A considerable portion of the valleys of the lower

Colorado consists of sandy flood plains, which are subject to occasional inundations and unsuitable for cultivation. This large acreage it is proposed to reclaim by impounding upon them the silt which annually passes down the Colorado river.

Mr. Davis' plan is for the provision of a series of reservoirs on the Colorado river by the construction of dams where the possible storage is large. The fall of the river is so slight that reservoirs of enormous capacity may be constructed without involving dams of impracticable height. At any time by opening the sluiceways of the reservoirs the current of the river will quickly cut the channel through the deposited sediment. With this exception, each reservoir is expected to gradually fill with sediment.

When this occurs it is proposed to draw down the surface of the reservoir permanently twenty to forty feet and to convert all of the reservoir site except the river channel into irrigated farming land, and, if necessary, construct another reservoir for storage purposes higher up on the stream.

It will then be practicable, whenever desired, to close the sluices and inundate all of the agricultural land in each filled reservoir, and thus fertilize it, as has naturally been done by the river Nile for its valley. Such irrigation is done artificially in some parts of Europe and Africa. With the deep alluvial soil, semi-tropical climate, arid atmosphere, abundant water supply and the practicability of thus richly fertilizing fields every year without expense, Mr. Davis states that such lands can be farmed the year around and several crops taken off annually, no acreage production being attained entirely without precedent in history.

LOCATION OF THE DAMS.

Mr. Davis has outlined a tentative plan, contemplating four dams, one at Norton, Ariz., with a capacity to irrigate 300,000 acres near Yuma; a second one at Bill Williams' fork, with a capacity sufficient to irrigate 400,000 acres; a third one at Bull's head, with a capacity to irrigate 300,000 acres, and a fourth one in the Black canyon of the Colorado, with a capacity of 200,000 acres. These reservoirs would each be provided with large canals, which would be navigable. The reservoirs, Mr. Davis estimates, would also develop water power to the extent of 500,000 horse power. In case more storage capacity is required in the future, other reservoirs could be constructed in the canyon of the Colorado, each of which would furnish additional storage, power and navigation facilities. This additional storage would only be needed by the complete filling by silt of the reservoir in the Black canyon, which Mr. Davis says would mean the creation of 200,000 or 300,000 acres of rich farming land, the value of which would far more than pay for the additional reservoir above.

The development of the enormous horse power above mentioned could be utilized extensively in the mining industry throughout the region, where power is very costly.

The cost of the entire development as outlined by Mr. Davis is $22,000,000. Against this, however, he credits at least 1,200,000 acres of land, which could be irrigated, alone worth several times the cost of the project; 500 miles of navigation worth at least $10,000,000, and immense power possibilities worth easily $100,000,000.

CORRESPONDENCE

NEW MEXICO COLLEGE OF AGRICULTURE AND MECHANICAL ARTS AND AGRICULTURAL EXPERIMENT STATION, MESILLA PARK,

December 4, 1902.

THE IRRIGATION AGE, Chicago, Ill.:

Gentlemen—I notice in your issue for November, last, more or less reference to the important question of pumping for irrigation, among which, on page 10, second column, is in full one of the recent press bulletins of this experiment station. Nothing is given to show to what it refers, and a reader would naturally presume that it was the result of some experiment in Colorado. As a matter of fact, this refers to one of the experimental tests conducted at this experiment station in connection with the extensive investigation of the best methods of pumping from wells, that this station is carrying on and has been carrying on for several months past.

For the whole of the Rio Grande Valley in New Mexico, and the arid regions generally, the question of pumping for irrigation is one of the most important of those presenting themselves to the farmer or fruit grower. Recognizing this fact, this experiment station has undertaken the investigation referred to, which has been carried on for nearly a year. The work accomplishel has demonstrated an apparently inexhaustible underflow on the grounds of the experiment station at Mesilla Park, New Mexico, which are typical of the agricultural lands of the Rio Grande Valley. A well, 48 feet deep, was sunk with slotted strainer in a gravel bed, and from this well, six inches in diameter, over 1,000 gallons a minute has been pumped. A steady stream was pumped for a test of thirty hours, throwing over 800 gallons a minute. The experiment station has already tested six different makes of pumps under precisely the same conditions on the same well, and full and complete data has been recorded, showing the economy of the various types. A comprehensive bulletin is in course of publication, giving the results so far accomplished. The experiment station is now about to sink another well, 12 to 14 inches in diameter. It has been demonstrated that the farmer can pump water from the underflow at a low cost and for a moderate outlay of capital can provide himself with a reliable and independent water supply. Respectfully yours,

FRANCIS E. LESTER, Registrar.

We have written to explain that the article referred to was copied from a western exchange, to whom credit was duly given. The bulletin mentioned will be published in full when a copy is received at this office.—EDITOR.

OBERLIN, OHIO, December 1, 1902.

D. H. ANDERSON PUBLISHING CO., Chicago, Ill.:

Gentlemen—The enlarged form of THE IRRIGATION AGE for November brings a pleasant surprise and is an indication that, in common with almost every other enterprise nowadays, THE IRRIGATION AGE is prospering. I congratulate you upon the persistent pluck and foresight which enabled you to hold on through so many years of depression to the development of irrigation interests until the dawning of the new day, so full of hope and of promise to the great, arid West. That you are already reaping your merited reward is evident. Your absorption of the *Drainage Journal* should add much to the value of your paper for the advertiser, and doubtless will. The quality of the leading articles in THE IRRIGATION AGE is deserving of especial notice and commendation. The article in the November number, for example, by Mr. Pargiter of India, on "Laterals and Their Management," gives the results of a large experience on an important question in practical irrigation. No irrigator, who wishes to keep abreast of his art, can afford to do without THE IRRIGATION AGE. Yours truly, B. F. SHUART.

MOLINE, ILL., November 28, 1902.

D. H. ANDERSON PUBLISHING CO., Chicago, Ill.:

Gentlemen—We wish to compliment you on the improvement in THE IRRIGATION AGE. Think you will be able to do much more business on it in this shape and with its improved appearance. Yours truly,

DEERE & CO.,
By L. B. KUHN, Advertiser.

NEBRASKA CITY, November 28, 1902.

THE IRRIGATION AGE, Chicago, Ill.:

Gentlemen—Can you refer me to any work (book) that has a good deal to say about the loss of soil by erosion and washing? I get some from geology and some from government reports, but, after all, they have but little to say; a few pages would cover all I can find. I am asked for an address before institute meetings this winter, so I want all the available information I can get. The loss of our agricultural soils is so enormous and its effects so far reaching that something must be done to stop it. Yours truly,

L. C. BURNETT.

MANSFIELD, OHIO, November 28, 1902.

THE IRRIGATION AGE, Chicago, Ill.:

Dear Sir—We acknowledge receipt of yours of the 21st inst., and also copy of November issue of THE IRRIGATION AGE, which you doubled in size. I think it was a happy thought to make this change. THE IRRIGATION AGE, in its new form, is certainly much improved and creates a better impression. We certainly appreciate the extra advertising space that we are receiving under our contract.

We wish you success. Yours truly,

THE AULTMAN & TAYLOR MACHINERY CO.,
By A. KALLMERTEN, Secretary.

McMILLAN, NEW MEX., December 20, 1902.

THE IRRIGATION AGE, Chicago, Ill.:

I am this day in receipt of copies for October and November, respectively, and glad to welcome THE AGE among my periodicals once more. The address of Hon. Thomas F. Walsh is very fine, appeals strongly to my judgment and sympathy, and is of itself well worth the cost of the subscription.

He is a noble and excellent man to utter such splendid sentiments. I would like to meet and know a man capable of such magnificent thought. Yours truly,

W. V. JOHNSON.

LINCOLN, NEB., December 19, 1902.

THE IRRIGATION AGE, Chicago, Ill.:

Gentlemen—Enclosed, I hand you express money order for $1.00 to pay enclosed subscription bill. Kindly receipt and return. I wish you unbounded success in your efforts to give the irrigators of this country a first-class publication.

Please announce that the Nebraska Irrigation Association will hold its annual convention and conference in the city of Lincoln Thursday, January 22, 1903, holding both day and night sessions. Important matters of legislation and the general interests of practical irrigation will be discussed by eminent and reliable authorities. A full one-fare rate will be obtainable from all points within this state, and a one and one-third rate from points outside of the state. Purchasers of tickets should take certificates of the American Short Horn Breeders' convention, which meets here at that time. Very respectfully yours, A. G. WOLFENBARGER,

President Nebraska Irrigation Association.

THE IRRIGATION AGE, Chicago, Ill.:

I have a well on southeast ¼, section 27, town 7, range 49 west, twenty-five miles southeast of Sterling, Colo. This well is 156 feet deep; a current of air came from it. Can this be explained. The water is fine, soft and cold. Respectfully yours, JOHN J. LONG,

Denver, Colo.

The above inquiry was referred to Prof. B. C. Buffum, director of experiment station and professor of agriculture, University of Wyoming, who sends the following reply:

I have your letter in regard to the well at Sterling and had a talk with Professor Knight about it. He tells me that air storage in nature is almost unknown, and thinks that if there is a flow of gas from the well it is something other than air. Very likely CO_2*. It would be easy to take a sample of the gas by filling a large bottle with water, inverse it in the gas and let the water run out, allowing the gas to take its place, when it could be corked up and saved for examination. Professor Knight thinks that in the region of Sterling there would be little probability of common air flowing from a well, as you indicate. Yours, truly,

B. C. BUFFUM.

*CO_2, carbon dioxide (carbonic acid gas), often found in mineral waters and forms an important part of limestone, etc.

ALL IN THE POINT OF VIEW.

In response to a request from the editor of a prominent magazine for a short article on the irigation controversy, the following was submitted by the editor of THE IRRIGATION AGE:

I have read the article published in your issue for October and am inclined to believe that the opponents of the merger of the National Irrigation Congress with the Trans-Mississippi Congress are unfairly dealt with.

In discussing the late Irrigation Congress, it is difficult to go into details without giving the impression that there is a lack of harmony in the organization, which, in fact, is not true.

This seeming difference is shown only in so far as a few of the delegates, who are interested in the National Irrigation Association, are anxious to have the Congress practically killed by merging with the Trans-Mississippi Congress. It can readily be seen that this move would leave the National Irrigation Association, which is a child of the Congress, and which was organized to act as financial agent of that body, with a clear field. In view of this situation, several delegates, who were particularly anxious to bring about the merger, are somewhat disgruntled, and I can, perhaps, better illustrate the case by reproducing a letter received from a prominent member of the National Association with my reply. It will be seen that the main object in opposing the merger is to keep the child from murdering its parent and at the same time prevent too much power being placed in the hands of one man, as would be the case if the National Irrigation Association were to occupy the whole field with only one individual in control. It is a fairly well established fact that upwards of $40,000 have been contributed and has passed through the hands of the acting official of this association, Mr. Maxwell.

HINSDALE, MONT., November 21, 1902.

EDITOR IRRIGATION AGE, Chicago, Ill.:

DEAR SIR:

In the last issue of THE AGE appeared an editorial regarding the National Irrigation Association and Mr. George H. Maxwell. I have not the time at my disposal just at present to reply to it specifically, but I want to say, as one who has been indentified with the settlement and irrigation development of Montana for nearly twenty years, and one who has been watching closely the interest created by the association referred to, and also Mr. Maxwell himself, also as one who is familiar with the history of the irrigation movement from its very infancy, that you have done both Mr. Maxwell and the association a great injury; you have also, in as far as you have gone, done the cause of irrigation an injury; it is clearly evident from the editorial in question that you are not posted upon the question and have been misinformed.

While on a recent trip over Montana, several prominent persons spoke to me regarding this editorial. A general feeling of indignation prevails. This is especially true in a section that has always been much interested in the question of irrigation.

You asked, in this editorial, for any criticisms contrary to your editorial. Had I the time I might go into a general reply, personally, I am sorry that THE AGE has seen fit on two occasions to take a view which is certainly detrimental to the best interest of this important question. I had thought that, with a change in the staff of THE AGE, that it would again reach its old-time importance in the discussion and promoting of interest in the irrigation question. I trust that this may yet be the case, but you are certainly on the wrong track. Yours truly,

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The following was sent in reply to above:

November 28, 1902.

MR. ————, Hinsdale, Mont.:

My Dear Sir—I am in receipt of your favor, dated November 21. A man usually forms an opinion of another through correspondence, whether he has ever met him personally or not, and from that source and from hearsay I have formed the opinion that you are a man of broad views and better able to judge than many others, inasmuch as your efforts tend to the betterment of the masses. I am, consequently, very sorry that any matter contained in our October or other issues should strike you as an injury to Mr. Maxwell or the cause of irrigation.

Your statement, however, that I am "certainly on the wrong track," does not fully assure me that such is the fact, and I fear that you possibly base your opinion on a

superficial knowledge of conditions inside of the organization known as the National Irrigation Association. I can very readily understand how such matters as we have published would sound harsh to one whose heart and soul is in this work and who has fully believed that the plans which George H. Maxwell or the National Irrigation Association are attempting to carry out are all good.

It would, perhaps, interest you to know that the writer helped William O. (Bucky) O'Neill, of Arizona, shape up his first speech on the subject of "National Aid," which was delivered before the Farmers' Protective Association of Maricopa county, Arizona, July 18, 1896, which, if you will look up the records of the National Irrigation Congress, you will find was some time previous to the time the Congress was held at Phœnix. This, by the way, was the first Congress in which George H. Maxwell took any part; hence, I claim that he is in no wise responsible for the early work done along the line which resulted in the passage of the irrigation law, and, while we all give him due credit for what he has done in subsequent years, the fact remains that he simply carried out the ideas of O'Neill and others; and, as one writer has stated, "in some sections of the arid region the impression prevails that he is a foster child of Uncle Sam and whatever he says goes with his gifted parent." There is no foundation in fact for the impression, but Mr. Maxwell does nothing to destroy the delusion. As a matter of fact, he does what he can to encourage it by adroitness and indirection.

I will ask, Mr. ————, if you have ever known of a statement being issued by the National Irrigation Association showing the condition of its finances, or if you have ever known of a list of members who contributed money to the association being published? or a statement published of the sums paid in by the different members of this association? or if you have ever received any information as to how the money received has been disbursed?

When the writer purchased THE IRRIGATION AGE, he went to Mr. Maxwell and explained to him that he was anxious to let the people, interested in irrigation, understand that the publication had changed hands, and would like very much to send a sample copy, only one copy to each member, mind you, so that they would understand that the publication had changed hands and was showing signs of improvement, editorially and otherwise. Mr. Maxwell refused to comply with this very reasonable request and if you look at the editorials of our November issue you will note that I quote his reason for refusal.

You may now place yourself in my position, if you please, Mr. ————, and tell me what your opinion of that sort of a stand would have been. Did it not look like a close corporation instead of a national organization? Why should Maxwell refuse to allow that list to be made public, or to give out information as to how much each member paid in the organization? These are a few of the points which first led me to wonder whether this was a National Irrigation Association or a Personal Maxwell Association. I note that since we have called attention to the discrepancies in the direction above indicated a meeting of the National Association has been called, to be held in St. Paul some time next year.

I have roughly outlined some of the features of the situation associated with Mr. Maxwell and am prepared to furnish you with much more data, but prefer to do so through the columns of THE IRRIGATION AGE.

Allow me to emphasize, however, that THE IRRIGATION AGE is working along the line of the best good for the arid and semi-arid West, and if work of this character removes from the front of the stage a man like Mr. Maxwell, it is no fault of THE IRRIGATION AGE or its friends. As stated previously, I can readily understand how, from your geographical position and remote point of view, you may be somewhat lacking in inside information concerning conditions surrounding this controversy.

I will call your attention to this particular feature, viz., that I have yet to notice where Mr. Maxwell has replied in print or otherwise to any of the statements made in this publication or by government officials in printed forms. Trusting that I may have the pleasure of meeting you some day and go into this matter more fully, I am, yours respectfully,

D. H. ANDERSON.

It will be readily seen that with the parent organization killed and out of the way that the National Irrigation Association, practically absorbing its patronymic, controlled by two or three individuals and with no especial necessity of informing the public of its doings, financial or otherwise, would control a wide strip of territory and could wield too great an influence either for the good of or injury to the cause of irrigation. In explanation of the above, will say that it is possible to be too good to a good cause.

At the meeting of the eleventh Congress at Ogden in 1903, this subject may possibly be discussed, but it is doubtful if it will ever be brought up again, as it is the intention of those having this meeting in charge to devote the time to a discussion of subjects of direct value to the arid West rather than to the airing of personal animosities or individual ambition.

THE WIDE OUTLOOK FOR IRRIGATION.

Nearly $7,000,000 is available in the federal treas- for the construction of national irrigation reservoirs. This fund promises to increase in the future, from the sale of public land. This new legislation thus introduces entirely new possibilities of enormous development in the heretofore arid west. The matter is creating the utmost interest throughout the semi-arid states, and many large reservoir locations are now rapidly surveyed by the government.

The public in the Mississippi valley and east thereof has as yet but little conception of what is meant by this federal policy toward irrigation. It is going to open to the settlement in small tracts for intensive agriculture very considerable areas of now worthless lands. We thoroughly believe in the general principle of this policy, but of course the utmost precautions are to be taken to insure economy and wise good judgment in the administration of the enormous fund now available for national irrigation works. It is proper that government should own, control and develop the main sources of water for irrigation throughout the arid regions. Only by so doing can the now worthless public lands be made valuable, and the interest of the whole people in the water supply be conserved. And within a very few years the income from the sales of land thus brought under water, promises to exceed cost of the irrigation works.

Intelligently administered, therefore, the new public policy may not only promote the welfare of the arid west in particular, and of the whole people in general, but may be self-supporting and perhaps yield a handsome surplus to the government over and above the first cost.—*Exchange.*

MERGER OF JOURNALS.

The D. H. Anderson Publishing Co., 112 Dearborn street, Chicago, announce that the *Drainage Journal* of Indianapolis, Ind., the only publication of its class in the world, will be merged with the IRRIGATION AGE January 1, 1903, by which move their circulation will be more than doubled, and the editorial department materially strengthened. THE IRRIGATION AGE is one of the best journals of its class, and is doing notable work in its chosen field. It is a first-class magazine, ably edited and recognized as an authority by all who are interested in irrigation. The combination with the *Drainage Journal* will make the magazine even more valuable than previous to the merger. Our good wishes are extended to the publishers.—*Implement Age, Philadelphia.*

NOT TROPICAL.

Not all of us can leave our work
To hunt the long-lost pole,
But we can freeze to death at home
At current rates for coal.

—*Chicago News.*

ODDS AND ENDS

POTATO TRADE OF THE UNITED STATES.

Imports of potatoes into the United States in the fiscal year ended June 30, 1902, amounted to 7,656,162 bushels, against 371,911 bushels in the previous year, according to statistics published by the United States Treasury Department. Exports in 1902 were 628,484 bushels, leaving the net imports 7,027,672 bushels. With two exceptions, the 1902 imports into this country were the heaviest ever made. The short domestic crops of 1881, amounting to only 109,145,494 bushels, resulted in imports in the following fiscal year of 8,789,860 bushels. Another shortage in the domestic production in 1887, when the crop amounted to only 134,103,000 bushels, was followed by imports of 8,259,538 bushels.

As a general rule neither the exports nor imports of this product are important. The trade is, in fact, an anomalous one among food products, in that heavy increases and decreases in domestic production have little effect upon the external commerce. During the past thirty years exports of potatoes from the United States have never amounted to so much as 1,000,000 bushels annually; in only fifteen years out of the thirty have imports exceeded that amount, and four times only have they exceeded 5,000,000 bushels. The annual production, meanwhile, has varied widely, ranging from the low figures of 1874, when the crop was only 105,981,000, to the high record figures of 1895, when the crop amounted to 297,237,370 bushels. The difference between the smallest and the largest crops of the past thirty years is thus seen to be 191,256,370 bushels, and it would be naturally expected in an important food product like this that the wide range in production would be reflected by important variations in the export or import trade. It has not been unusual, however, that in a year when the crop was greatly short of an average, and was apparently entirely insufficient for domestic consumption, there followed no appreciable increase in imports. Crop variations ranging from neglible quantities up to as high as 190,000,000 bushels have never yet resulted in an import trade amounting to so much as 10,000,000 bushels annually.

N. A. Easton, of Merle, San Diego county, forwards to the Los Angeles Express a sample of the evergreen Australian forage plant, which has been found admirably adapted to the arid lands of Southern California. He has more than forty acres planted to this peculiar shrublike grass, and he declares that it is excellent for live stock and for poultry.

While the plant will grow profitably on lands having but little rain it is found to be far more profitable where there is plenty of rain and where water is available for irrigation. The plants are set from four to eight feet apart, like cabbage plants, when grown without irrigation, and ten feet apart when subject to irrigation. The plants must be watered until rooted, after which they will take care of tremselves.

"This plant has been known to grow successfully on the hardpan, or on rocky, steep side-hills," says Mr. Easton. "It is far superior to evergreen millet, as it has but one tap root and does not kill out like alfileria. It is a great fertilizer when plowed under and well rotted, and with irrigation it has produced fifteen tons of hay an acre the first year and thirty tons the second year."

Without irrigation the product is said to be about one-tenth as much. Mr. Eaton declares that it will make most any rocky sidehill worth $5 to $10 an acre or more where brush or timber has grown successfully, and it is very nutritious for all kinds of stock when accustomed to it. The tender tops, he says, are excellent for greens.—*Riverside* (Cal.) *Press & Horticulturist.*

The following, clipped from The St. Paul Globe of Nov. 18, is an evidence that Geo. Maxwell of the National Irrigation Association is awakening to the fact that an occasional meeting of his association would be the proper thing:

"At the meeting of the Board of Directors of the Chamber of Commerce, it was announced by the Secretary, B. F. Beardsley, that he had just received advices from the executive committee of the National Irrigation Association that the national advisory board of the association will hold its next annual meeting in St. Paul in October, 1903. There are about 600 members of the association on this board, and a majority of the number are the most representative business men of the country. The national association numbers about 3,000 members, and it is expected that at least 500 will be present at the convention here next October.

The Oregon Irrigation Association met recently at Portland and elected permanent officers, appointed committees on resolution and legislation and adjourned until next day. The following were elected to serve during the ensuing year:

President, A.H. Devers of Portland; vice-president, W. R. King, Malheur county; secretary, J. M. Moore, Portland; treasurer, W. T. Wright, Union county. The election of Devers as president is considered a victory for the adherents of government irrigation as against private enterprise under the Carey act. The resolutions passed by the association will be received by the United States government as a partial guide for its reclamation work and as an expression of popular sentiment in this state.

George H. Williams, mayor of Portland, delivered the address of welcome to the delegates, in which he facetiously referred to the steady downpour of rain during the past two days, remarking that "eastern people who have traveled in California and have been told there that it rains 12 months of the year in Oregon will be surprised to hear that $1,000,000 can be properly expended in this state in artificial irrigation, but they do not know that Oregon is a state distinguished for its variety of scenery, climate and soil."—*Spokesman-Review.*

A recent dispatch from Portland, Ore., gives the following information:

The Oregon irrigation association adopted resolutions requesting F. H. Newell, chief hydrographer of the United States Geological survey, to begin work at once on reclamation projects under the national irrigation law at such points in Eastern Oregon as in his judgment offer the best assurances of success and benefit.

Mr. Newell, in an address to the association, said the United States would not interfere with existing rights and that companies organized to do the work would be allowed to continue without interference from the United States government.

One of the functions of the Smithsonian Institution, at Washington, is the diffusion of knowledge in language "understanded of the people;" so that, while most of its works are intended primarily for the specialist, there is an exception made by the Secretary in publishing an Appendix to the Report of the Board of Regents, which is in fact an annual summary of the most interesting events of the scientific year, prepared for that large body of the public which does not care for professional memoirs, but has a general interest in such matters.

This popular volume for 1901 is before us. It contains fifty articles, many of them illustrated, nearly all prepared by masters of the respective subjects, telling in clear and interesting language of the latest progress in all the principal branches of knowledge.

A short sketch of the history and work of the Smithsonian Institution begins with a paragraph from President Roosevelt's first message to Congress, in which he calls attention to the Institution's functions and its present needs. The paper further states that the Smithsonian Institution, which is composed of the President and his Cabinet, and the Vice-President and Chief Justice of the United States, has a remarkable organization for the administration of funds for the promotion of science. Its activities could be still further increased if it had greater means at its absolute disposal; while those who are thinking of giving for some special scientific object may yet find the Regents, on account of the peculiarly disinterested position they hold, the best counsellors in suggesting the channel into which gifts for public purposes might be directed, even should they not see their way clear to accepting such donations for the Institution itself.

"Bodies Smaller than Atoms" is the title of an interesting paper, and as we read "The Laws of Nature," "The Greatest Flying Creature," and "The Fire Walk Ceremony at Tahiti," we are reminded of the wide range of subjects included in the Report. Wireless telegraphy, transatlantic telephoning, and the telephonograph are discussed by experts in electrical progress. Attention ought also to be called to papers on utilization of the sun's energy, the Bogosloff volcanoes of Alaska, forest destruction, irrigation, the Children's Room at the Smithsonian, the submarine boat, a new African animal, pictures by prehistoric cave-dwellers in France, automobile races, the terrible lizards that once lived in America, and Mr. Thompson Seton's paper on the National Zoölogical Park at Washington.

The whole volume has been called "the best popular scientific annual published in the world."

The Smithsonian Reports are distributed by the Institution to libraries throughout the world; may be had by purchase at cost from the Superintendent of Documents, Washington City, *and may also generally be obtained free of charge from the applicant's Member of Congress.*

ONE HORSEPOWER.

When men first begin to become familiar with the methods of measuring mechanical power, they often speculate on where the breed of horses is to be found that can keep at work raising 3,000 pounds one foot per minute, or the equivalent, which is more familiar to some mechanics, of raising 330 pounds 100 feet per minute. Since 33,000 pounds raised one foot per minute is called one horsepower it is natural that people should think the engineers who establish that unit of measurement based it on what horses could really do. But the horse that can do this work does not exist.

The horsepower unit was established by James Watt about a century ago, and the figures were fixed in a curious way. Watt found that the average horse of his district could raise 22,000 pounds one foot per minute. At that time Watt was employed in the manufacture of engines, and customers were so hard to find that all kinds of artificial inducements were necessary to induce power users to buy steam engines. As a method of encouraging them Watt offered to sell engines reckoning 33,000 foot pounds to a horsepower. And thus he was the means of giving a false unit to one of the most important measurements in the world.

THE DEARBORN CANAL.

Montana State Arid Land Grant Commission Reports on It.

A meeting of the members of the Montana State Arid Land Grant commission was recently held in Missoula at the office of the president, Col. Thomas C. Marshall. The full membership was present—President Marshall, Vice-President and Field Agent Donald Bradford, Helena, and Secretary D. H. Cory, of Helena. The business considered was largely routine, but a report presented by the field agent showed the affairs of the commission were being carried forward as directed, and that indications pointed to a large amount of good which would follow plans for irrigating a large area of land in Northern Montana.

Figures of the agent were confined largely to work being done on the Dearborn canal in the northern part of the state. He furnished documents to show that the canal now carried water that was irrigating satisfactorily nearly 14,000 acres. One-half of this has been contracted for by settlers now living on the lands, and who have made at least one payment on a contract purchase. Other letters read gave assurance that the remainder of the land would probably be claimed within the coming six months.

According to previous arrangements, the board will go ahead with the erection of reservoirs and dams to hold water for the irrigation of a tract containing 22,000 acres in Cascade county. The supply for this will come through the Dearborn canal. It is not expected the work on this feature will be completed before 1904.

Renew your subscriptions to the IRRIGATION AGE for 1903. Send us in Post Office or Express money order for $1.00.

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EDITORIAL

Hypnotized? Is it possible that Mr. Maxwell has caught Mr. Wooldridge with one of those "heroic looks" which he assumed in recent photographs and has hypnotized him? God forbid.

Watch for Replies. THE IRRIGATION AGE has written a number of letters to leading men throughout the West asking their opinion on the range problem or leasing question, as well as their views on the matter of state boards of control of the water supply. It is our intention to publish all of the replies and allow our readers to form an opinion after all sides of the case have been presented.

Wooldridge in Defence. The editor of this journal does not wish to be unfair in any sense to any individual and after having published a letter from Mr. Wooldridge in response to an editorial on Mr. Maxwell in our issue of October, with our reply to Mr. Wooldridge, which appeared in the December issue, it is only fair to give publicity to the answer from Mr. Wooldridge, which is cheerfully given space in our correspondence department. The editor has great respect for both Mr. Wooldridge and his opinions, but is constrained to note that the gentleman has not fully answered several of the important questions contained in our letter to him dated November 28.

Arnett on Tile Drainage. In an early issue will be presented an article on "Tile Drainage, Its Benefits," by Mr. J. Arnett, C. E., London, Ohio. Mr. Arnett has prepared a very interesting story, and the remarkable feature in connection with it is that the gentleman is upwards of 83 years of age. We hope to present a likeness of Mr. Arnett in connection with its production.

Why? Why has Geo. H. Maxwell and his friends who are members of his association, who claim that there are too many congresses, and advocate a merger of the Trans-Mississippi and Irrigation Congress, why, we ask, have they called a meeting of the "National Association" to be held in St. Paul this year? If there are too many congresses perhaps it would be a good plan to reduce the number by a merger of "The Maxwell-National" with the Trans-Mississippi. Would this arrangement suit "George?"

Prof. Golf. We are pleased to note that Prof. A. Golf, formerly of Bonn, Poppelsdorf, Germany, who recently made a tour throughout the irrigated sections of the United States to study our irrigation systems, has been made assistant in the Agricultural Institute of the University of Halle, Germany. Prof. Golf writes us that THE IRRIGATION AGE is a very important assistant in becoming acquainted with new developments and in the preparation of his report on Irrigation in the United States, which he is now arranging for the University. THE IRRIGATION AGE will publish the report in full as soon as the manuscript is submitted and it should prove interesting to all our readers, as it will give the impressions of a careful student who covered the field thoroughly while in this country.

Prof. Clarence T. Johnston. We are showing in this issue, in connection with our article on The Assuan Dam, a fine lot of photographs taken along the River Nile in Egypt by Prof. Clarence T. Johnston, Chief Assistant Irrigation Investigations, U. S. Department of Agriculture. These photos were taken in 1902 by Prof. Johnston when on a trip of investigation of this great dam in the interest of the Agricultural Department, and through the courtesy of that gentleman we are permitted to embellish our article with them. We are also showing a fairly good likeness of Prof. Johnston.

Scipio Craig. THE IRRIGATION AGE has changed its magazine form of the regulation size—6x9 inches—to a sort of a quarto form—9x12 inches. Now if the editor would let up trying to stand in with the cattlemen and the state cessionists his change of form would look like a change of heart. Which that same is a much needed change.—*The Citrograph*, Redlands, Cal.

Scipio: Little did we think, when looking at those honest blue eyes when we met in Colorado recently, that you carried a knife in your boot-leg. Ah, me! Scipio Craig!

Irrigation and Drainage Beginning with this, our January number the subject of land drainage will fill a good part of our columns, as with this issue *The Drainage Journal* is merged with THE IRRIGATION AGE. Hereafter a separate drainage department will be maintained, to which will be contributed articles by the best thinkers and students of this very important branch of agriculture. Regular articles will appear from the pen of Mr. C. E. Elliott, agent and expert in charge of drainage investigations, United States Department of Agriculture. Mr. Elliott was formerly owner and editor of *The Drainage Journal*, and has made this subject a life-long study. We extend our best wishes to the many thousand readers of *The Drainage Journal*, whom we gladly welcome as readers of the combined journals.

Fred Bond. Mr. Fred Bond, State Engineer of Wyoming, whose likeness is shown in these columns, is a native of the State of Iowa, where he lived up to the time he became a citizen of Wyoming. He graduated with distinction from the Iowa State University, Iowa City, with the class of 1880 and moved to Wyoming in the summer of 1882. His first work there was for the government in connection with government surveys, in the office of the U. S. Surveyor General. Following this, Mr. Bond became acquainted with the banking business in Cheyenne in the capacity of bookkeeper, and later was appointed city engineer of that city, which office he held for four years. In 1894 Mr. Bond was engaged in field engineering in the northern part of Wyoming. During the four years in which he was at this work he was associated with others in some of the largest canal surveys undertaken in his state. Mr. Bond returned to Cheyenne in 1898 to accept the appointment of chief clerk in the office of the Surveyor General, but resigned that position later to accept the appointment of State Engineer of Wyoming, and he has filled that important office acceptably to the present time. Mr. Bond is very popular throughout his state and has a wide circle of friends among those interested in irrigation all over the country. THE IRRIGATION AGE will try and secure an article from the gentleman for a future issue on the future of irrigation development in his state.

MR. FRED BOND.
State Engineer, Cheyenne, Wyoming.

The Range Problem. The passage of the late irrigation act has brought the attention of the public to the value of our vacant lands and many theories have been recently advanced providing that only actual settlers receive title to the lands occupied or used. That this policy would be all right where a large area can be brought under irrigation and where a comparatively few acres will support a family is not disputed. The trouble has been that the possibilities of national irrigation have been over-estimated by the periodicals devoted to this subject and sent out broadcast to the public. Where lands can be reclaimed the Irrigation Bill has provided that they can only be disposed of to actual settlers after the government has completed the irrigation works. It is only necessary, therefore, to withdraw lands before surveys are begun to insure protection to the settler who is to come.

Unfortunately the papers referred to have already created the impression throughout the East that the reclamation of the arid West is simply a matter of building canals and laterals and storage works to retain

the flood water until the irrigator has use for it. We wish this were the case; that the sand hills of western Nebraska, the bad lands of the Dakotas, Wyoming and Colorado, the deserts of New Mexico, Arizona, Nevada and California, the high table lands of Idaho and Montana, and the entire mountain region could all be brought under irrigation and cultivation. After the water resources of the West have all been utilized there will be 250,000,000 acres of land which cannot be reclaimed, and which has no great value for mining, timber or for agriculture. It may be possible to reclaim 50,000,000 acres of arid land along our streams; this remains to be seen. What shall be done with the 250,000,000 acres of public lands which can never be irrigated and which are now of value only to those interested in the growing of live stock? That difficulties will arise regarding the division of this land among the owners of flocks and herds has already been demonstrated by experience that has been disastrous to many homes and has reflected but little credit on the disposition of the government toward the management of this valuable property.

Several large and influential stockmen can monopolize the range in their own vicinity and by employing numerous men in the management of their interests control local politics and policies to such an extent that they can stifle any move looking toward a definite division of the range which would give smaller concerns opportunities equal to their own. The same element in irrigation matters that labors to defer the final settlement of rights to use water. The range problems, however, should be much easier to settle since no third party is, as a rule, interested in a continuation of the strife and litigation.

We must recognize that while much is to be accomplished through the irrigation of arable lands in the West, that there has already grown up one of the most prosperous and profitable industries of the country owing to the grazing value of large areas of the public domain. This industry needs encouragement, and those engaged in it should have the protection of the government as far as it is possible for this to be extended. It is not a credit to the government or our land office officials to permit a continuance of the strife which now exists. If a leasing system can be adopted which will prevent range troubles and at the same time limit monopolies in land which are now common, although not recognized by law, it should at least be given a trial. If, as has been suggested, a local option law were to be made effective it would be left with the livestock interests of each community as to whether the range should be divided or not.

It should always be borne in mind that the grazing area will always be in excess of the irrigated area; that a family can live comfortably on from forty to 160 acres of irrigated land depending on soil and climate; that it requires from four to forty acres of grazing land to support a single steer. Should not the two kinds of lands be classified and disposed of under such restrictions that the people would derive the most from them and the strife on the range be brought to a close?

In defending its stand on irrigation matters and the problems of the open range the *Rocky Mountain Husbandman,* of Montana, makes the following statement concerning the papers of the state, while criticizing an article which appeared in the San Francisco *Chronicle,* condemning a certain agent of the transcontinental railways: "Before these declarations can be made to carry any weight with them it would first be necessary to know whose utterances they are, who owns the San Francisco *Chronicle.* We know that here in Montana all the daily papers are owned by three concerns, The Amalgamated Copper Company, W. A. Clark and the Great Northern and Northern Pacific Railway Companies, and their utterances are made in accordance with their interests." It would seem, under such conditions, that the *Husbandman* should endeavor to represent the farming and stock interests in an independent and fearless manner. We believe that this it will do, and that sooner or later, the campaign against reform in irrigation law and in the disposition of the public lands now being waged will show that only selfish motives are at the bottom, and that Montana must protect the irrigator and the stockman or these industries will suffer to such an extent that here will be no demand for a purely agricultural paper along the upper Missouri.

IRRIGATION IN NORTH CENTRAL CALIFORNIA.

One of the large irrigating ditches near Stockton, Cal., is the one known as the Woodbridge canal, which waters 30,000 acres of land. The land under the ditch is exceedingly productive when plenty of water is applied. Each season three to five crops of alfalfa are harvested, the average yield for each crop being from one to one and one-half tons per acre. The method of irrigating alfalfa fields is to flood at a depth of two to three inches after each cutting.

This region is celebrated for its fruit plantations. Pears, plums, peaches, prunes, oranges, all do well. The orchardists in that country are experts at caring for trees, which are given frequent and constant cultivation. Not a weed is allowed to develop and the trees are sprayed regularly and in every way given the best of attention. The fruit trees are watered by canals and wells. There seems to be an inexhaustible supply of water underlying all this region. It is made available by boring wells from 40 to 120 feet deep, and eight to ten inches in diameter. These adequately supply pumps with a capacity of 1,000 to 1,500 gallons per minute. This amount of water is sufficient to irrigate eighty acres of orchards or vineyards. The pumps are run by gasoline or steam. When land cannot be had adjacent to a canal, a pumping plant can be put on each farm at no very great expense.

EGYPTIAN IRRIGATION.*

While comparing irrigation in the United States and in Egypt it should be borne in mind that the contrast between political and social life in the two countries is necessarily great. Until within the last half century the khedive of Egypt has been considered the owner of all the land and water. The people were regarded as slaves and until quite recently they were at the command of the political leaders for all kinds of public and private work. Farmers have been tenants rather than proprietors. Land titles have only recently been recognized. The tax gatherer has taken everything from the farmer each year, leaving only enough to keep soul and body together. The farmer has been compelled to borrow money at ruinous rates of interest and before his crops were harvested the lender has secured all the surplus of the farm profits. The English are reforming many of these evils, but the peasant has been accustomed to corruption in all branches of the government for so long that he can not understand the new administration and consequently does not appreciate much that has been done for his benefit. English engineers in the Egyptian service fully understand the condition of the farmer, and are well enough acquainted with other irrigated countries to appreciate the difficulties which confront them in the administration of irrigation law and regulatons.

PROF. CLARENCE T. JOHNSTON.
Chief Assistant Irrigation Investigations, U. S. Department of Agriculture, Cheyenne, Wyo.

Among the engineers with whom I have had the pleasure of talking was Mr. W. Willcocks. He has had 20 years' experience in Egyptian irrigation and held a similar position for 15 years in northern India. He has written and traveled much and has had opportunity to study irrigation law and practice throughout the world. I visited him at Cairo to learn of Egyptian irrigation, but found myself compelled to discuss our own shortcomings during our conversation. Mr. Willcocks and others who have given the matter study realize our mistake. He felt reasonably sure of his ground when he undertook a criticism of the way we have permitted the water to be bought and sold. He regards many of our states as having failed altogether to meet their obligations when it comes to protecting the irrigator. The Nile is one of the most important rivers in the world as far as navigation is concerned, yet during May and June of each year both branches of the river in the delta are practically dry. It is plain, therefore, that Egypt does not recognize the doctrine

WATER CARRIER.

of riparian rights when the supply of water is needed for irrigation. Our greatest blunder, according to foreign critics, is in permitting private parties to buy and sell water which is placed temporarily in their hands as a trust. The doctrine of priority of rights was unknown to the foreign engineers I met. They can understand how such a doctrine should come to be recognized, and agree with us that it is a just basis for establishing rights to the use of water.

Egypt excels us in the administration of such law as it possesses. The principal strength of the administration, however, lies in the efficiency of the irrigation engineers. Why they should be successful may be made more evident as one appreciates the size of the country and the primitive condition of the farmer.

ASSUAN DAM.
From West Bank of Nile—Lower Face of Dam January 7, 1902.

Egypt has to-day but 5,000,000 acres of agricultural land. Over half of this is in the delta. The delta is triangular in shape and about 120 miles on each side. The valley above becomes narrower as one ascends the

* Portion of an illustrated address delivered at the Irrigation Congress, at Colorado Springs by Clarence T. Johnston, Assistant Chief of Irrigation Investigations, U. S. Department of Agriculture.

river. The widest point is located about 40 miles above Cairo. At Assuan the valley is only a few hundred yards wide. There are three large dams on the Nile. The one at the head of the delta is perhaps one of the most striking in the world. The one at Assiut, 250 miles above Cairo, is of nearly the same design and will not be discussed separately. The dam at Assuan, which has just been completed, is of a new type. The ancient system of irrigation in Egypt was perfected during the 12th dynasty, about 4,000 years ago.

The delta is a network of canals and drains. The water in the canals runs a few feet below the surface of the ground and it is all lifted by devices which have been invented by the natives. There are a number of fine, large pumping plants in the delta, but a large part of the water is still lifted by baskets swung by two sturdy natives or by a cylinder furnished with a wooden screw, turned by hand. As one ascends the river the character of these devices change. The country in the neighborhood of Cairo is full of interest to the traveler. The great dam 12 miles down stream is an object visited by tourists who have but little interest in irrigation. The valley is dotted with small villages, where the

THE ROSETTA BANOP.
From Mainland West of Nile Looking East, Wooded Land in Distance on Delta, Lock in Foregroudd.

farmers who till the surrounding lands live during high water. The village of Talbia, to which I shall refer later, is on the road from Cairo to the pyramids of Gizeh, 7 miles away.

The great dam at the delta was begun early in the last century by the French. The khedive would not consent to its construction until the engineer agreed that a fort should be erected along the dam. There are two branches of the dam, one across the Rosetta and one across the Damietta arm of the Nile. Each dam contains three forts, one at each extremity and one in the center. Running north from the line of the dam in the delta is one of the largest canals in Egypt. The head-works are of substantial masonry and the canal furnishes water to practically all the land lying between the arms of the river.

As one crosses the river and reaches the farming land, the natives' houses along the Nile may be examined. Some of these people do not live in villages but reside on their farms. As soon as one gets back into the districts which are annually flooded, village life only is possible. The farmer labors in his fields almost incessantly along these high lands. His only tool is a kind of hoe having a handle but a little over two feet in length. This compels him to assume an attitude which alone would not be an inducement for a native of the United States to become an Egyptian farmer.

The flow of the Nile is nearly the same each year.

LOADING COTTON OPPOSITE CAIRO.

It is a much steadier stream than any of the large rivers of the United States. The high water mark of the Mississippi at St. Louis may be 250,000 cubic feet per second or it may reach to nearly a million. The Nile never exceeds 450,000 cubic feet per second and seldom falls below 300,000 cubic feet per second during the period of flood. The river varies from 1,500 feet to a mile in width. It has many small channels and numerous islands are found along its course. Some of these islands are cultivated, while others are simply sand bars. As one ascends the Nile, boats may be

PERSIAN WHEEL OR SAKIEYEH.
For Raising Water for Irrigation.

seen laden with cotton and other farm products. Pleasure boats are ascending the river and farmers are transporting straw, pottery, and other commodities from upper Egypt to Cairo and Alexandria. At a number of points the Nile spreads out over a broad, sandy bed,

giving it the appearance of a much larger river. The odd native boats may be seen at any landing.

The devices for lifting water are numerous along both banks. The shadouf is the most common because of the simplicity of its construction. The native is justly proud of his contrivance for raising water. Each machine raises water about 6 feet. I have seen as many as five lifts before the water was finally poured into the distributing channel on the bank. Sometimes the shadouf has but one lift. Often two men work together, one on the right and one on the left. The sakiyeh or Persian wheel is owned by the aristocratic native farmer. It costs about $125 on an average and two or three oxen are necessary before one can be operated successfully. Many large steam pumping plants may be seen along the river. Some of these have been erected on scows and go from place to place as the demand for water necessitates. Probably one of the largest canals in Egypt is the Yusef, which furnishes water for the Fayum Province. It is 180 feet wide and 30 feet deep and carries 30,000 cubic feet of water per second during flood season. This is a larger volume than the maximum discharge of the North Platte River.

PLOWING.

The Yusef Canal has many branches after reaching the province. Many of the basin canals have no head works but simply depend upon earthen dams thrown across the channel near the river. When the water reaches a certain stage the dams are broken and the basins fill forthwith.

The town of Assuan, 580 miles south of Cairo, is nearly on the southern border of Egypt. It is located on the east bank of the river, just below the first cataract. The island of Elephantine lies opposite in the river and the island of Philae is 4 or 5 miles up stream, just above the cataract. The granite formation of the first cataract appears just south of Assuan. The Egyptian railway ends at Shellel, opposite the island of Philae. The island contains a number of temples of the Ptolemaic period, the foundations of which are being strengthened by the Egyptian government so that the structures may not be injured when the Assuan reservoir is filled. The water will stand 6 to 10 feet on the island during this period. The temple of Isis is the most celebrated structure on the island. Similar temples on the south end of the island and the kiosk on the eastern margin are also picturesque and interesting. A row of columns along the west shore of the island is representative of the architecture of the Ptolemaic period. Two nilometers are located on this shore. They are simply stairways running from the land down to the Nile. As the Nile rises its depth is indicated on the walls of the stairways by graduations of different kinds.

Two miles north is the Assuan dam. It is 1¼ miles long and 70 feet high. As places is was neces-

IRRIGATED GARDENS, CAIRO.

sary to go 70 feet below the bed of the river to find solid material upon which to erect the dam. It is built entirely of granite masonry and contains enough stone to build a wall 6 feet high and 18 inches thick from Colorado Springs to Omaha. No water will flow over the dam. The discharge of the Nile is controlled by 180 sluiceways through the dam, which are closed by heavy steel gates during the time water is being stored. Work on the foundation was greatly facilitated by turning the discharge of the river from one channel to another as the construction progressed One of the problems

JOSEPHS CANAL.
Largest in the World Near Medinet el Fayum.

which the engineers had to overcome was to protect the cement from the sun until it had set properly. This was accomplished by covering all newly laid masonry with burlap which was kept wet. Some of the sluiceways are lined with ashlar masonry, while 40 of the lower ones have cast iron linings. This was used because the work could be completed much more quickly, and a

certain amount had to be done each year before high water appeared in the Nile. The dam had to be put in shape to withstand this high water during June and July each year, and the work could not again be undertaken until toward the middle of November. The dam was completed July 31 of this year. It will store 860,000 acre-feet of water, which is sufficient to irrigate

IRRIGATING FIELD WITH WATER RAISED BY PERSIAN WHEEL NEAR CAIRO.

about 400,000 acres of land. This water will be used largely to extend the system of perennial irrigation and to reclaim a small area of new land. It will require storage works having a capacity six times that of the Assuan reservoir to furnish water for perennial irrigation to all of the arable lands of the valley. Reservoir construction has therefore just begun. Even when all the reservoirs are completed, no great change will have taken place in the climate of the valley. It will still be necessary for the irrigator to use a pump or other

CANALS IN FAYUM PYOVINCE.
75 Miles South West of Cairo.

water raising device. Water for domestic purposes will still be carried by women, as it has been for thousands of years.

Returning to Cairo we will proceed along the road leading to the pyramids until the village of Talbia is reached. The town proper is located just to the south of the pyramid road. Districts called "hods" containing 5 to 50 acres or more are supposed to divide the land into areas having the same taxable value. The farms which lie within these hods are numbered, so that the official records refer to the number of the farm and the number of the hod, in addition to showing the name of the village to which they belong. The farms are long and narrow. This is due to the fact that only the hod lines are preserved by monuments. When a piece of land is sold, measurements are made along the hod lines instead of laying out a new piece of land having better dimensions. I have the measurements of a number of the farms near Talbia. One farm in particular was found to be 6 feet wide and 1,500 feet long and contained less than ¼ acre. The farming scenes around the village of Talbia are as interesting as those elsewhere in Egypt. The farmer plows his land with a wooden plow where a hoe is not used instead. It seldom happens that one farmer possesses a team of his own and animals are exchanged. This brings about strange combinations. An ox and a camel drawing a plow is frequently seen. The water buffalo is among the most useful and profitable of the animals grown by the Egyptians. Where it is difficult to plow the land, natives may be seen in the fields breaking the ground with a hoe. Indian corn is

LOADING BOATS WITH WATER JARS AT ASSIUT.
240 Miles South of Cairo.

raised extensively and it forms an important part of the food of the farmers. It is piled along the high embankments before the season of flood, where the grain is beaten from the cobs by clubs in the hands of the farmers. Egyptian corn is treated a good deal the same way. Wheat is threshed by the old-fashioned sledge drawn by oxen. All kinds of grain are winnowed and all straw is preserved for feeding to the animals. Where a small stream of water can be obtained from a well or from a pump situated on the banks of the Nile, farmers may be seen irrigating. Often the earth is thrown out by hand after being loosened by means of the hoe. Canals are still dug as they were thousands of years ago, the material being put in baskets with the hoe and carried by the native workmen to the bank.

Leaving the village of Talbia, the pyramids may be seen in the distance. The trolley line which runs from Cairo to them is furnished with cars which were made in St. Louis. A drainage channel runs along side the road, which carries water from the irrigation basins back to the Nile. The basins near the pyramids are quite low and are the last to reappear after the flood.

CAN THE UPLANDS BE IRRIGATED?

EDITOR PRICE, OF THE STERLING, COLORADO DEMOCRAT, THINKS THEY MAY.

For the benefit of those who have made no study of the question of upland irrigation and of the water which may be supplied for that purpose by storm drainage, we submit the following facts:

The amount of precipitation in the arid region, mainly rainfall, is sufficient to raise good crops every year if it were properly distributed throughout the season and wholly used for moistening the soil. This is easily demonstrated. Of one and one-quarter inches of rainfall, about one-fourth of an inch seeps into the soil and one inch runs off in the mass of storm drainage, following the declination of the land surface to the lowest available point, usually a large depression, where a temporary lake is formed, or the head of a stream by which it is mainly carried down to the great rivers and thence to the gulf. Allowing that four-fifths of the water which falls is thus carried off and its use lost to the land on which it is precipitated, and that really only one-fifth of that precipitation is left for crop growth, since the uplands have produced on an average more than one-fifth of a crop ever since the

KOM OMBO TEMPLE.
South Silsileh On East Bank of Nile.

settlement of the country, and have always produced a full crop when the moisture was sufficient, it follows that if a good proportion of the four-fifths of the moisture which is carried off in the storm drainage could be retained on the land and applied to its crops the arid region would be made to blossom as the rose. While it is not possible to distribute water evenly over our uplands, because of the rolling surface of the country, it is possible by constructing dams in the line of drainage to arrest the outflow and make artificial lakes from which the land below them could be irrigated.

Computing the present loss of moisture by storm drainage to be four-fifths of the precipitation and accepting the present estimate of total precipitation of fourteen inches as correct, we figure an annual loss of moisture in this dry climate of about eleven inches, at least nine inches of which, or more than three times the amount of storm moisture now appropriated by the soil, could be retained on the uplands by artificial means, and applied to the purposes of irrigation.

Properly applied there can be no reasonable doubt that nine inches of moisture would raise the annual crop average of these uplands to a very profitable point, for less moisture is required by crops in this region than in one of greater humidity.

To be radically conservative, suppose that only six inches of the annual precipitation is wasted by storm drainage. The net result of water wastage for

THE ISLAND OF PHILAE.
Two Miles South of the Assuan Dam, Looking East from West Bank of Nile.

each acre would be 21,280 cubic feet or 490,000,000 cubic feet of water for each township annually. This would fill a reservoir four and one-half miles long, 1,000 feet wide and twenty feet deep. Such a body of water would irrigate, after three or four initial years, 10,000 acres of land or a little less than half a township. It would not be desirable to construct one great reservoir in each township because a number of smaller ones would be nearer to the land and less expensive,

LOOKING NORTH FROM THE ISLAND OF PHILAE.
2 Miles South of Assuan Dam.

avoiding long laterals and consequent seepage, and evaporation, thus insuring greater efficiency of service.

The average cost per township of such a system of reservoirs would be in the neighborhood of $30,000, if the work were done by the most economical and advantageous methods, while the increase in annual profits arising from the servient lands would be the same

amount. Of the latter item, operating and betterment charges, interest and sinking fund requirements would absorb $6,500 annually, leaving a net result of annual profits, $23,500. However, from what we have said it must not be inferred that we favor the township system of reservoirs. We use that area to illustrate the probable profitableness of an enterprise of the character referred to. As a matter of fact, such reservoir systems as we have suggested would necessarily have to be constructed on natural lines of storm drainage—the long draws or drains and the channels of storm floods—in consequence of which township lines would cut no figure in their development.

But while storm drainage is the most important factor in the reclamation of the arid uplands, it is by no means the only factor. The waters of the South Platte river from November 1st to March 15th of the following year are not required for the irrigation of the Platte valley. During these months so much of the Platte floods as might be necessary should be diverted from that stream by ditches and used to fill the upland reservoirs. We have not at hand sufficient data by which to compute the average discharge of the Platte river for the months of November, December, January, Bebruary and half of March, but it is very great; probably sufficient to irrigate all eastern Colorado, western Nebraska and Kansas, if it were all made available for that purpose and was supplemented by the impounded storm drainage; at least all of the territory indicated which is susceptible of reclamation. At flood tide it probably flows, in the vicinity of Sterling, conservatively estimated, 5,000 cubic feet per second, or 432,000,000 cubic feet per day. The agricultural possibilities incident to the entire appropriation of the vast bulk of water to irrigation are difficult to estimate.

It may be that additional legislation will be necessary to the effective working of upland irrigation systems, and, if so, representations to that effect ought to be immediately made to the Legislature, which will convene within a few days. More important yet, the Legislature should be asked to make a small appropriation for experimental purposes. The more conservative may hesitate to embark upon a plan of improvement of such magnitude and capitalists to finance a proposition of this kind unless we first demonstrate to them the practicability of the plan and the safety of their investments.

IN PRAISE OF PROSPERITY.

They raised his salary two years ago last May,
The said increase amounting to thirty cents a day;
Since then they've raised the prices
Of carrots and of beets,
Of flour and of meats,
Of corn and coal and fruits,
Of babies' little boots,
Of potatoes, milk and cheese,
Of the product of the bees,
Of hats and socks and coats,
Of all that sinks or floats.
He's paying out the money that he saved before his raise,
But prosperity's upon us, and his heart is full of praise.

—*Chicago Post.*

THE IRRIGATION MATTER.

The following is taken from the editorial columns of *The Implement Age,* of Philadelphia, one of the leading implement journals of the world:

"Mr. Fred Bond, State Engineer of Wyoming, sends us the following regarding an editorial which appeared in *The Implement Age* of November 24th, which is presented in order that explanation may be made:

"Dear Sir—In the issue of the *Age* for November 20th there appears an editorial in which is discussed certain criticisms of Mr. Geo. H. Maxwell by the IRRIGATION AGE, in which you state that just as soon as the least suspicion arises that irrigation development is being promoted for selfish purposes the doom of irrigation will follow, and I wish to protest against any such conclusion by your influential paper. It is not fair to insist that the experience of the country following the enactment of the irrigation law shall be wholly different from that succeeding the passage of other laws. Is it not a fact, and one to which there is practically no exception, that adventurers and promoters undertake to feather their nests at the expense of the public immediately following legislation of any nature, and especially that concerning new subjects and for which large sums of money are available? In this section of the arid region the feeling seems to be general that the success of the new law can be best and earliest assured by the prompt segregation and elimination from any possible connection with its operation of any and all who may undertake to use it for personal or selfish ends. Surely *The Implement Age,* whether the friend or the enemy of the irrigation act prior to its passage, can join with the West in hoping that the funds made available will be expended wisely and well without damning the whole plan because 'promoters' who, like the 'poor,' are always with us, need first to be located and weeded out. As long as Mr. Maxwell worked as a lobbyist for the passage of the law the West generally did not inquire into his motives, but his present activity has wholly to do with the disposal of the funds, and taken in connection with the nature of his employment is indefensible from any standpoint.

"Upon reading your editorial I communicated with Prof. Elwood Mead, of Washington, D. C., and requested him to send you a copy of his open letter to the delegates of the last National Irrigation Congress held at Colorado Springs. This letter is now probably in your hands. You will find in it an accurate and concise statement of a few of Mr. Maxwell's positions and conflicting views on irrigation matters which are well worthy of your consideration."

WHY HE DID IT.

A characteristic story is told of Abe Gruber, the well known New York lawyer. When he was a boy looking for something to do he saw a sign "Boy Wanted" hanging outside a store in New York. He picked up the sign and entered the store. The proprietor met him. "What did you bring that sign in here for?" asked the storekeeper.

"You won't need it any more," said Gruber, cheerfully. "I'm going to take the job."—*Washington Post.*

The tongue usually has more to do with honor than the conscience has.

IRRIGATION OF RICE IN THE UNITED STATES.

An interesting report has just been issued by the office of experiment stations known as Bulletin No. 113. It is comprehensive of searching investigations and should be in the hands of all rice growers, a copy of which can be had by application to the Department of Agriculture at Washington, D. C.

In his letter of submittal through Director A. C. True, of experiment stations, Prof. Elwood Mead, expert in charge of irrigation investigations, gives out the following valuable information:

WASHINGTON, D. C., April 2, 1902.

Sir:—I have the honor to submit herewith a report on the irrigation of rice in the United States, including a report on the irrigation of rice on the uplands of Louisiana and Texas, by Frank Bond, agent and expert in irrigation investigations, and a report on irrigation of rice in North Carolina, South Carolina and Georgia, by George H. Keeney, special agent, irrigation investigations.

During the last half century rice production in the United States has grown but little, the crop of 1850, as given by the census of that year, almost as large as the maximum crop reported since that time, and considerably larger than the average crop of the last ten years. While rice production has remained practically stationary, there has been a decline in the South Atlantic States and an increase in the Western Gulf States. Within the past few years the raising of rice in Louisiana and Texas has developed into one of the leading industries of that region, and has given great value to lands heretofore used only for grazing, and to water which had been allowed to waste into the Gulf of Mexico. This development has been so rapid that laws and institutions have not kept pace with the industry, and already serious loss has resulted from the failure of those States to provide for the establishment and protection of titles to the use of water. Streams have been overappropriated, and early investors who should have been protected in their use of water have been made to suffer with the later comers, who should have been prevented from diverting water until earlier settlers were supplied. This study of conditions in Louisiana and Texas was undertaken for the purpose of applying to those States, so far as conditions were similar, the lessons learned in those parts of the country where irrigation has long been practiced. It is hoped that this report may aid the rice growers and the lawmakers of Louisiana and Texas in the adoption of codes of irrigation laws which will bring about the highest development of their resources.

The rice industry in the South Atlantic States has been on the decline for many years, owing chiefly to the decline in the price of rice and the inability of the rice growers in those States to cheapen production sufficiently to make rice growing profitable under the new conditions. If rice farming along the Atlantic coast could be so modified as to permit of the use of labor-saving machinery, there is little question that the industry in that region could be carried on at a profit. The descriptive portions of the accompanying report on the industry in Louisiana and Texas, should suggest to the rice growers of the South Atlantic States methods which will enable them to compete with cheap labor abroad and with labor-saving machinery at home.

During the past ten years the United States have produced less than half the rice consumed in this country, the average importation for that time being 172,736,057 pounds per annum, having a value of $3,185,968. Rice as yet enters very little into everyday use in this country. With the present large importation and the increasing use of rice as a staple food rather than a luxury the possibilities for the expansion of this industry are unlimited.

There have been frequent calls upon this office for information regarding pumping water for the irrigation of rice and other crops. The attempt has been made to meet this demand by collecting information regarding the cost of pumps and their installation and operation, and their duty in the irrigation of rice. This information is included in the report of Mr. Bond.

Respectfully submitted,

ELWOOD MEAD,
Chief of Irrigation Investigations.

PRES. SLOCUM, OF COLORADO COLLEGE, BEFORE THE 10th NATIONAL IRRIGATION CONGRESS.

With the annual export of nearly a billion dollars' worth of farm products, and the business of the country adjusted to that fact, with a rapidly increasing population to be fed, with a shortage in the corn crop affecting nearly every citizen in the republic, we have come to problems which require the very best training and the most careful thought for their solution. There must be *the same* large grasp of the situation that the English have had in their irrigation projects which will double the amount of arable land in Egypt, and which will accomplish more to relieve poverty in that country than has ever been done in all its history.

A careful study of the situation indicates that the colleges and universities have an important part to play in this national undertaking. The people as a whole know very little about the whole matter. The nation has been interested in questions which relate to the tariff, the creation of harbors, foreign commerce and domestic manufacturing, and thus far have left this matter alone until it is now demanding consideration. This makes it necessary that the irrigation of our large areas of arid land should receive the most intelligent and scientific consideration. It is not a matter of partisan politics, but one which requires special training and careful study of the whole problem and all that is involved in it. For this reason the time has come when our colleges and scientific schools should give the whole subject serious consideration.

It is important that our colleges should offer courses of lectures treating the whole subject of irrigation, including a study of all the arid districts in the United States, the problem of water supply and the great water sheds and reservoir sites; the relation of forests to irrigation.

Let me whisper to you, little maid, little man—
  Don't follow the path that's wrong;
Be honest and noble and always do right,
  And your life will be sunshine and song.
Go, make thy garden fair as thou canst,
Thou workest never alone;
Perchance he whose plot is next to thine
Will see it and mend his own.

IRRIGATION IN CALIFORNIA.

Several interesting phases of agriculture in California appear in the report of Irrigation Investigations of the United States Department of Agriculture, just published as Bulletin No. 119 of the Office of Experiment Stations.

Professor Hilgard, of the University of California, gives the results of 14 years' study of the water problems of the Santa Ana valley in southern California. In this valley water is scarce and exceedingly valuable. The right to a single inch sells for $1,250, and irrigated orange lands have sold for $1,800 an acre. He shows that the gravel deposits of the river where it leaves the mountains act as a regulator, the water sinking into these debris fans where it is stored up without expense for dams or losses from evaporation. His researches show that this water feeds the artesian wells below and that as the number of these wells is increased the pressure and flow is diminished, the final result however, being a considerable gain in the water obtained. These studies of Prof. Hilgard will be widely read in California for the bearing they have on the interdependence of underground water supplies. The recent decision of the state supreme court in the case of Katz v. Walkinshaw, limiting the right of a land owner to take percolating water from his own land, has given the subject new interest.

The report of Prof. Hilgard is supplemented by one made by Wm. Irvine, engineer of the Gage Canal, giving the duty of water in the Santa Ana valley and some conditions which influence it. An interesting feature of Mr. Irvine's report is the illustrations of the canal, measuring boxes, and methods of distributing water. Nowhere in this country if in the world is water used with greater economy and skill than in this section. The main canal and many of the distributing laterals are cemented and in some cases pipes are used. Water is delivered to the different tracts from hydrants and carefully measured over weirs, all these details being illustrated in this report. The canal was operated at first without cementing but the losses from seepage and growth of vegetation in the banks and bottoms reduced its capacity so much that only one-fourth of the calculated volume could be carried through it. Since cementing the loss is only about 1 per cent. The plans and specifications for this work are given so that engineers may understand clearly its character. The expense of cementing a channel 7 feet wide on the bottom, 15 feet on top, and 4 feet deep was 75 cents per linear foot.

Irrigation in central California is covered by a report by A. E. Chandler, Agent and Expert. The canals where Mr. Chandler's measurements were made were not cemented and in some cases the losses from seepage were as great as those on the canal in southern California before its improvement. On the Vandalia Ditch 92 per cent of a discharge of 16 cubic feet per second was lost in a distance of two miles. The illustrations show that the flow of water in these canals is also interfered with by weeds and grass so that it is probable that cementing or some other method of lessening seepage losses will be employed in the near future. The possibilities of this are discussed by Mr. Chandler in his report. He estimates that some canals on which the losses are large could be cemented for a cost of between $4,000 and $5,000 per mile and that the loss of water in a single season in some sections has been 28 per cent more than the cost of this work. The products of irrigation in this section have a high value. Under the Pioneer Canal the orange crop was worth $137 per acre; on one orchard under the Pleasant Valley Ditch, $107 an acre. On this orchard water was sparingly used so that the value of the crop grown with an acre-foot of water was $63.79.

This report may be obtained by applying to the Director of the Office of Experiment Stations, United States Department of Agriculture, Washington, D. C.

A recent issue of *The Signal,* Weisar, Idaho, contains the following:

"S. F. Stark, accompanied by his father, returned from the line of the construction work of the Malheur Butte Ditch Company Monday afternoon. They report more than 50 teams at work and this force will be increased to 100 as soon as the line is cross sectioned ahead of the work far enough to allow of their being placed on the work. Messrs. Stark and son's mission to the city was to secure an engineer to do the work. D. A. Utter, who is the engineer in charge, is employed at Mineral surveying some mines in that locality, and could not do the work.

"The construction work is under the management of Hoskins & Harkins. Their contract calls for the completion of their work—sixteen miles—by April 1st. This will bring the ditch to the upper end of Dead Ox flat, opposite Weiser. It is the intention of the company to have the water on Dead Ox flat in the spring in time for irrigation. The completion of the ditch to the upper end will practically cover the entire district, as small ditches and laterals will be run in every direction from the main canal, so that it may be distributed to all the ranches covered by it. The bringing of the water to the ranches of that section will be a matter of great gratification to them, as they have waited long and patiently for the completion of the big canal. It not only means much for the ranchers of that section, but for Weiser, which is the natural supply point for that section.

"R. C. McKinney, who is the resident agent of the company, reports much inquiry for lands covered by the ditch, and expects a great deal of activity in that section in the spring."

Even now from far, on viewless wing,
Hither speeds the nameless thing,
Shall put they spirit to the test;
Haply, or ere yon sinking sun
Shall drop behind the purple west,
All shall be lost—or won!

—*R. W. Gilder.*

DRAINAGE DEPT.

REMINISCENCES OF A DRAINAGE SURVEY.

BY C. G. ELLIOTT.

It has been sixteen years since the subject of the drainage of the Red River valley in Minnesota was first taken up in a comprehensive way. In view of the active interest exhibited during recent years in the construction of ditches in the valley, and the gratifying success which has attended the work in both constructive and legal phases, it may prove of interest to describe some of the pioneer work which preceded the system of improvements which is now being carried out.

The Red River valley has been noted from its earliest settlement as a tpyical wheat growing country. The merits of "Minnesota No. 1 hard" were appreciated by every milling establishment in the Northwest, and the superior nutritive value of flour made from it was well understood in the markets. The fame of the immense wheat farms which were opened up in the 70's and the reports of money made in operating them brought the valley into prominent notice as a desirable place for the home seeker and speculator in lands. The large or bonanza farms, as they were called, were selected from a large domain and naturally the choicest locations were first occupied.

The portion of the valley which became distinguished in this respect is a strip of prairie land from twelve to eighteen miles wide bordering the Red River and extending from the north line of the state south a distance of two hundred miles. To the casual observer it is a plain diversified by no slopes which suggest adequate natural drainage. Such streams as there are have their rise in the higher lands lying to the east, flow westerly towards the Red River, but in crossing the prairie plain many of them loose themselves and form marshes thousands of acres in extent, and then as they approach the river discharge their overflow through diminutive channels—mere ditches—into the sluggish Red River of the North. Upon a closer examination at a time when there is an abundance of water to indicate the comparative levels, large flat areas are discovered with corresponding more elevated tracts, the difference between the two being perhaps from one to three feet, but of such large extent that no drainage outlets are perceptible. Another natural feature of this valley are well defined channels six or seven feet deep and often several miles in length which occur at irregular intervals, but have no outlet connection with any stream. These are called *coulees* and are evidently old water channels which have been rendered inoperative by the action of more recent streams from the eastern slope of the valley.

According to the evidence secured by the geological survey of the state, the valley was at one time a large inland sea having connection at the north with Lake Winnipeg. Later as the land at the north became higher, the movement of the water as it receded from the higher land was toward the West where it found an exit through the channel of the Red River. As the channel of the river became better defined, the fall of the water was more rapid until at last it passed away leaving the lacustrine clay bed upon which the alluvial deposit was subsequently made. This body of water is called Lake Agassiz. As the waters of this inland sea gradually receded from the higher land, beaches were formed which can now be traced and show the successive positions occupied by the shore line of this ancient lake. These beaches often fragmentary, but sometimes continuous, have been located and are marked upon the geological map of the state, and seem to prove conclusively that the theory of the existence of an ancient inland sea is correct. Artesian wells have been sunk 200 feet or more deep through soil, yellow clay and blue clay into a stratum of gravel where fresh water is found, indicating that rock does not exist at ordinary depths.

These were the characteristics of the valley as seen by the writer in 1886. At that time the desirability of better drainage had become pretty well impressed upon the minds of leading business men. A series of wet seasons had just closed during which great injury had been done to crops which, in addition to the low price of wheat then prevailing, had worked great hardship upon all classes of settlers. The methods of farming are peculiar to the climate and should be briefly mentioned. During the rigorous winters the ground freezes to a depth of six feet, thereby effecting a thorough opening up and pulverization of the soil to that depth. The field for the crop is plowed in the early fall and the wheat sown in the spring as soon as the frost passes out of the surface sufficiently to leave a few inches of mellow seed bed. The moisture produced by the continual thawing of the frost furnishes all needed moisture for the growing plants during the first part of the season. Early seeding is imperative, otherwise the grain does not have time to mature in the fall before frost overtakes it, resulting in "frosted wheat." If warm rains melt the snows on the slopes to east of the valley land quite rapidly, a wave of water moves down the slope and over the fields, causing a suspension of all seeding, often delaying all farming operations for two or three weeks. This may mean to the farmer a difference between a good crop and a total loss. In addition to this annual risk, occasional summer rains drown crops already well started. These discouraging effects were becoming a serious menace to the prosperity of this wheat growing valley and it was decided that something must be done. The extent of the valley, its level surface and lack of adequate outlets, presented a problem in drainage which no one had solved. There was much difference of opinion as to what direction the drainage should take. The banks of the few streams which could be utilized were higher than the land bordering them. The coulees were channels with no outlets. Swamps of from 2,000 acres to 30,000 acres which filled up and overflowed the surrounding land intensified the difficulties to be surmounted. That united action of the counties bordering on the Red river should be taken was a proposition finally acceeded to by those who had given the subject consideration.

A convention was called to meet at Crookston in July, 1886, to formulate a plan of action. The counties were well represented by delegates, who took an active part in the discussion of the plans proposed. President J. J. Hill, of what was then known as the St. Paul, Minneapolis & Manitoba R. R., was there and encouraged the movement greatly by offering to contribute one-half of the cost of a preliminary survey. It was agreed that a topographical survey should be made and a comprehensive plan of drainage be formulated and reported to the same convention, which should be convened at the call of the chairman after the sur-

vey was completed. A joint commission was chosen by President Hill and the counties, which should have direction of the work and of the expenditure of the funds jointly contributed. It was estimated that the work required in six counties would cost $10,000. Only five counties united at this time in the work, Marshall, Polk, Norman, Clay and Wilkin. The commission organized as the Red River Valley Drainage Commission and offered the writer the place of chief engineer of the survey. This was accepted and immediate steps were taken towards getting parties in the field.

It was desired by the Commission to have the survey completed and report ready to submit before the close of the coming December. How to accomplish the work within the time required no little thought and planning. There were but few available engineers in the locality, and to get any from a distance required time. The plan was to get one party in the field at the earliest possible moment and from that draw a chief of party for the second and so continue until four parties should finally be in the field. The general plan of work adopted was as follows: Copies of township plats, as found in the U. S. Land Office, were made to be used as a basis of the survey, and as field maps. These plats were constructed on a scale of two inches to one mile and showed every topographical feature found by the U. S. government surveyors in subdividing the townships. It was proposed to follow the section lines east and west to and from the river, taking levels at every quarter mile and at such intermediate points as might be necessary, and to trace out to the right or left of this line any depressions which might be found, taking and recording levels on the natural surface and also in the bottom of all depressions. The original government corners could be located in most instances, for but a comparatively small part of the country had been fenced and but few of the corners had been obliterated. They were invariably "post in mound," the post part of the corner, in many cases being a mere stake. The survey was to be a level survey with estimated distances between government corners.

A party consisted of four levelmen, four rodmen, one teamster and one cook. One of the instrumentmen held the position of chief of party, and was charged with the direction of the party, comparing and checking of field notes, and the daily entries on the field map. The outfit consisted of one team and wagon which were furnished by the teamster, two wall tents without flys, one 12x14, used as a sleeping tent, and one 9x12, used as a cook tent; a cooking outfit consisting of a light iron cook stove and tin and iron utensils. In all but one of the parties the cook was employed by the month and provisions were furnished by the Commission. In one party the cook furnished the outfit and provisions and boarded the men at $5.00 per week. The difference in expense of the two plans was but slight. Sea level elevations were obtained from benchmarks furnished by the railroad company, and closing elevations were taken and noted wherever it was possible to reach them.

In field work each man started from a common point and ran his independent section line with the necessary offsets during the day, the four in the party making a sweep four miles wide. At the close of the day the men on the outside lines ran a check line to the center and the four closed on the same point, the chief of party noting the disagreements of elevations. It was then his place to record all elevations on the field map and fill in such topographical features as each instrument man had noted in his book. The camp, according to instructions given in the morning, had moved forward to the estimated closing point for the day. The following day the programme was repeated. Each man carried his noon lunch with him and pulled into camp at night checking on the levels taken by one or more of the party. The closings of the levels of the four were usually within one-tenth of a foot, though two-tenths were allowed. These discrepancies were not carried on but were adjusted each day and the entire work checked up on the next benchmark found which was at the crossing of the lines with the railroad. In this way any errors made were not permitted to accumulate, thus keeping all of the lines within reasonable limits of accuracy.

Four parties such as described were placed in the field and continued work until the last of November. They were made up of county surveyors, student engineers, railroad engineers and one veteran U. S. government surveyor. Levels of six different makes were used, each man furnishing his own instrument. The weather during the time the field work was done was unusually pleasant so that there was no delay on that account.

The field maps and note books were turned into the office, and from them was made a map of the part of each county covered by the survey. The elevations were transferred to the county map, those indicating the bottoms of streams or drainage depressions being placed in parentheses, thus showing at a glance the depth of any channel which was outlined. No contour lines were placed upon these maps for the reason that there were tracts which for a mile or more were practically level, and others where there were local slopes of varying degrees to such an extent that contour lines would be misleading, and of no value in planning systems of drainage. After all elevations and topographical features had been entered upon the map, the plans for drainage were worked out from the data at hand. The area was divided into districts, main drains located and designated by numbers, estimates of sizes and cost made out, and the whole tabulated. The limits of this article will not admit of a description of the results developed by the survey or the numberless details connected with the estimates required, nor can adequate credit be given to those whose untiring labor and faithfulness made these results possible. The convention was called for Dec. 20th, at which time the Drainage Commission reported to the convention that the survey had been completed and presented the maps and estimates showing the feasibility of the work. Mr. J. T. Fanning, C. E., consulting engineer for the Commission, made an elaborate report endorsing and commending the plans which had been evolved from the survey. The reports and copies of the maps were soon published in pamphlet form, and thus made available for use in the several counties. The subsequent work done by the people of the valley in their efforts to obtain state aid in carrying out the work and in securing the passage of a drainage law, together with a description of the work accomplished in the valley during recent years, would make a most interesting addition to drainage literature.

DRAINAGE PROBLEMS OF IRRIGATION.*

BY C. G. ELLIOTT.

The drainage of irrigated lands seems like a proposition involving a contradiction of terms. Yet its necessity is a fact in many of the older irrigated areas of the West. Had the necessity of this been suggested to the early promoters of irrigation improvements, they would have pointed to the heated sands and barren wastes as furnishing a sufficiently conclusive answer and dismissed the matter with scarcely a passing thought. However, such a necessity exists and is acknowledged to-day. By the side of productive fields are seen areas of marsh and bog similar in appearance to those found in the well watered parts of the rainfall belt. Thousands of acres which were once the pride of the farmer, affording him abundant crops and ample remuneration for his labor, are now waste, by reason of the water-logged condition of the land. Villages and towns are also victims of this unforeseen condition, and find the necessity of drainage forced upon them as a sanitary measure.

The causes which have produced these undesirable conditions may be briefly given. In the improvement of arid lands it is necessary to lead the water required for irrigation in ditches which are constructed for long distances through soils often exceedingly open by reason of the large per cent of gravel and sand which they contain. As a result, much loss by leakage occurs, especially during the early history of every canal. In many localities this is never effectively checked, but is looked upon as an unavoidable loss which must be provided for. In some of the older ditches upon which measurements have been made, this loss is found to be from 30 to 50 per cent of the total volume of water taken from the stream. It is continual during the season when water is supplied to the land. In addition to the supply from this source may be mentioned the reckless and prodigal use of water which frequently prevails in early irrigation practice. The soil at first is dry and deep and apparently will contain an unlimited supply of water, but unless some underflow furnishes a relief, the ground fills up and the water appears on the surface at lower levels, or at points where there is some underground barrier which obstructs its course. Where the surface is generally level, as in some of the districts in southern California, the filling up is more uniform and manifests itself in a more general saturation of the soil, with its accompanying results. This is commonly known as "seepage" and is a condition becoming more familiar to irrigators each succeeding year.

The saturation of the soil is not the only injury done by the seepage. The soils in nearly every locality in the arid regions contain large quantities of sodium chloride, sodium sulphate and sodium carbonate, and other salts which are derived from the rocks from which the soils originate, and are distributed through them, forming an important part of their fertility under normal conditions. When, however, any portion of the soil contains an excess of water, these substances are dissolved from the solid portions and are held in solution. The water, when brought to the surface by either gravity or capillary attraction and evaporated, leaves the salts concentrated at or near the surface. The continuation of this process results in the accumulation of alkali, as it is commonly called, in such strength as to destroy all vegetation except such as is indigenous to alkali soils. While these salts are valuable when properly distributed in the soil, more than one-tenth of one per cent has been found to be injurious to the larger part of cultivated plants. The dryness of the atmosphere produces an excessive evaporation whenever moisture is brought to the surface, resulting in a rapid concentration of the salts, especially during the most heated season in the arid climates.

This is briefly the situation in some of the irrigated districts of this country, and, it may be added, that a counterpart may be found in foreign irrigated districts which has attracted the attention of investigators for some years. The engineering problems connected with the treatment of this growing evil, which is curtailing the profits of the irrigation farmer, are somewhat different from those to be dealt with in humid lands where drainage is successfully practiced. The rise of soil water must be controlled or limited to a certain horizon below the surface. Owing to the finely divided structure of this soil and its chemical composition, its capillary power is such that this horizon should be distant not less than 5 feet from the surface, and for many kinds of plants a greater depth is preferable. Otherwise the water will continually pass to the surface where, being evaporated, it will occasion the results before described. The source of the water is the supply contained in the irrigation canals, which always occupy a higher level than the land irrigated by them. It places a constant head upon the soil water, in many cases similar to the force which produces artesian flow. In other cases, water under this head follows courses in the lower soil until arrested by some less permeable barrier, it appears at the surface.

The remedy, in the light of present investigation, is to cut off the supply rather than to remove the water after it has appeared, or, in the case of large and level tracts, such as are found in southern California, to so arrange the drains as to arrest the supply from beneath rather than remove it after it reaches the surface. In land which requires reclamation, water flows upward instead of downward, either directly or after it has passed through an inclined stratum of soil, and is then arrested and forced to the surface. In either case, it is clear that if a drain can be located in such a way as to intercept this flow before it appears too near the surface, an important part of the problem has been solved. It is not necessary to intercept and remove all of the excess of water, since the soil will care for a part of it without detriment to its surface production. In the fruit belt of Fresno, Cal., it has been estimated that in order to control the water line of the soil properly, 2½ cubic feet of water per second per square mile should be removed. Each location, however, demands a special investigation to determine this quantity on account of the varying conditions of surface, soil, and physical structure of the land through which the supply ditch passes.

The proper location of drains is, perhaps, the key to the situation and furnishes a field for practical investigation of a peculiar nature, since it is not necessarily the number or kind of drains which will accomplish the work, but their intelligent and skillful location, both as to surface locality and depth. Various elements enter into this phase of the work which can not be mentioned at this time. It is sufficient to say that present drainage practice in irrigated land, though of limited

* Read before the Engineering Section of the American Association for the Advancement of Science. Dec. 31, 1902.

extent, is sufficient to emphasize the truth of these suggestions.

The various kinds of drains, such as open ditches and covered drains constructed either of drain tile, or of lumber in the form of wooden boxes, have their appropriate places in construction work, according to the locality which may demand attention and the conditions peculiar to it. The laying out of proper grades, details of construction with their practical difficulties, will furnish to the engineer a fruitful field for the exercise of both common sense investigation and technical experience.

This practically new drainage problem is of great interest to the older irrigated districts and should also command the earnest attention of all canal companies and irrigators, in view of the serious results which are certain to follow in the wake of excessive leakage from canals and the wasteful use of water. Lands newly reclaimed from the desert may in time require supplementary drainage work. The conclusions which may be drawn from recent investigations thus far made in Colorado and California upon this subject are:

First.—Much valuable land now under irrigation has been destroyed by seepage and the resultant deposit of alkali, and the process is still going on in certain quarters at a rapid rate.

Second.—Such land can be reclaimed and other land now threatened with the effects of seepage can be protected from injury by simple methods of drainage.

Third.—The simplest and most effective method of drainage is a ditch, either open or closed, constructed across the slope where seep water first manifests itself parallel with the supply ditch and between it and the injured land. Whatever subsequent work may be found necessary, this is the first step.

Fourth.—The depth of drainage in most, if not in all cases, must be not less than 5 or 6 feet, in order to be effective.

Fifth.—For the protection of extensive tracts, large ditches of considerable length may be required in which coöperation of land owners in their construction will be necessary, and which can only be done effectively under the provisions of suitable drainage laws.

It may be said that the growing importance of this subject, in view of the added interest now taken in the improvement and extension of irrigated areas, demands more minute and careful examinations than have thus far been made. The preservation of the lands already subdued, irrigated and improved, is as of great importance as the addition of new land to our cultivated domain.

At Latham, Logan county, Ill., recently, R. M. McWilliams, the dredge boat man of Mattoon, was awarded a contract to dredge a ditch eight miles long known as the Illini-special drainage district. Mr. McWilliams will have to remove 10,000 yards of dirt, and the contract must be completed in the early spring.

There were numerous bidders there, and Mr. McWilliams was the successful one of fourteen who were anxious for the work.

The large contracts taken by the McWilliams company in the past year makes it one of the widest known dredging concerns in the West.

The contract includes eight miles of open ditch, and five miles of drain tile—10 to 18 inches. The ditches are to be six feet deep, five feet at the bottom and 17 feet wide at the top.

CORRESPONDENCE

HINSDALE, MONTANA, Dec. 28th, 1902.

EDITOR IRRIGATION AGE:

My Dear Sir: Your favor of Nov. 28th came duly to hand, but owing to a rush of work has not received attention until the present time.

Answering your questions, I have seen several lists of members in various sections, among others being lists of the Chicago, St. Paul, Montana, and California membership, together with amount of their membership fees. These lists contained the names of the largest business houses and commercial organizations in each locality, and have known how some of the money was disbursed, for instance, I was informed by one in authority to know that in support of the Chicago Congress Maxwell pledged and paid $1,000 for the use of the Central Music Hall in which the meetings were held; again that he paid $1,000 for the use of the Auditorium; that the association paid all the expenses incident to the Chicago Congress, which was no small amount, and which congress was one of the most successful ever held.

Regarding his refusal to furnish you a list of members to whom you desired to send copies of THE AGE, I think that was nothing unusual. I do not doubt but that he would have been pleased to have sent the copies through his office for you, but to furnish a list for that purpose would be another matter. In my own particular line of work, for obvious reasons I would not furnish any one with a copy of my mailing list, nor do I think you would do so with the mailing list of THE AGE. Now let us be fair in this matter, would you?

If you have fully followed the history of this irrigation movement during the past six or eight years, you will admit that the entire movement was on the decline, that the Missoula congress was the last one at which any strength was developed. Even there money was not available for the purpose of publishing the proceedings of the congress, that some time elapsed before courage was mustered to try it again. In the meantime Maxwell at the suggestion of a few of his friends concluded to establish the headquarters of the movement at Chicago, and to carry the work right into the east; among Maxwell's friends and others it was not seen how he could maintain the work, the expense being so great; then it was proposed to organize the National Irrigation Association and by providing a membership fee provide the funds with which to carry on the work; it was in this manner that interest was worked up in the Chicago Congress, and the expenses of that Congress met. It was the real starting point of the entire national irrigation movement, Maxwell, by arousing the commercial interests of the east and south and inducing them to co-operate with the west, at the same time awakening an unusual interest among the press of the east, brought an influence to bear upon Congress, which could not have been secured in any other way, and men like O'Donnell, Boothe, Gibson, Wantland, Maxson, Gavin, Beardsley, Thurber, Fowler and Hewitt, all men of national reputation marvel at what has been accomplished by Maxwell.

In THE AGE you state that the three transcontinental lines were interested to the extent of $30,000 per year. To me and those who desire to see the arid lands of the west settled and developed, this is interesting news. It affords me much satisfaction to learn that they have at last recognized the importance of the movement to the exent of assisting it financially, and they can well afford to, it means greatly increased traffic to them to have the west settled.

Reference has also been made to the "Open Letter." I beg to advise you that to my own personal knowledge that certain statements therein contained are at variance with the facts; that I have here in my possession letters which prove them. I do not think it hardly necessary to go into personal reference unless absolutely necessary, but if the proof is required it can be produced.

My friend, for several years past an effort has been made to secure control of first one thing, then another. At one time it was the leasing of the public lands. I supported that idea until I discovered that the effort being made was not in the interest of the small settler, and that if any attempt were made at the time to secure a leasing bill that advantage would be taken of the man who was

just beginning to move west again and create a home. Then came the proposition to place the carrying out of the provisions of the irrigation bill under state control, and now it is being attempted again under a new guise, namely, that a state board of control shall be created in each state. I presume if this should prove successful then the effort would be made to have the carrying out of the provisions of the new irrigation bill under this state board of control. From my experience here in Montana with the manner in which the state school lands question has been manipulated in the past, I am unalterably opposed to schemes of this character.

It is also being asserted throughout the west that unless such a state board of control is created we are not in harmony with the government authorities, and in proof of this, quotations are made from the report of the Secretary of Agriculture. Care is taken, however, not to mention the fact that the administration of the irrigation law is not under the department of agriculture, but under the department of the interior, but nevertheless the impression is created among those not fully posted that we are really in opposition to the government by not following the recommendations of the honorable Secretary of Agriculture. When the real facts are made known, what effect will this have on the people at large? Do you not think they will discern the true inwardness of the matter?

In my desire to see the west fully settled and developed I yield to no one; no one would oppose more strenuously any matter in which I would feel that it was opposed to the best and lasting interests of my state. On the other hand, I do not believe there is a man in my state who is willing to labor harder, or to make a more continued effort to secure anything which would benefit her. I believe any scheme gotten up for selfish purposes will not triumph for any length of time. I believe that you are well aware of the attempt which is being made at this very time in this state to foist a proposition upon us farmers and irrigators which is obnoxious to us, and which *will not prevail* if I know anything about the people of this state. This matter also comes from the same source.

The situation throughout the west today on the national irrigation movement is that we are divided among ourselves. First it is this, then that. The original proposition was that the west could not build the large propositions. In order to secure the passage of the irrigation bill it was pointed out that the Secretary of the Interior had recommended three specific propositions which were entirely too large for private capital. Now it is stated that the money should be divided up into small propositions. Only last summer a prominent government official told me that the officials had reversed themselves, and it was ordered that attention would be paid to small propositions. Then some section in the west, fearing that some other section may get a little advantage over them if the work of reclamation is not started in that particular section, gets up a protest remonstrating against the first proposition. My attention has been called to articles which have appeared in the *Denver Republican* criticising the St. Mary's Lake proposition. Yet this was one of the three propositions recommended by the Secretary of the Interior. In the article referred to all sorts of ridiculous statements were made which had no foundation in fact, and we are not one of those communities in the west which is tamely waiting for some one to pull us out of the mire. We are sawing away. Each year shows a good increase in the acreage of irrigated land. We now have fully 80,000 acres under water and are adding at least 10,000 yearly. While additional water supply would be of immense benefit we do not believe in waiting. But the entire situation in the west presents a peculiar condition of affairs to the easterner and is not inspiring, or calculated to secure their support. It occurs to me that the wisest course would be for the people of the west to unite upon those matters which we all agree upon, and let those other matters await a more favorable time for settlement. We are supposed to be interested principally in irrigation, yet we branch off onto leasing, state control, etc.

In conclusion, I do not believe we can secure any full recognition in the east as long as we are divided among ourselves. Patriotism would suggest that we all unite, and present a united front to the east. Again we cannot hope for much without the aid of the east. The best way to reach the east, in my judgment, is through the business interests of the east, just as Maxwell is now doing, and if the railroads can be induced to assist us by contributing financial support we should congratulate ourselves on the fact, and the National Irrigation Association is just the agency to accomplish this. We should aid the association in every way possible.

Maxwell is charged with wanting the merger at Colorado Springs, as a delegate to the Trans-Mississippi Commercial Congress at St. Paul last July, and as an executive officer I did all I could to bring that about, believing it the only proper thing, and believe it will prevail in the end. It is a great waste of time and expense to have two or three organizations for practically the same purpose, and we have reason to be thankful to the Trans-Mississippi Commercial Congress for their strong endorsement at Cripple Creek. There is no doubt in my mind that it assisted very materially in securing the passage of the irrigation bill.

An organization similar to the National Irrigation Association is an absolute necessity to carry and sustain interest in irrigation matters. In the irrigation congress no provision is made whereby funds are provided. The Trans-Mississippi Commercial Congress have found it necessary to perfect a similar organization with a permanent membership fee. Were we fortunate enough to unite with the Trans-Mississippi Commercial Congress and were able to exert any influence it would be a case of the tail wagging the dog. You know it has been a very difficult matter to develop interest and financial means sufficient to hold a congress each year, and have been only too glad to ask the T. M. C. C. people to give us a day for irrigation discussion. The same people who are interested in one organization are also interested in the other, and have the same interests at heart. There is no earthly reason why two different congresses should be held. See my position this year; I could find time to go to one, but not to both, although I had expected to go to the irrigation congress until the last day.

In THE AGE reference was made to the request from the executive committee for $10 to assist in paying the expenses of publishing the report. No request of this character was made after the Chicago Congress, and I believe the people of Colorado Springs pledged the necessary expense of publishing the report when the congress was offered them at Chicago.

I offer you these suggestions in the best of spirit, and trust that you will receive them in that way. I trust we may have the pleasure of meeting on one of my trips to Chicago, and that you will do everything possible to bring about a better feeling among the opposing forces in the west. When I see you personally I have some inside history to tell and show you myself, and I wish to say in conclusion that the right will prevail in this as well as in other matters. Propositions for selfish reasons might prevail for a time but not always. It would be much better for the welfare of this movement if all would sink their personal feelings in the matter, agree on those maters on which we all think alike, and let the others rest.

With sincere regards to you personally and the hope that we may meet at no distant time, I will close this letter, which has grown longer than I expected when I sat down to reply to you. My friend, in conclusion, and without mentioning names, there are more than one government official, or set of officials, interested in this matter. Some are very conscientiously doing everything in their power to accomplish a result, even to the extent of not protecting themselves when assailed. They go right on doing their work, in a quiet, unostentatious manner. Another set I cannot say so much for. Strife is being created, and I have letters from senators of the United States complaining of their action pending the passage of the irrigation bill in which this statement occurs: "The greatest foes of the movement come from supposed friends of the west, and who are from the west. Their opinions are frequently quoted and accepted as facts, and make it difficult of explanation. Mr. ——— and Mr. ——— so and so (naming them) are doing more harm than the east all put together, and I fear that the bill will not receive a favorable consideration at this time.

Yours truly,

W. M. WOOLDRIDGE.

REDFIELD, IOWA, Jan. 2, 1903.

IRRIGATION AGE AND DRAINAGE JOURNAL:

Gentlemen: Enclosed find programme of our twenty-third annual convention to be held at Ames, Iowa. If not too late kindly publish same. If you can give us a little write up it will be greatly appreciated. We had the largest attendance of any state meeting last year and as Ames is the home of Iowa College, every member should be present this year.

Very truly yours,

ROBT. GOODWIN, JR., Secy.

PHILLIPS, WIS., Dec. 22nd, 1902.

THE IRRIGATION AGE AND DRAINAGE JOURNAL,

Dear Sirs: I have been observing closely for about three years past, the effects of drainage on our swamps in Price county, Wisconsin. Have tried to ascertain what it costs to clear these low-lands of timber and prepare for crops. Cost of ditching per rod of different sized ditches. How near the ditches should be to each other and how deep. How long after draining before the land was ready for crop, etc. Have also tried to ascertain the relative values of upland and low land after having been put into crop. Effects of excessive rains or drouth upon same. Durability of soil. What fertilizer is best. What profits per acre are received from raising hay upon same, and the tons per acre taken from these low lands. It is only this year that I began actual experiments upon these marsh lands. Have a peat marsh of 200 acres on the main highway, two miles south of the city of Phillips. Began clearing last fall and have now 18 acres cleared, and 10 acres is ditched and partly into crop. This swamp is surrounded by improved farms. The farmers had no faith in the marsh, claiming it was sour and made sport of us as we prepared to put in a crop. Have a pretty little garden now in the center of the swamp and near the road which crosses it. Have a variety of vegetables in it, which are doing splendidly. I might write you a short article occasionally, upon the results of my investigations. I am more and more convinced that the swamps of the north are a gold mine to those who buy early and put into tame hay.

Yours very truly,
DEWITT VAN OSTRAND.

HOUSTON, TEX., January 10, 1903.

EDITOR OF THE IRRIGATION AGE:
Chicago, Ill.

Dear Sir: We beg to advise you of the formation of the firm of Maxcy & Anderson, civil and mechanical engineers, to do a general consulting engineer business, and especially the engineering of irrigating plants, of which there are a great many being built in Texas and Louisiana.

The members of this firm are Mr. John W. Maxcy, who has had charge of much of the important engineering work in this section, and Mr. William E. Anderson, who was, for a number of years, mechanical engineer for the American Cotton Company.

Very respectfully,
MAXCY & ANDERSON.

KEOTA, IOWA, Jan. 2, 1903.

IRRIGATION AGE AND DRAINAGE JOURNAL:

Dear Sirs: Enclosed please find draft for $2.00 to pay subscription for your journal for the years 1902 and 1903. I have always considered your journal one of the indispensable helps in our business. The past year has been a very prosperous one in our business. We have not been able to supply the demand. The 25th of last September I bought Mr. J. C. Clarke's interest in the works. I now own the works alone. I have recently contracted for a new 60 H. P. boiler and expect to add another building to my works in the spring. Wishing the journal a happy new year, I remain,

Very truly,
S. K. LEACOX.

CAREY, OHIO, Jan. 5th, 1903.

IRRIGATION AGE AND DRAINAGE JOURNAL:
Indianapolis, Ind.

We have just effected a consolidation with the Heck & Marvin Co., of Findlay, O. The company will be known as The Van Buren, Heck & Marvin Co., and with a capital and facilities at least four times as great as has the present company.

We will be pleased to send you copy for our ad as soon as we possibly can.

Thanking you for past favors, we are

Very truly yours,
S. C. VAN BUREN'S SON & CO.

Renew your subscriptions to the IRRIGATION AGE for 1903. Send us in Post Office or Express money order for $1.00.

THE TILE WORKS AT CHARLESTON, ILLINOIS.

One of the oldest drain-tile factories in central Illinois is that of S. H. Record at Charleston. Mr. Record began business in 1877 with a horsepower mill and one small kiln. He dried his tile in an open shed, as was the universal custom in the earlier days of the clay business. When drying tile with steam heat was first proposed, it was regarded as an innovation which should be adopted with caution. It was found, in many cases, that rapid drying made the tile crack and in that way occasioned considerable loss. Drying in the open air, however, was entirely too slow to keep pace with the growing demand for drain tile, as was also the molding of them by the horsepower mill. These primitive methods gave place to the steam power mill and to sheds equipped with steam pipes the manipulation of clays, the regulation of artificial heat for the dry shed, and the art of burning the ware were gradually learned by dear experience. Competition in the tile business became disastrously sharp by reason of the multiplication of factories. Our veteran clay workers dwell upon this phase of the business with special bitterness in recounting the early trials of the tilemaker. The reduction of selling prices below the cost of manufacture forced many out of business, and nearly ruined others, if we may believe the reminiscences related by the veteran tilemakers. Many expensive

TILE WORKS, S H. RECORD, CHARLESTON, ILL.

mistakes were made in developing the business, and, take it all in all, there were ups and downs in the career of the manufacturing of drain tile, which the purchaser knew nothing of.

Now that the condition of the trade is such that there is good demand for tile and fair prices are realized, the feeling is better and tilemakers prosecute their work with energy, having confidence in the future of the business. Many of the older factories show the successive steps of enlargement which have been made necessary by the steady advancement of drainage interests. Mr. Record's shed was extended, after which an L constructed of hollow building blocks was put up in a substantial manner. Both are two-stories high, have slated floors and are heated by a complete system of steam pipes. The clay used is tender and considerable care in handling the heat is required or the tile will crack badly in drying. The tile mill and clay dump are located in the angle of the L formed by the two dry-sheds, from which both sheds can be filled with equal facility. The clay is hauled to the dump with

teams, and worked direct from the bank on a New Departure mill. This mill makes large tile as well as small, which is fortunate, as there is a growing demand for drains of large size. Doubtless a much more convenient factory, and a better one in every way could be built now after twenty-five years' experience. Though the modern tile factory is far in advance of the one built several years ago, yet it is but the development of those primitive affairs which have served the people well.

Mr. Record has apparently acted upon the advice once given by an experienced tilemaker when inquired of regarding the best kiln to use. Said he, "Learn to burn the kilns you have." The practice of doing the best with what one has has laid the foundation of many a fortune and is often the best course to pursue. This factory at Charleston enjoys a good trade. It is in the broom corn belt, which is noted for its fertile land and well-to-do people. The farms are being more highly improved each year, requiring the addition of drains to complete the systems which in many instances have only been outlined. All this adds to the productiveness of the land and the consequent wealth of the broom corn belt of Illinois.

Pulse of The Irrigation Industry

Supervisor West, who has been up and down the Colorado river the past week, says that fully 150 men are with the government surveying parties, which are running lines preparatory to the building of the immense Government canals, which are to spread the waters of the Colorado river over the desert lands and make them blossom. One crowd of surveyors has been along the river north of Needles, as far as the Bull's Head and has taken soundings and run lines along both banks between the Bull's Head and Fort Mojave. From present appearances it would seem that the Government intended to build canals on both the California and Arizona side of the river. At the Bull's Head a wire cable has been stretched across the river and very complete soundings and measurements have been taken at that point. It is believed that at that place the big diverting dam will be built, as it affords unusual natural advantages and is above the head of steam navigation.

There is evidence that the surveyors have done much work along the river, below Needles, as the surveyors' flags are to be seen at various points. It is reported at Needles that another crowd of surveyors are working north along the Colorado from Yuma.—*San Bernardino Sun.*

On his return to Great Falls, President Hill spoke freely to the newspaper men concerning the development and growth of Montana. He pointed out that with irrigation this State has just as good possibilities as Washington, where thousands of new settlers are locating, and said when the Montana lands are reclaimed "the Great Northern will see that the settlers are brought here to occupy them." The "Great Northern will lend every assistance in securing irrigation, for we are as much interested in the upbuilding of the State of Montana as you are." Mr. Hill asserted that the reclamation of the arid lands is too large a proposition for individual effort; "it must be done with national aid and will be if the proper spirit is shown in this and other parts of the State." When the arid lands are reclaimed Mr. Hill said the question would be "How quickly can we build railroads, not when?" "There are in the Middle West thousands of homeseekers, ready to move to any western state just as soon as they know they can get land fit for agricultural purposes. Develop your agricultrual resources and other things will be cared for accordingly." This is good advice for the people of Montana. It is true that the irrigation bill has been passed, but much remains to be done to make it effective. There is a vast area to be reclaimed and but little money for the work at the start. To secure early advantages under the law the people of Montana must work together in harmony. When the lands are reclaimed and ready for settlement the settlers will come, and with the increased settlement and development the railways will quickly follow. They will go where there is business for them, and the settlement of the country will make more business than could be secured in any other manner.—*Northwest Magazine.*

J. M. Johnston, missionary among the Navajo Indians, has secured an appropriation and authority from the government to experiment in the irrigation of desert lands now occupied by the Indians. Mr. Johnston was in Chicago recently, and stated that he had secured authority to spend $5,000 at once in his experiments, and declared that he believed the dawn of better times and of a complete independence was at hand for the Navajos.

Mr. Johnston is located at the mission where the Little Colorado crosses Canon Diablo, and his plan is to irrigate from that river by means of wells sunk in the bed of the river. The present plan is to sink several deep wells in the river's bed near Canon Diablo and to run pipes from these to the adjacent lands, and by means of the supply thus obtained to irrigate them sufficiently to produce grazing grass.

Mr. Johnston expects to demonstrate to the Interior Department the practicability and value of the plan, and to show that it is the only way that the Navajos and other Indians now occupying the great Red Desert of Arizona and New Mexico can be kept from being a constantly growing charge upon the government. Experiments have already been made, and have elicited the fact that water flows underground and close to the surface in many portions of the desert, so that irrigation by means of wells, both in the bed of the river and in the desert, would provide an abundance of water for irrigation purposes. Mr. Johnston said:

"I expect to prove to the department that it will cost very much less to make the lands of the desert fertile than it does to supply the Indians with food and clothing. Every year the desert Indians are becoming more and more destitute and more and more of a charge upon the government. All that the Navajo, for example, needs is a little water to make the grazing grass grow on his lands, and he will become more than self-supporting. The Navajos are now self-supporting, but their condition is fast becoming poorer and poorer, and their flocks are yearly dying out for want of sustenance. I believe, however, the government is awakening to the facts, and that the irrigation plan will prove the solution of the Indian question so far as the desert red men are concerned.

ODDS AND ENDS

TO RECLAIM THE LAND OF GOSHEN.

A consular report states that in the land of Goshen, lying between the Nile and the Red sea, and famous in Biblical history as the region to which the Israelites were assigned by Pharaoh, the Egyptian government is now engaged in a gigantic reclamation project. Profiting by the example of enterprising private companies, the authorities have determined to reclaim an immense area which has long suffered from lack of sufficient moisture and which was, it was supposed, rendered utterly worthless by a canal dug by the engineers constructing the Suez canal for the purpose of supplying fresh water to the large force of workmen engaged in that undertaking. The canal was not carefully constructed and the seepage was of unusual proportions. Reaching the alkaline deposits which underlie the entire area, the water brought them to the surface in such quantities as to make the soil absolutely arid.

The government is now constructing two canals at different altitudes. One will supply fresh water for irrigation, and the other will carry away the alkali drawn off by the drains, which will be placed about four feet below the surface and 150 feet apart. During the first year it will be necessary to keep the surface saturated and no crop can be grown, but immense quantities of alkali will be washed out and into the Red sea. The second year a forage crop can be raised, and after that the usual crops of Egypt—corn, wheat and cotton—can be grown in great abundance. In the course of this work the surveyors discovered the well preserved remains of an irrigation canal, constructed by one of the Pharaohs, a description of which is to be found in Herodotus. The officers in charge are now working on the problem of restoring portions of the original aqueduct for present use.

HISTORY OF ALFALFA.

So much is said now of the wonderful qualities of the forage plant known as alfalfa that its history is overlooked by the majority of farmers.

Alfalfa is a native of Western Asia, according to the report by the Maryland Experiment Station, whence it was early taken to Southern Europe. The Spaniards carried it with them to South America. From Chili it was taken to California and thence spread throughout the drier portions of the West. Everywhere it has added immensely to the stock carrying capacity of farm and ranch. Its great value as a feeding crop becoming better recognized, an effort has been made to extend the use of it and there is probably no state now in which it is not growing, at least experimentally.

Recently the Department of Agriculture has imported from Turkestan a variety which is remarkable for its ability to resist great extremes of heat and cold, and it is this variety which it is believed by the officials will be extremely valuable for the states of the Northwest.

Briefs have been filed by the Farmers' Irrigation District and William Frank in the three-cornered contest over the right to tap the Platte river in Scotts Bluffs county for the irrigation of a tract comprising about 60,000 acres of land. The Farmers' Canal Company, which is the third party in interest, has not yet filed its brief, although today was the date set for all of them to be in. It is estimated that the land which it is proposed to irrigate will be worth $2,000,000. The scheme of William Frank contemplates watering 150,000 acres, and the development of power along his canal for industrial purposes. He rests his claim wholly on priority of application. The irrigation district objects to Frank's pretentions because, it is claimed, it is speculative and will give him a monopoly of rights, contrary to the terms of the Constitution and against public policy. It is alleged that he proposes to exact $20 an acre for water rights, and that the granting of his application will deprive residents of the district from watering their own lands.

It is alleged that Mr. Frank has at heart not so much the interest of the district as of his own bank account. When the district came into the field it issued $400,000 bonds, afterwards declared valid by the supreme court. Mr. Frank undertook to negotiate them. He failed to find a taker. Then he made the district a proposition to construct the canal through the agency of a syndicate, if the district would give him a half of the land, amounting to 40,000 acres and the $400,000 in bonds. For this reason the counsel for the district assert that Frank is in the business for speculative purposes.—*Omaha Bee.*

In commenting on the late irrigation congress the *Denver Field and Farm* has the following to say in comparison with the National Farmers' Congress:

"Our own beloved National Irrigation Congress is built on much the same plan, the only difference being that it is run principally as a one-man show, although it must be said in all truth that the one-man-Maxwell was thrown down so good and hard at the recent meeting in Colorado Springs that all the wind-pudding was knocked out of him, and hereafter he will be numbered among the nit crowd."

The San Gabriel River Water Committee held its monthly meeting Tuesday morning. It has just completed putting a submerged dam in the development tunnel, which is confidently expected to result in a heavy accumulation of water during the winter months, and a correspondingly increased flow through the summer.—*Covina (Cal.) Argus.*

THE DEARBORN CANAL.

A meeting of the members of the Montana State Arid Land Grant commission was recently held in Missoula at the office of the president, Col. Thomas C. Marshall. The full membership was present—President Marshall, Vice President and Field Agent Donald Bradford, Helena, and Secretary D. H. Cory of Helena. The business considered was largely routine, but a report presented by the field agent showed the affairs of the commission were being carried forward as directed, and that indications pointed to a large amount of good that would follow plans for irrigating a large area of land in northern Montana.

Figures of the agent were confined largely to work being done on the Dearborn canal in the northern part of the state. He furnished documents to show that the canal now carried water that was irrigating satisfactorily nearly 14,000 acres. One-half of this has been contracted for by settlers now living on the lands, and who have made at least one payment on a contract purchase. Other letters read gave assurance that the remainder of the land would probably be claimed within the coming six months.

According to previous arrangements the board will go ahead with the erection of reservoirs and dams to hold water for the irrigation of a tract containing 22,000 acres in Cascade county. The supply for this will come through the Dearborn canal. It is not expected the work on this feature will be completed before 1904.—*The Missoulian.*

The Lake Koen Navigation Reservoir and Irrigation company was restored the right to do business in the state of Kansas by the charter board at Topeka recently. The company, so it was alleged, had refused to pay its just debts and had also failed to file a statement of its business in compliance with the law. The attorneys for the company showed that it was willing and able to pay all just debts and that the failure to make a statement of the business was simply an oversight. The officers of the company claim that the trouble started in the first place by the action of a man who attempted to hold up the company for $10,000, which he happened to be in need of, and that he had no just claim, the company having paid him in full.

The company was said to be one of A. E. Stilwell's enterprises, but Mr. Stilwell said last week that he was neither an officer nor director in the company. He took $2,500 worth of stock when a reorganization was being effected and the enterprise is now known as the Lake Stilwell company. The company was formed in Barton county, Kansas, where it is proposed to build an irrigation reservoir.—*Kansas City World.*

"Among the Flowers with Rexford," the regular department of experiences and help for amateurs in floriculture in the January *Home and Flowers,* contains an editorial, "What to Do in January," Rexford; "The Golden Hop-Tree," by W. C. Egan, and "January in Southern Gardens," by Mrs. G. T. Drennan.

A FAIR AVERAGE.

Visitor—"Lady Evelyn tells me, Dan'l, that you have had four wives."

Daniel (proudly)—"Ess, zur, I 'ave—an' what's more, two of 'em was good 'uns!"—*London Punch.*

Ere yet thy heart be hard and dry,
Make haste to pardon and atone;
One hoarded hate shuts all the sky,
And turns the Father's heart to stone.
—*Frederick Langbridge.*

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CALIFORNIA FOR THE WINTER.

The cold weather which characterizes the average winter in the north, east and middle west naturally causes considerable attention to be drawn to the sections of the United States in which different conditions obtain. California, Arizona and Mexico are the great winter resorts of the country. Southern California contains a myriad of attractions for the tourist, and the Southern Pacific-Sunset Route operates double daily passenger trains between New Orleans and all California points, with all modern conveniences and comforts and excursion sleeping cars Washington, Cincinnati and Chicago to San Francisco on regular days.

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THE IRRIGATION AGE

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A monthly illustrated magazine recognized throughout the world as the exponent of Irragation and its kindred industries. It is the pioneer journal of its kind in the world, and has no rival in half a continent. It advocates the mineral development and the industrial growth of the West.

EDITORIAL

Dreamwold Drainage. Through the kindness of Mr. Geo. H. Pollard, manager of Dreamwold, the farm and country place of Mr. Thomas W. Lawson, Scituate, Mass., we are enabled to present an article from the pen of the contractor, Mr. O'Hearn, on the drainage work accomplished on the polo field on this place, with pen drawings showing plan of work. The article, with illustration, will be found on another page.

An Opinion. In a recent letter from a gentleman prominent in irrigation affairs in Montana we find the following: "I have to thank you personally for the stand you have taken in upholding Elwood Mead. His department has done wonderful work for the west during the short time since its establishment. I regret very much that there should be such antagonism between Mr. Maxwell and himself. I have known for a long time both Mr. Mead and Mr. Newell and consider that the interests of the West are safe in their hands.

Nebraska Irrigation Association. In this issue is presented a report of the annual meeting of the Nebraska Irrigation Association, which was held at Lincoln, January 22. Among the many interesting papers presented are those of the president, Mr. Wolfenbarger, and that of Mr. J. C. Stevens, assistant secretary of the Nebraska State Board of Irrigation. Mr. Wolfenbarger treats particularly of what Nebraska land will produce by the proper application of water, and advises investigation along lines to improve small tracts and gives figures of profits from small holdings properly cultivated. The paper by Mr. Stevens is published in full in connection with the report, and is worthy of perusal by all our readers.

Eleventh Irrigation Congress. The eleventh National Irrigation Congress, which will be held at Ogden, Utah, September 8, 9, 10, 11, 1903, promises to be largely attended, and if the people of Utah carry out their present programme the delegates will receive a welcome at Ogden such as has never been accorded delegates at any similar meeting. As will be seen by articles in another column, an appropriation has been made by the State Legislature for ample money to properly entertain all delegates. It is estimated that a fund of not less than $10,000 will be available for that purpose. All interested should make preparation to attend and help swell the number so that the eleventh congress may outstrip all preceding meetings in point of attendance and results.

Wolfenbarger's Speech. We wish to call attention to the speech of Mr. A. G. Wolfenbarger, president of the Nebraska Irrigation Association, which appears in our report of the annual meeting of that body. Pump and wind mill people should be interested in the following paragraph:

"A cattle rancher about forty miles south of Brush,

Colo., produced on a little truck patch, containing less than one-half acre, over $129 worth of miscellaneous garden vegetables by irrigation from a wind mill plant, the storage reservoir of which did not cost to exceed $23." Mr. Wolfenbarger says farther:

"Our people need to learn that on thousands of farms there are opportunities to construct and put into operation small irrigation plants, which would increase the value of farm products from $100 to $300 per acre on each farm when such a plant is established."

What Mr. Wolfenbarger says of Nebraska and the West is equally true of the Central and Eastern States, and the time is not far distant when manufacturers of wind mills, gasoline engines and other pumping outfits will begin a campaign of education along these lines east of the Missouri River.

President Wolfenbarger.

A. G. Wolfenbarger, of Lincoln, Neb., recently unanimously elected president of the Nebraska Irrigation Association, is one of the best known irrigation attorneys in the central West. He is a farmer's son, and for the past twenty-five years has been engaged in journalistic and social reform, and for the past twelve years has been actively engaged in the practice of his profession in the capital of Nebraska.

MR. A. G. WOLFE NBARGER,
Lincoln, Neb.

He has held commissions from four governors of his State as an accredited representative of Nebraska in the various national irrigation congresses. He has devoted much time to the study of irrigation law and history, and in all positions he has held in connection with the irrigation movement he has never received a dollar of salary and his expenses have been met from his personal funds. He published the Nebraska Irrigation Annual in 1896 and 1897, and during his incumbency as an officer of the Irrigation Association has printed and circulated over three tons of literature on this subject. A good likeness of Mr. Wolfenbarger is shown in this issue.

Secretary of Agriculture.

Through the courtesy of the Division of Publications, U. S. Department of Agriculture, we are presenting in this issue a very good likeness of Secretary of Agriculture James Wilson, who was born in Ayrshire, Scotland, August 16, 1835. Secretary Wilson is a nephew of Rev. Dr. J. McCosh, ex-president of Princeton College. In 1852 his parents emigrated to the United States, settling at Norwich, Conn., whence, in 1885, he removed to Traer, Tama County, Iowa. He attended the public schools and finished his education at Iowa College. As early as 1861 Mr. Wilson took up farming as an occupation, and in the same year was elected to the State Assembly, of whose lower house he became speaker. In 1872 he was elected to the Forty-third Congress (1873-75), also to the Forty-fourth (1875-77), and to the Forty-eighth (1883-85). In the interim between the Forty-fourth and Forty-eighth he served as a member of the railway commission; in 1870-74 he was a regent of the State University, and in 1890-97 was director of the agricultural experiment association and professor of agriculture at the Iowa Agricultural College at Ames. He was confirmed Secretary of Agriculture in President McKinley's cabinet, March 5, 1897, and was retained in office when the President began his second term. Secretary Wilson is recognized as one of the most conscientious workers in the cabinet and has accomplished great good for the farmers of America since being placed in this high office.

FIGHT ON.

If things seem a little blue,
  Keep on fighting.
Stay it out and see it through,
  Keep on fighting.
Do not give up in despair,
There will come a change somewhere,
Skies to-morrow will be fair.
  Keep on fighting.

Is the struggle hard and long?
  Keep on fighting.
Face the music and be strong,
  Keep on fighting.
Show you're game and proud of it,
That you're not the sort to quit,
That you have old-fashioned grit.
  Keep on fighting.

But if you should win or no,
  Keep on fighting.
If you lose, then be it so,
  Keep on fighting.
You had better bite the dust
For the cause you know is just
And eternally go down
Than with wrong to win renown.
  Keep on fighting.

IRRIGATION IN THE SOUTH.

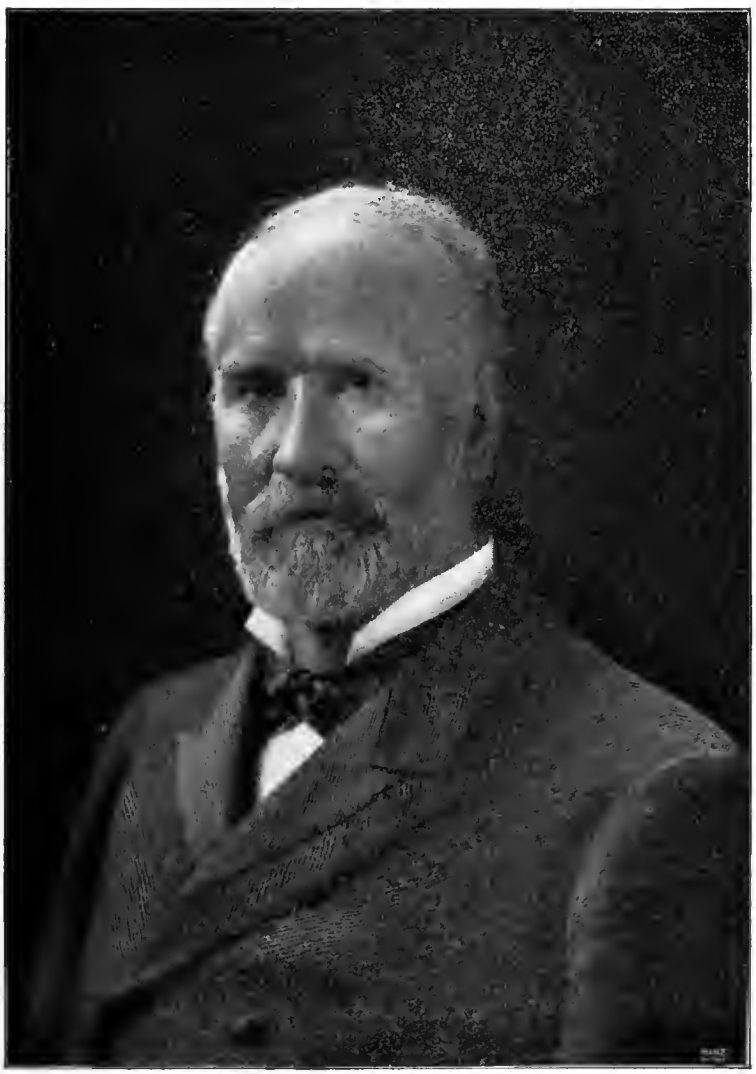
BY FRANK BOND,
Assistant in Irrigation Investigations, U. S. Dept. of Agriculture.

In no other portion of the humid sections of the United States has agriculture by irrigation received such an impetus as in the States which border the Gulf of Mexico. The success which waited upon the artificial application of water to the rice fields of southwestern Louisiana and southeastern Texas has encouraged the application of the principle to the diversified farm crop, and especially to the growing plants of the market gardener's truck patch. But as yet agriculture by irrigation, so far as the same is applied to market gardening, is in the experimental stage in the South. It may be said, however, that no failures have yet been experienced by those farmers who have used irrigation in their fields or patches of vegetables, grain, tobacco, or orchards. The irrigation of sugar cane may be anticipated at an early date, for the observant cane grower has learned that during every week of drouth the joints on the cane grow shorter and shorter, the ripened stalk often showing a shortage below what a sufficient rainfall would have produced of 10 to 25 per cent. In a cane field covering thousands, or even hundreds, of acres, this loss is tremendous in comparison to the cost of an irrigation plant capable of preventing it. The writer believes that irrigation of sugar cane in districts subject to drouth conditions is one of the certainties of the near future. In southern Texas the irrigation of truck farms from comparatively shallow artesian wells has already become established, and with marked success, and the farmers of Alabama and Georgia also are awakening to the fact that they have within their reach a means of preventing the failure of crops which has become so regular the past few years that farming was being considered a doubtful occupation. In southern Georgia 800 bushels of onions per acre, worth $1 per bushel, is a common crop when opportune rains in May and June come to mature the plants. During these months in 1901 and 1902, however, the necessary rains did not come, and complete loss of crop followed, the healthful but odoriferous vegetable withering away in the dry and shrivelling heat. One good irrigation each year would have saved the crop and made the returns maximum in quantity and irreproachable in quality—measured from an onion standpoint.

MR. FRANK BOND.

The irrigation of corn and peas near Rome, Ga., during the past season has demonstrated the great value of this aid to agriculture in the humid States. In addition to saving valuable crops by artificial application of water, there is no doubt that these worn-out lands will be greatly benefited in another way. Greater diversification of crops will be possible, causing a renewal of soils and thus increasing their productivity.

The chief crop of the South at the present time which is dependent upon irrigation is the rice crop. The experiment which was begun upon the plantation of the Abbott Brothers, of Crowley, La., Michigan farmers who went South "to grow up with the country" ten or a dozen years ago, has developed into an industry of the greatest importance to the people of the United States. Prior to 1889 the upland prairie region of southern Louisiana was an immense grazing country, occupied almost wholly by the descendants of those unfortunate French subjects who were deported from Nova Scotia by British ships about a century and a half ago. Longfellow, in entrancing verse, and George W. Cable, in touching prose, have made pleasant reading out of the hard facts of their exile without mitigating the horror of an exodus that will always seem as unnecessary as it was deplorable. During all the years following their exile in 1755, the Acadians, who spoke their native French and taught it to their negro serv-



Courtesy Division of Publications.
SECRETARY OF AGRICULTURE WILSON.

ants, occupied these prairies with their herds of horses and cattle until rice growing in the closing years of the nineteenth century changed the face of the country as no fairy wand could have changed it. Stock raising as the dominant industry of the people gave way to rice growing, and prairies which fifteen or twenty years ago were dotted with lowing herds became noisy with the songs of harvesting machines and the promising clatter of the separator. Land values responded immediately to the influence of the change from pastoral to intensive agricultural conditions. Prairie land worth $1 per acre for raising ponies and dewlapped cattle soon brought $10 per acre, the price rising rapidly to $20, $40, and even $50 per acre for choice locations in 1902.

Courtesy Division of Publications.
BINDERS AT WORK, RAYWOOD, TEXAS.

Owing to the topographical character of this country the method of supplying water for the irrigation of rice differs materially from that employed in the arid and semi-arid States. The water supply is contained in sluggish bayous and streams which are from 5 to 70 feet below the land to be irrigated. This water must be lifted by pumps, and a series of three or four supplementary lifts are often necessary to get the water sufficiently elevated to reach the higher lands. The average lift of these pumps is about 20 feet and their discharge varies between 1,000 gallons and 50,000 gallons per minute. The water from the pumps is discharged into a flume and carried to the first canal, which conveys it as far as the contour of the surface will permit. These canals are not dug into the earth, but a strip of the highest land is fenced in, as it were, by two levees thrown up on either side and running parallel. The water at one end of the canal is exactly the same height as at the other end, and if no means were provided to withdraw it, overflow would occur on both sides from one end of the canal to the other. At the farther end of the canal, if the land to be irrigated has not yet been reached, another pumping plant is established, which again lifts the water, emptying it into a still higher flume and by which it is carried to a higher canal. There is sufficient grade to the land along the canal, on one or both sides, to carry the water by lateral canals to the lands to be irrigated. Contour levees 12 to 18 inches high are run across the fields of rice often enough to permit any entire "cut" or field to be covered with water so that the depth on the lower side will not exceed 10 or 12 inches. Rice being a water plant, requires a completely saturated soil to bring it to maturity, and it is the practice to keep the fields covered with water for a period varying between 50 and 70 days.

At first glance it would appear that enormous values of water would be required, but careful measurements show that the duty of water in rice growing is fully twice as great as it is when used for the ordinary farm crops of the irrigation States. That is to say, the four or more feet required to be diverted where the soils are gravelly and very porous is reduced to two feet or less in the rice districts, where the loamy and clay soils hold water without loss except that due to evaporation. On this account seepage losses, which are a very important factor in irrigation in the North-

Courtesy Division of Publications.
PLOWING RICE FIELDS WITH CATTLE, BAYOU PLAQUEMINE, LOUISIANA.

west, do not interest the rice planter. However, the latter has troubles of his own, especially along streams and bayous where over-appropriation prevails.

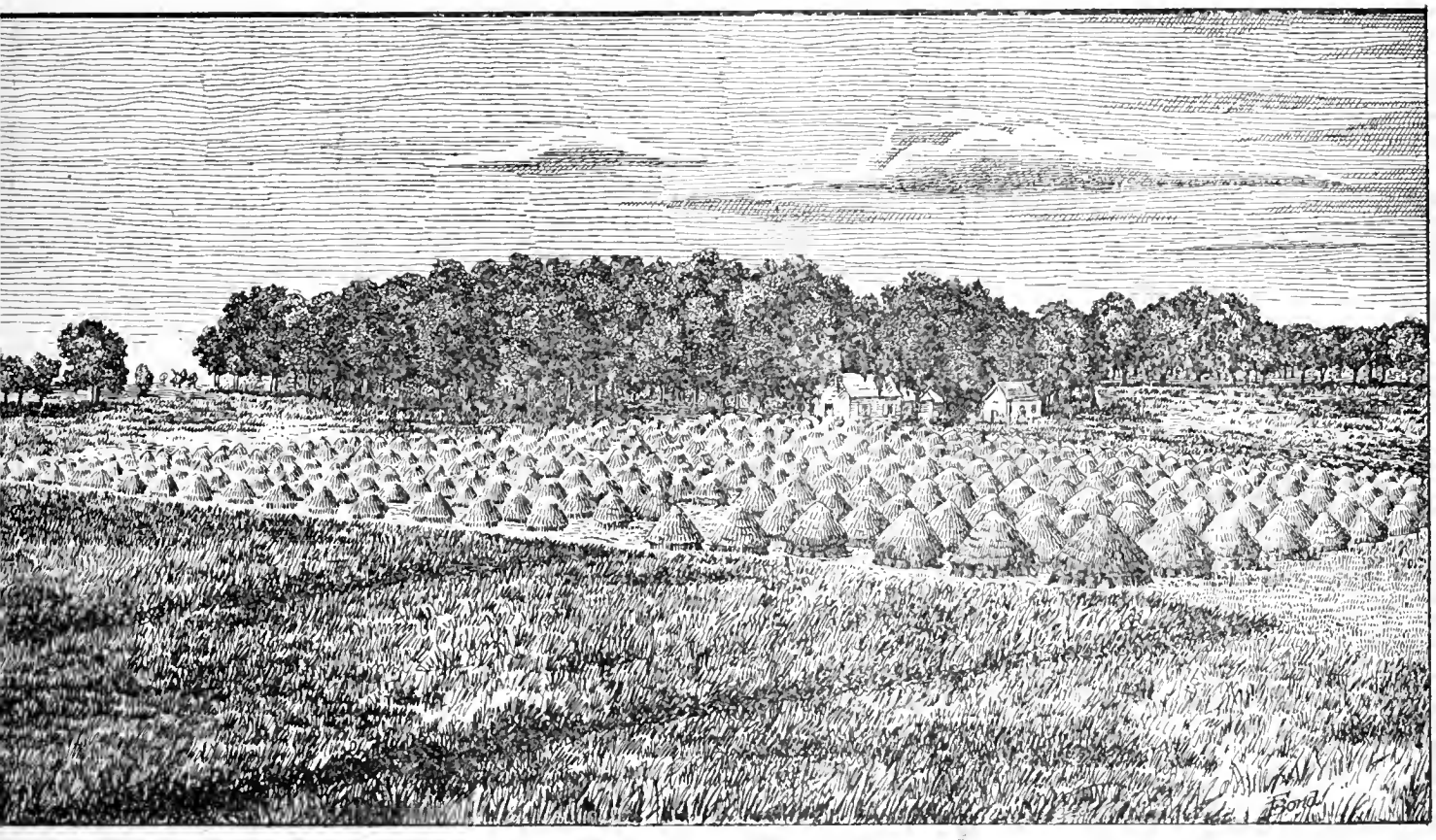
It is a matter of interest to know that nearly all of

the water courses in the rice district, which flow serenely, deliberately, and in almost perpetual shade, follow channels cut far below the level of the water of the Gulf of Mexico. Because of this fact, salt water for irrigation becomes a certainty when a dry season prevails and the pumps withdraw the fresh water from the upper reaches of the stream. This is not a theory, but an actual experience of rice farmers along several streams during 1901 and 1902. The result was great loss of crops and also damage to soils.

In one important particular only does rice growing in Texas and Louisiana differ greatly from wheat farming in the Northwest. Owing to the rapid growth of vegetation in the warm climate, both fall and spring plowing are practiced by the best farmers, but in general the preparation of the soil, planting, harvesting and threshing the crop are processes exactly similar to those followed on a wheat farm. After the plowing, the land is usually disced thoroughly and then harrowed to still further reduce the lumps. The broadcasting sower fastened to the rear of the wagon box, or better still, the regulation seed drill, is used to plant the seed, the reaper and binder cuts the grain, and the regulation separator threshes it in the most approved and expeditious fashion. Preparation to irrigate the rice crop and the method of applying water, however, differ greatly from the practice in the wheat field where irrigation is necessary. Repairing the field levees, described above, is usually left until the seed is planted, and actual irrigation, which does not begin until the plant has reached a height varying between 6 inches and 1 foot, which, depending upon the season, occurs from one to two months after planting. At this time a flood of water from the great canal is poured upon the highest cut on the farm and through the lower levee, conveyed successively to the cuts below until the entire farm presents

Courtesy Division of Publications.

THRESHING RICE, MOORE-CORTES PLANTATION, BAY CITY, TEXAS.



ourtesy Division of Publications.

RICE STACK YARDS.

the appearance of a shallow lake. Nothing further is required in maturing the plant than keeping the fields saturated until the appearance of the head indicates that within ten days or two weeks the services of the binder will be needed. The levees are then cut and the water drained off.

Water for rice irrigation is not confined to the supply contained in the bayous and rivers which empty into the Gulf. In both Louisiana and Texas lands which are too far removed from the large canal, or too high to be covered from this source, are being reclaimed by artesian water, which appears to underlie the entire region at depths varying from 50 to 300 feet. Six, eight, ten, and twelve-inch wells are put down into the beds of gravel which supply this water and centrifugal pumps lift it to the rice farms above. Some of these wells flow freely, but in the great majority the water must be lifted a height varying between 4 and 20 feet. Continuous pumping from these wells materially reduced the water level during the irrigation season, and although the extent of development based upon this supply is conjectural, there is no doubt that it will be much greater than the area which the unaided surface water will supply. Small farms and large population are the dominant features of the artesian well districts, and prosperity seems to prevail wherever wells are bored.

In conclusion it may be said that the irrigation of rice in Louisiana and Texas is an infant industry. There is a superabundance of land adapted to the requirements of this crop and sufficient water to greatly magnify the acreage now utilized. Successful rice farming is being carried on in a territory 50 to 70 miles wide and extending from the Vermillion River, in Louisiana, on the east, to and beyond the Colorado River, in Texas, on the west. The discouragements along many streams due to the presence of salt water under the pumps, which is the immediate effect of prolonged drouth, will continue until some reasonable settlement of the live question of water rights is undertaken and the experience of other States turned to a profit in Louisiana and Texas. In the former State, diversion of a stream for any purpose is unlawful, and there is, of course, no recognition of special or prior rights. Provision for any division of the supply among those who do not appropriate is not discoverable in the laws of either State.

Under the able direction of Prof. Elwood Mead, the U. S. Department of Agriculture is making a careful study both of the water right problems and the physical problems of irrigation which confront the rice grower. As a result of this assistance wiser water laws and regulations governing the diversion and distribution of water in the States mentioned may be anticipated at an early date. A settlement of these questions is of the greatest importance to the stability and prosperity this important agricultural industry.

THE ELEVENTH IRRIGATION CONGRESS.

Ogden, Utah, 1903.

The next session of the Irrigation Congress is to be held in Ogden on the 8th, 9th, 10th and 11th days of September next. This congress had its inception in the minds of Utah men, its first session was held in this city, and now after ten years it comes back to Utah to hold its eleventh annual session. It is not necessary to dwell upon the importance of this body, says the Salt Lake Tribune of January 23, representing as it does the life of the great agricultural processes of the whole arid region; its importance cannot be overestimated. The passage of the National Irrigation law increases the importance of the functions of this congress, and as the benefits of that act become better understood and its workings more applied, the great irrigation question will grow in magnitude and beneficial application.

We note that a very proper move was made in the House yesterday in support of this meeting of the congress. A resolution of welcome, whose preamble recited the origin in Utah and the benefits of irrigation in this mountain country, was unanimously passed. A bill was also introduced and referred to the House Judiciary committee (of which an Ogden member is chairman), which appropriates $6,000 to aid in defraying the expenses of the executive committee of the congress, on condition that $3,000 for the same purpose be raised by the people of Ogden. This is not much money to pay out for such a meritorious meeting as this of the Irrigation congress will be, and it is not probable that there will be any particular objection to it, as the object is worthy and the purpose a public purpose. We look to see the bill go through with ease.

The Salt Lake Herald of January 23 has the following to say concerning the 11th National Irrigation Congress:

A bill of particular merit was introduced in the House by Dr. Condon of Weber county yesterday. It provides for an appropriation of $6,000 to aid in defraying the expenses of the executive committee of the eleventh annual session of the National Irrigation Congress, to be held in Ogden next September. A proviso that the citizens of Ogden must raise at least $3,000 in addition is included in the bill.

The importance to Utah of the National Irrigation Congress is beyond estimation. The organization was formed in Utah eleven years ago, and it is particularly fitting that after so many years the irrigationists should again assemble in the state. The next meeting will be of special interest because by the time it assembles we will have had at least the beginning of a practical test of the new national irrigation law.

The practical benefits of irrigation are neither intangible nor indefinite. They are actual and concrete. No argument is needed to convince Utah people of the importance of the work; no argument should be needed to convince the legislature that the Condon bill should be passed as promptly as possible. The sum of $6,000 is not a large one, as public appropriations are measured.

The money is not to be used for the benefit of any individual or any single community. It will be used in the furtherance of irrigation ideas and irrigation work. Utah has been highly honored by the congress. Colonel Edwin F. Holmes of Salt Lake is president of the organization, and Fred J. Kiesel of Ogden is chairman of the executive committee. The state is pledged to entertain the congress in a fitting manner and the legislature should do its part.

The prompt passage by the legislature yesterday of the joint resolution of welcome to the congress and of endorsement of its purposes, indicates the temper of the lawmakers. The Herald does not believe there will be any trouble about the adoption of the Condon bill.

IRRIGATION IN THE SPOKANE VALLEY.

During the present year the State of Washington has begun to realize that her greatest resource is her fertile land for farming, and the supply of this is gradually diminishing. Still this vast resource is comparatively free, as many years are needed before the land of the State will be made to yield all of which it is capable.

RESIDENCE, ORCHARD AND SPILLWAY, GREENACRES, WASH.

The question of reclaiming the arid land by irrigation has become of wonderful importance, and already the building of canals is an important feature in the commercial affairs of the West, and large amounts of capital are being employed in this construction. Barren land over the State has assumed a new value which is based upon the chances and cost of putting it under canal. High line ditches, deep cuts, long flumes, etc., are some of the things which are necessary in order to get water upon tillable land near some good market. At first this cost of ditching governs, to a certain extent, the cost of the irrigable land, but in time, as the district becomes well enough established so that the returns therefrom can be counted upon, then it is the revenue which it will bring to the farmer that determines what he is willing to pay for his land.

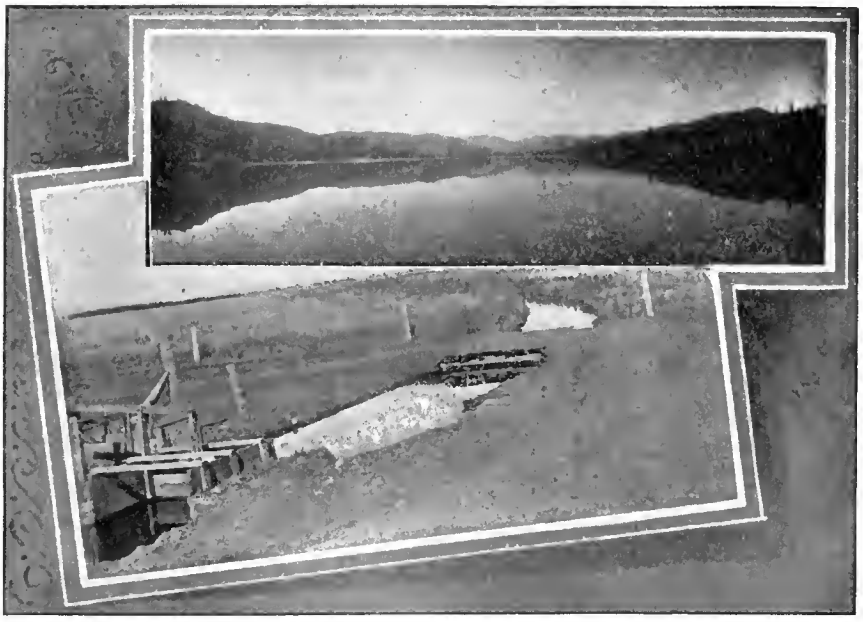
Along this line some almost fabulous amounts have been realized from investments made in land when it is first put upon the market after ditch is built. In the State of Washington rushes have been made to secure this land as soon as canal is completed, and in almost every case companies have sold first tracts so low that the farmers have the first year made as much from produce as they have paid for the land. This, however, is only where a ditch is new, for it soon becomes known just what elements enter into the farmer's business as resources or liabilities and the land values are determined accordingly.

In this respect there is no irrigation country in the West which is capable of such rapid increase of value as the lands of the Spokane Valley. The expenses in connection with putting water upon the land are comparatively small, and yet the merits of soil, climate, and market are unequaled.

The richness of soil has long been evidenced where irrigation has been used and in a few sub-irrigated tracts in the surrounding foothills. In few cities are the yards richer in trees, gardens and vegetation of all kinds than are those of Spokane, where the city water makes the soil respond to its fullest extent. Time alone is needed, now that canals have been built, to make the entire valley one large garden, and then the return to the farmers, the wealth of the valley, and the prosperous condition of the mining country which is dependent, will be many times as great as at present.

As to the climate little need be said, as the Spokane climate is already far famed.

The market? Well, yes, a few things can be said regarding it. A careful study of Spokane's location will show the vast area of mining country tributary and at the same time dependent upon Spokane. It is tributary in wealth and commercial affairs and dependent for nearly all produce which it uses. Spokane is the great general store for this area, and as this land is the land where the highest prices are paid for labor, the prices which these people can pay for produce is not to be scorned. The population of this area added to Spokane's own population, making in all about 200,000 people, must



RESERVOIR AND MAIN DITCH, GREENACRES, WASH.

be supplied through the Spokane market. Then consider that the Spokane Valley is surrounded by mountainous country and that the only land excepting the valley itself is many miles distant, and it will be readily seen the wonderful incentive which this valley land offers to the raiser of some special kinds of farm produce. Fruit, berries, vegetables, dairy produce, etc., must be secured near at hand in order that it may be shipped to this mining country and arrive there in good condition. At the present time, when the irrigated land is but making a start at production, it can be understood why the mining towns are seldom supplied with the above. To be sure, other portions of the State—Yakima, Wenatchee, Walla Walla, Clarkston—help out in supplying the market, but they are all over one hundred miles away, and the freight and commission charges necessary cause the high prices which are found in the Spokane markets. Now that irrigation is making it possible to raise these articles in the valley it can readily be seen why the returns to the farmer are so great and why these lands will increase rapidly in value.

MAIN CANAL, GREENACRES, WASH.

We are showing in this connection scenes in the Greenacres irrigation district near Spokane, Wash. These cuts fairly well illustrate what may be accomplished by irrigation. This section is owned by the Spokane Valley Land & Water Co., Spokane, Wash.

NEW IRRIGATION ENTERPRISES.

There ought to be a big demand in the intermountain country this spring for implements used in canal and ditch excavation and dredging. There are two immense corporations starting in at American Falls and Twin Falls on the Snake river in Idaho; the former for electrical power generating and irrigation, and the latter for irrigation. One of the canals of the Twin Falls Company will be 69 miles long and 80 feet wide at the bottom. This gives a canal sufficiently large for transportation purposes, and will doubtless be used thus to a considerable extent. The railroads, too, are to enlarge the borders of their operating garments, and implements needed in construction work will be largely called for this spring along the lines of the D. & R. G. Oregon Short Line, and the Pacific roads.

ANNUAL CONVENTION OF THE NEBRASKA IRRIGATION ASSOCIATION.

(From staff Correspondent)

Held at Lincoln, Neb., January 22.

A large representative body was present at the opening of the annual convention of the Nebraska Irrigation Association in Room 106, University Hall, this morning at 10 o'clock. The session continued throughout the day and adjournment was taken at 4 o'clock. Unusual interest was shown in the discussion. Between ten and fifteen counties were represented by from one to ten delegates each. The discussions were of intense interest, covering wide range of topics, and a very valuable paper was read by Assistant Secretary Stevens of the State Board of Irrigation on the water supply of Nebraska.

The association was called to order by President Wolfenbarger, who delivered his annual address, which is as follows:

To the Officers and Members of the Nebraska Irrigation Association: We assemble in annual convention and conference after a lapse of more than the regular term, and it has been deemed a matter of great importance that this association, which was the pioneer of practical irrigation in its broadest and most comprehensive view, should again take up educational and promotive work looking to the material, economic and general welfare of our great commonwealth.

Since we last met Congress has passed an important act providing for national aid and, to a limited extent, national supervision along certain lines of irrigation, but this only increases the importance and urgency of maintaining our organization and keeping it in step and touch with the progress of our day.

This new national enactment calls for a most careful analysis and consideration on the part of our committee on legislation, and it is the hope of your president that this new committee will be selected with great care and with especial reference to the fitness and ability, of its members to grasp in a timely manner the vital problems that confront our people in assisting in the wise administration of the present law, and in suggesting and urging necessary amendments, which are practically certain to be needed as time progresses.

Irrigation, although practiced in the great West for more than a third of a century, may be still truthfully said to be in its infancy. Only a small proportion of the waters available for irrigation purposes have as yet been applied to beneficial use. Uncounted millions of cubic feet of storm and flood water pass over the surface of our soil, carrying with it more or less of injury and destruction, before it reaches the Gulf, and the present generation and its successor owes it to civilization to see that man utilizes his great opportunity in turning this great force of nature into an engine for his advancement, protection and legitimate enjoyment.

Our present law is poorly understood, and in fact remains uninterpreted by our Supreme Court, with conflicting decisions pending on appeal or error from the District Courts of our State. In certain sections of Western Nebraska the rights of prior appropriators are wholly ignored and confusion and dissatisfaction exist among many who have staked their all on the promises of protection held out by our present and antecedent statutes. It is hoped that the atmosphere will soon be cleared, and a broad and comprehensive policy—as broad and comprehensive as the statute and our con-

stitution will permit—will be adopted and declared by the expounders of our law.

Irrigation in our State presents a most promising outlook to the man who is ready to be reasonable, diligent, studious and patient. The man who undertakes to irrigate too much land with too little water will always be disappointed. The man who undertakes to irrigate his land with water which rightfully belongs to his neighbor will ultimately come to grief. But he who realizes the value of priority of appropriation, consummated and vested by beneficial application of the water to the soil, and who has the courage to go forward until he has made a success of his undertaking, will not know defeat.

I cannot at this time discuss the various branches and methods, but it has been demonstrated by William A. Sharpnack, of Harlan County, during the past two years that the cultivation of sugar beets by irrigation will yield a net profit of over $90 to $110 per acre per year. This he has demonstrated by two years' cultivation of thirteen acres of land irrigated from a small private plant. A well known farmer in Scotts Bluff County, in 1902, marketed $700 worth of potatoes from two acres of irrigated land. A cattle rancher about forty miles south of Brush, Colorado, produced on a little truck patch containing less than one-half acre, over $129 worth of miscellaneous garden vegetables by irrigation from a windmill plant, the storage reservoir of which did not cost him to exceed $23.

Our people need to learn that on thousands of farms there are opportunities to construct and put into operation small irrigation plants, which would increase the value of farm products over $100 to $300 per year to the farmer putting in such plant, and in the aggregate the increased value of agricultural production in our State would amount to, at a safe estimate, over two million dollars.

Trusting and believing that this meeting will result in reviving interest in this vital subject, I cast the burden of duty upon everyone present and invoke your aid in placing our organization in its rightful place at the head of the procession which is marching steadily to the goal of success.

Following Mr. Wolfenbarger's address, and in the absence of Secretary Oberfelder, of Sidney, J. C. Stevens, of Kearney, was chosen secretary protem. A committee on credentials consisting of Mrs. Nellie M. Richardson of Lincoln, F. G. Hamer of Kearney, and Frank Meagley of Lexington was appointed by the president. This committee made immediate report, which was adopted.

The next order of business was to hold the annual election of officers, which resulted as follows: President, A. G. Wolfenbarger, of Lincoln; vice-president, W. H. Wright, of Scotts Bluff; secretary, H. O. Smith, of Lexington; treasurer, W. H. Fanning, of Crawford. An executive committee in addition to the officers named were Hon. J. S. Hoagland, North Platte; C. G. Crews, Culbertson; Henry E. Lewis, Lincoln, and F. G. Hamer, Kearney. The president gave notice that the standing committee would be announced at a later date.

A committee on resolutions consisting of F. G. Hamer, W. Z. Taylor and O. P. V. Stout was appointed. Pending the report of the committee on resolutions Mr. J. C. Stevens read a paper on the subject of the water supply of Nebraska, which is herewith given in full.

A study of the water supply of Nebraska and of the uses to which this supply has been put leads one to the conclusion that the development of this resource is still in its primitive state.

The lands drained by the North Platte River and its tributaries have undoubtedly received the greatest attention, and from an agricultural point of view has reached the highest state of development of any within the State. But there are yet large areas of arable lands now used only for grazing, and some hardly fit for that, that need only the application of water that yearly goes to waste to make them immensely productive.

This river, rising as it does in the northern part of the main range of the Rocky Mountains in Colorado, and flowing in a northerly course across nearly half the State of Wyoming, thence bending to the east and south, is fed throughout its course by numerous mountain streams, receiving their waters from the melting snows.

Whenever, as in the last two or three years, there is a scarcity of winter snows in the mountains, a like diminution in the flow of this stream is plainly evident. Inspection of diagram published in the Fourth Biennial Report of the State Board of Irrigation shows this at a glance. During the present winter, if reports are true, there has been abundant snows in the mountain regions, so that for the coming summer we may safely predict a large increase in the discharge of the North Platte River.

The next question that presents itself is the conservation of this supply. In the natural course of things, this stream furnishes its greatest amount of water before the crops in the valleys are ready for its application. The greatest floods occur in May and June, when water is in little demand, and there is plenty and to spare for everyone, but in August and early September, when the application of a little water would aid so materially in the maturing of these valuable crops, there is none to be had. What water may reach Nebraska is soon lost in its transition through the sandy river bed. Now, what is needed to equalize this flow and make the supply available when most needed, are impounding reservoirs in eastern Wyoming of sufficient capacity to hold the flood waters of the spring till such times as they are most needed. A calculation of the probable capacity of such a reservoir based on the results of the U. S. G. S. reports of the daily flow of this river for the six years previous to 1901, shows that in order to utilize the entire supply, and make it available when needed, should have a storage capacity of 2,300,000 acre feet, or water enough to cover two entire townships to a uniform depth of 50 feet. Such a single reservoir site does not exist, but a series of sites may be found that may be made available only by the outlay of an immense amount of capital, and this the Federal Government must take in hand in order to insure success.

The South Platte is in many respects similar to the North Platte, except that it goes dry much earlier in the season. The lands contiguous to this stream are capable of excellent cultivation; most of its waters, flood waters and all, however, are appropriated for irrigation purposes in Colorado, so that it is of little value to the Nebraska irrigator.

Similar in many respects to the two Plattes is the Republican River, draining the southern portion of the State, though the period during which the surface flow is extinct is of much shorter duration, and it not infre-

quently happens that water is found throughout most of its course during the entire season. Yet the value of this stream may be greatly increased by storing the flood waters. A measurement of the river at Superior during the flood in July of the past year showed a discharge of nearly 15,000 cubic feet per second, while another in September of the same year gave a discharge of 154. These are the maximum and minimum measurements for 1902.

The streams heretofore mentioned show that during some seasons an infinite ratio exists between the maximum and minimum discharge. But now we come to a river where these conditions do not exist. I refer to the Loup, in which this ratio is sometimes as low as 1½ for the season and seldom reaching above 4. The lowest actual measurement made on this river since continuous records were begun in 1895 was at Columbus in July, 1901, which showed a discharge of 1,211 second feet. The greatest amount similarly found at the same station was on August 10, 1902, giving a discharge of 7,685 cubic feet per second. The ratio of this maximum to minimum for the extremes in eight years is 6.34. The exceptional uniformity in the flow of this river is nicely illustrated in a diagram published in the Fourth Biennial Report of the State Board of Irrigation, entitled "Nebraska and Colorado Streams, Comparative Mean Discharges for Six Years, 1895 to 1900, Inclusive," showing at a glance the means for the six years of the mean daily discharges for the months of April, May, June, July, August, September and October of the Loup at Columbus, North Platte at Camp Clarke, Arkansas at Canon City, and the Cache La Poudre at Fort Collins. The agricultural district in the neighborhood of Greeley, Colo., depending entirely upon the Poudre River for its water supply, has a world-wide reputation. What the possibilities for development along this line in the water-shed of the Loup River, with nearly three and one-half times as much water and a uniformity of flow that is not excelled by any other river in the country, can only be imagined. Extensive surveys have been made for the utilization of the waters of this stream for power purposes, and we are undoubtedly living in a period that will see the construction and operation of some of these plants.

Next in importance I would name the Niobrara River, draining the northwestern part of the State and emptying its waters into the Missouri. The land through which this stream flows is not nearly so well adapted to agricultural purposes as the southern and eastern parts of the State. The country is rough and heavily rolling and the river banks are high, so that although it has a discharge, measured at Valentine, of from 800 to 1,200 cubic feet per second, and is remarkably uniform in its flow, irrigation throughout a large portion of its course is impracticable. It has, however, a heavy fall. Surveys made near its mouth show a fall of over 10 feet to the mile, so that the condition on this river makes it principally valuable for its possibilities in power development.

One who has traveled across Nebraska on the F. E. & M. V. Railroad cannot but be impressed with the beauty and richness of the Elkhorn Valley. Extending on either side to the hills beyond are green fields of corn and smaller grain, broken by patches of shady timber, dotted here and there with villages or farm houses. Through it all winds the cool waters of the Elkhorn River that has brought to this valley its wealth of peace and contentment.

On motion of J. S. Hoagland it was ordered that the papers read before this convention, and particularly the paper read by Mr. Stevens, be printed in the Nebraska Irrigation Annual, and that it be given as wide circulation as possible, because of its interest to the public.

The committee on resolutions submitted the following, which was unanimously adopted:

Whereas, An investigation by experts in charge of the irrigation work of the United States Department of Agriculture has been instituted and is still in progress for the benefit of the water users of the States of Nebraska, Wyoming and Colorado; and

Whereas, The said experts have made arrangements for carrying this work to completion, and we believe that the funds appropriated for this work in former years have been economically expended and with great beneficial results to communities concerned; therefore be it

Resolved, That we respectfully request and urge that when the agricultural appropriation bill is under discussion on the floor of Congress, the recommendations of the secretary of agriculture and the director of the office of experiment stations relative to this investigation be thoroughly indorsed by the honorable representatives of the State of Nebraska in the Senate and in the House of Representatives; and be it further

Resolved, That the secretary of this association be instructed to forward forthwith a copy of this resolution to each member of the Nebraska delegation in Congress.

Resolved, That the right to obtain support from the soil lawfully occupied by him belongs to every citizen of the State as an inherent and natural right, and where such right may not be fully enjoyed without diversion of water from the running streams of the State, and its application to the production of crops, the right to so divert and apply the water exists, and should at all times be so declared and maintained by all legislative and judicial authority.

Whereas, There is no adequate method provided by the district irrigation law of this State whereby an irrigation district may disorganize and settle its business affairs; therefore, be it

Resolved, That the committee on legislation of this association is hereby instructed to prepare and present to the present Legislature a bill providing a just and equitable method whereby an irrigation district may disorganize itself and settle its business affairs.

Whereas, The operation for seven years of the Nebraska law providing for the control and distribution of the waters of the streams used for irrigation has been marked by an especially orderly and progressive advance of the irrigation industry and by an almost complete absence of expensive litigation in regard to water rights; and

Whereas. The operation of this law enables the irrigator to have the priority and extent of his right to the use of water determined practically without expense, in marked contrast to the experience in this respect of irrigators in nearly all other States; and

Whereas, Said law has also permitted the irrigator to rest in the assurance that his rights so determined will be promptly and effectively enforced; and

Whereas, The administration of the law has been characterized by honesty, impartiality, tact and judg-

ment on the part of the officers charged with that duty; therefore, be it

Resolved, That we join in earnest commendation of the wisdom and foresight of the men who framed the Nebraska irrigation law and secured its passage; and be it further

Resolved, That we hereby express our appreciation of the manner in which the said law has been administered by the Nebraska State Board of Irrigation, acting through its representative, the state engineer, secretary and his assistants, at all times and under the administration of the different political parties.

F. G. HAMER, Chairman.

At the afternoon session the president called Mr. F. G. Hamer to the chair. Addresses were made by J. S. Hoagland, W. H. Wright, F. G. Hamer and others and a general discussion of the subject of irrigation, its methods and effects was participated in by a large number of delegates and was of particular interest.

A very interesting and instructive address on the subject of "Drainage as Affecting the Different Alkalies Contained in the Soil and Their Removal by Flooding and Drainage," made by Prof. O. V. P. Stout, whose experience as an expert of the U. S. Department of Agriculture in California, Nebraska and other places particularly qualifies him to speak on this subject, was the feature of the afternoon session.

The selection of a time and place for the next annual irrigation convention was left with the executive committee.

INFANT DAMNATION.

Deacon Johnson—"Does yo' b'liebe in infant damnation, Brudder Jackson?"

Brother Jackson—"Deedy no! Dey'll pick up cuss words 'nough widout bein' swored at by deir parents."—*Puck.*

VICE VERSA.

Here's a late story anent Christian Science. A Boston mother said to her little daughter, "If you had my faith, darling, you would have no toothache."

The child replied, "Well, mother, if you had my toothache you wouldn't have any faith."—*Boston Herald.*

TRAIL SONG.

Here's out on the open trail, my lass,
With a heart for rain or shine.
Here's out to race with wind in the face,
To roam and to rove at the wilding pace
Where the weather thrills like wine.

We'll follow the wind of the way, my lass,
Where it chases a truant stream,
We'll loaf along with a vagrant song,
With the glow of life and all thrilling strong,
And the future a vibrant stream.

For what's a day or a year, my lass,
But time for finding joy?
We've naught to do, we crony two,
With the ship of Worry's crafty crew,
We're free from all annoy.

Then here's a song, a song, my lass,
A song for the open trail!
We're off to seek the crimson streak
That's sunk behind West Mountain's peak,
And to drink from Freedom's grail.

—*Frank Farrington in Lippincott's.*

A PROFESSIONAL IRRIGATIONIST.

We would like to know who appointed George H. Maxwell the dry nurse of all irrigation legislation, says a recent issue of The Oakland, Cal., Tribune. Mr. Maxwell has for years enveloped the subject of irrigation in a cloud of talk, but so far as anybody—that is, anybody not on the inside—is able to discern not a drop of water has yet fallen from these clouds, not a yard of earth has felt any moistening influence from his percolating ambience and eloquence. What's his graft, anyhow? He is the high cock-a-lorum of some association or society or other that is about as misty in personnel as the Kings of the Fourth Egyptian dynasty. But the association or whatever it is has money to spend, and that is what is letting out the slack of Maxwell's jaw.

Who is doing the putting up? And what is the putting up being done for? Maxwell is a lawyer. At least he is an attorney which sometimes means the same thing. He butted into the irrigation question some years ago, and has since been butting into everything that pertained to water and forest legislation, and everything, as well, that was connected with the public domain, from cattle raising to timber. One thing is quite certain. Maxwell is not muddying the irrigation waters for his health. Only we would like to know whose black jack he has got in his pocket.

Maxwell is opposing the Works irrigation bill presented by the California Water and Forest Association on the ground that it will destroy riparian rights. This very clearly indicates that he represents interested parties, for he is not an interested party himself. Proceeding a little further, it is not difficult to reason out that his clients are men who want an irrigation law with a kink in it, a law that will enable them to monopolize the irrigable waters in certain sections. If this is not the joker up Maxwell's sleeve we are mightily mistaken.

The Arabs have a proverb to the effect that he who owns the water also owns the land. Mr. Maxwell didn't get this maxim out of the lawbooks, but he evidently wants to get it into the law books in a form that will allow certain thrifty persons, most likely the members of the aforesaid association, to make a practical application of it for their own benefit.

The question now is not as to the desirability of irrigation; it is a plain question of the economic practicability of a wholesale application of it throughout the arid sections of the West. The most valuable, because the most productive, farm lands in the United States are in those parts of the arid regions where irrigation is practiced; for agriculture by irrigation yields larger crops of nearly all the staples than are produced upon the same acreage in the humid districts and agriculture, even now, is the chief resource of nearly all of the arid states and territories.

The apparent need is that the construction of reservoirs shall be managed by the General Government. That would obviate the chief causes of failure, and would place the individual farmer upon a more secure footing. There must also be an intelligent modification of existing laws respecting both land and water rights, to meet actual needs. Then the prairies will enter with confidence upon a future of limitless achievement. In the arid and humid zones together there will be more than one-quarter of a billion acres of productive farms.

DRAINAGE DEPT.

WISDOM OF PLANNING COMPREHENSIVE DRAINAGE SYSTEMS.*

BY C. G. ELLIOTT.

The commonwealth of Iowa is destined to soon occupy one of the leading places among the prominent agricultural states of our nation. Her location between two of the greatest rivers of our country and the 56,000 square miles of land inclosed by her boundaries, give her a commanding industrial position. Above all, her soil being naturally fertile and especially susceptible to improvement, may be so developed that there is scarcely an acre which may not become a productive factor in the markets of both state and nation. The attractiveness of her lands and confidence in her future agricultural prowess have induced a large number of most excellent citizens from states farther east to locate within her boundaries, much to her advantage in both material and social affairs. The development of her natural resources is of eminent import to each one of her citizens. This convention will consider one of those industries which pertains to her material progress, in so far as it relates to individual business interests. The manufacture of finished products from native clays is an art of notably ancient origin, and one distinguished by great advancement in the methods of work and results obtained since the days of the Pharaohs.

The application of one division of the clay industry to the development of the lands of the state may very properly engage the attention of prominent clay workers here to-day. The number of flourishing factories for the manufacture of drain-tile in the state and the continued addition to the list indicate the active interest which is taken by landowners in this phase of development. Those who are interested financially in this matter enjoy the advantage afforded by the experience of other states in dealing with the various problems connected with drainage. No organization is better qualified to appreciate the needs of the state in this regard, nor in better position to wield an influence in shaping public opinion regarding proper laws and comprehensive work than this association. Every measure may be promulgated and supported by its merits. While manufacturers of tile and implements for drainage may incidentally profit by the advancement of such interests, it may be easily shown by referring to the history of the movements in other states, for a similar purpose, that landowners, citizens and the country at large will receive far greater benefit.

Only one phase of this subject can be alluded to in this brief paper. The people of the state are but just beginning to appreciate the additional productiveness of their soil which may be secured by drainage. The value of comprehensive plans is beginning to force itself upon those who are most fully conversant with the subject. As early as 1883, the writer made plans for the tile drainage of a large farm in Black Hawk County, for Gen. A. C. Fuller, of Illinois. All tile for this work were shipped from central Illinois, which fact may afford some notion of the expense of underdrainage at the time of its inception in Iowa. The outlet for the system was of easy access, but the boundary of the watershed included a much larger area of land than that owned by Mr. Fuller. The work did not include the entire watershed, and in later years complications arose when it was desired to make the drainage of outlying lands more complete. The defining of watershed lines and drainage basins should be one of the first duties of those who desire to undertake such work in a comprehensive and efficient way.

The method pursued under the old laws of Ohio, Indiana and Illinois, of constructing a drain and assessing its cost with reference to its length and land immediately contiguous to it, gave rise to much confusion and to complications which later called attention to the wisdom of recognizing natural watershed boundaries in the consideration of all large drainage operations. Yet this is now often overlooked, and there are drainage districts in Illinois which overlap each other and landowners find themselves under the embarrassing situation of being assessed for work under two or more different organizations. It will be wise for tile manufacturers to inform themselves fully upon drainage questions and to become advisers, as far as their business relations extend in these matters. It is said that an old physician, in giving advice to young practitioners, said: "Never discuss health topics." Perhaps there are manufacturers who follow the sentiment of this counsel. If such is the case it is a mistake. On the ground of personal interest, if no other, manufacturers of drainage requisites may well interest themselves in promulgating sound and far-reaching ideas on a subject upon which their own prosperity as well as the agricultural advancement of the state depends.

It was a memorable occasion in the history of Illinois drainage when Senator Whiting appeared before the tilemakers' convention of that state, asking the assistance of that body in obtaining the passage of a more comprehensive and equitable drainage law. Such enterprises, the value of which had become recognized, were greatly jeopardized by the confusion resulting from adverse decisions of the courts, relating to the existing laws and the individual rights of drainage. The association endorsed the efforts of the Senator and appointed a committee to act with him in urging the passage of the bill then pending. The result was the enactment of the law of 1885, which, as finally amended, constitutes the most practical legislation ever enacted for the development of a state requiring comprehensive drainage systems.

Developments of the drainage practice of Indiana resulted in the passage of the law of 1893, which permitted the substitution of the large drain-tile for open ditches where such was regarded advisable. This was brought about by the active influence of tile manufacturers, so that now the use of tile from 20 to 30 inches in diameter in place of the open channels is not uncommon in that state.

Iowa has the example of states older in the work, from which she may profit without passing through the entire experimental successes and failures from which these practices and laws were derived. When Minnesota realized her need of a law to meet the demands of her growing drainage interests, she evolved one from the Illinois code. When Missouri wished to improve her waste lands in a radical and comprehensive way, she found the Indiana law best suited to her requirements. By taking heed to the lessons learned by others,

*Read before the Iowa Brick and Tile Association, Ames, Jan. 21, 1903.

we may obey the injunction of the old adage, "Cut off your losses and let your profits run on."

But returning to consider the necessity of looking further in drainage matters than the immediate needs of the hour, it may be observed that tile manufacturers should consider the probable demands in the near future for tiles of large size as the development of drainage work proceeds. Reference has been made to the special enactments of Indiana regarding the use of large drain-tile. In a late number of the "Drainage Journal," an engineer, writing from Christian County, Ill., says:

"We have for the past several years been laying large drain-tile for principal outlets upon drainage districts in this locality, using twenty-eight, twenty-seven and twenty-four-inch tile and sewer pipe for the work, and of course maintaining a portion of the old channel to carry away overflow, with adjacent lands fairly well underdrained. One district comprises 2,850 acres, having a twenty-eight-inch tile outlet for a mile, then reducing in size, and with branches radiating therefrom and comprising fourteen and eight-tenths miles of main and principal branches, besides almost hundreds of miles of field branches. The main line has a gradient of but three and two-tenths feet fall per mile. During the unprecedented flood in the first week of July the overflow from the lands continued but thirty hours, and no damage was done to the growing crops. Upon the other systems, most of which have a better gradient, no damage was suffered by reason of the surplus water, and we regard this sort of a system of drainage as being eminently the proper kind. Where tile or sewer pipe will serve the purpose, and the drainage area is not too great, I have of late years used tile upon my drainage work."

Iowa has every condition of land requiring drainage, from the rolling portions which drain themselves into sloughs and draws, to extensive levels, vast swamps and overflowed bottoms. All will be drained in time, because the land is fertile and well worth the labor and expense. Scarcely a condition found elsewhere in the Middle West can not be duplicated here. No more important advice could be rendered to any locality where adequate drainage of land is contemplated than to definitely define and describe the natural boundaries of the areas to be treated and to outline the main drainage which should be provided for them. This is a simple process, but is frequently omitted until a large amount of interior drainage has been executed, and complications of a vexatious and serious nature begin to rise. "There is a tide in the affairs of men, which, taken at the flood, leads on to fortune." Iowa is at that point in the development of her agricultural resources. The manufacturers of drain-tile must seize upon the opening now afforded by the unusual interest which is being shown in this state in the development of her lands. The 290,000,000 bushels of corn produced in the state in the year 1902, though large and satisfactory under present conditions, represents but one-half of what she may produce eight years hence, if her lands are wisely developed and properly cultivated. In accomplishing this, however, a fair amount must be invested in drainage improvements, of an extended and comprehensive character, in which those who furnish the material and execute the work will be materially interested and should be party of the second part in the transaction.

In carrying out this work in a comprehensive way the aid of the engineer should be secured in the beginning of every proposed work. Too frequently this matter is deferred until some serious difficulty is encountered from which he is expected to extricate the landowner, public officer or contractor. The engineer should be a man of good information and experience in his particular line of work. Many who are in other respects accomplished engineers do not have the qualifications for the efficient planning of drainage work. This association would confer a benefit upon the land interests of the state if it would sanction the work of the competent engineer and even go so far as to recommend that drainage work be placed in charge of those who are professionally fitted to direct and advise. This should be done, not for the purpose of adding another expense, but to secure better results in the end at less cost. Tile manufacturers are in a position to do much in the interest of thorough work if they choose. As purchasers of machines often ask the seller about the work they will perform and how they should be set up and operated, so have purchasers of drain-tile, in time past at least, inquired of manufacturers concerning their use, where skillful labor may be secured, and for much other gratuitous information.

Let us turn for a moment from the consideration of matters of conquest, that is, the reclamation and improvement of property, the labor and vexation connected with the work, and the vicissitudes of business in the acquirement of a competency, to the results which may be expected to be enjoyed. No titled owner of estates in foreign countries can appreciate the feelings of the American landowner who, by his own well-directed efforts, has made himself a home, and looks out upon the fruitful fields which are his by title acquired through intelligent labor. He may well forget for the time being the trials only made pleasurable by the thought of future success, and enjoy the afternoon of life surrounded by the amenities of a peaceful home. It is not all of life to overcome the physical difficulties along its pathway. It is not quite enough to know that he has succeeded in a business way. The building up of character, the cultivation of higher sentiments and the commendable discharge of obligations to his associates in business and to his immediate family should in reality be the ultimate end sought. He who, though in the garb of his daily work, can exhibit the higher elements of citizenship and manhood is most worthy the name of a successful man. There are no more inviting fields for the establishment and development of rural homes than may be found in the state whose clay manufacturing interests you represent. Without your work, which is both honorable and remunerative, the state will fail to point off upon the dial of progress these successive periods which characterize our age and define our position among industrial people. Her rural citizens may take a commendable pride in the towers and minarets which adorn her cities, and boast of their part in the direction of the affairs of state, but after all they turn with greatest satisfaction to the acres which they have improved and adorned as their own most valued heritage, and the state's choicest possessions.

WHY?

Tess—"You and Miss Sere don't seem to be good friends. What's the matter?"

Jess—"Why, she remarked that she was twenty-four years old and—"

Tess—"And you doubted it?"

Jess—"Not at all. I merely said, 'Of course, but when?"—*Philadelphia Press.*

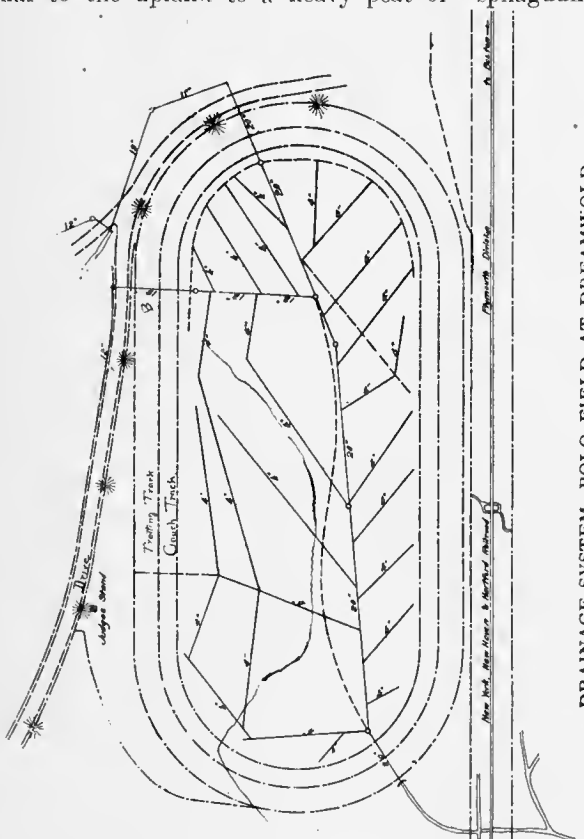
POLO FIELD AT DREAMWOLD.

THE FARM OF THOMAS W. LAWSON CO., SCITUATE, MASS.

The polo field, so called, is the area enclosed by the trotting and coach tracks, and contains about eight and one-third acres, which was originally a swamp, practically impassable except when surface became frozen in winter time. Through the center of this area was a brook, which was the natural outlet for some 200 acres of territory lying to the south and west.

The growth on this swamp varied from bushy scrub growth to heavy wood, and contained many varieties such as white birch, maple, ash and oak, interspersed with alder, dog-wood, wild grape and brier, all together forming the usual typical growth of similar land in the vicinity.

The soil also showed much variation, from the loam usual to the upland to a heavy peat or "sphaguum,"



DRAINAGE SYSTEM—POLO FIELD AT DREAMWOLD.

and varied in depth from six inches to three and one-half feet. The subsoil showed even a greater variation, and within a very small area, sand, gravel, clay and hard-pan, so called, was encountered, all saturated with water supplied by springs, which made the handling of such materials both difficult and expensive. The area between the contour line A B and the track (to the west) on plan accompanying was cut down and the material used in filling the two tracks to grade required, while the remaining area was not changed as to grade, but was stumped and grubbed and roots and rubbish burned and ashes spread.

The fact of this site of the polo field being the natural outlet for surface drainage of area beyond, required provision to be made not only for the field itself but for the additional territory mentioned, and for that purpose a main drain of 20-inch Akron pipe, laid dry and surrounded on sides and top by small stones, was constructed.

From this main drain lateral drains were laid, as exigency required, and wherever possible at an angle to the surface slope of the land.

The brook existing was filled with stone, and connected with the main drain, and the westerly part of the field near the turn of trotting track was ditched and stoned in like manner, thereby cutting off water coming under the track on the original level of the ground. This ditch was connected at intervals with the lateral drains, and thereby with the main drain.

Another drain twelve inches in diameter was laid almost at a right angle to the main and extending underneath the track and driveway, which acted as an outlet for the several catch-basins along the driveway.

At intervals on the main drain, man-holes were constructed of stone and covered with iron covers, set so as to be covered by about six inches of top soil.

The general surface of the polo field was as is usual to swamp areas, practically level in itself, and the fact of being governed by the grade of the outlet at a culvert under the railroad made the available grade for the 20-inch main drain limited, there being but about twenty inches fall in the total length of over 1,100 feet. This same condition governed most of the lateral drains, except where they were laid when surface was cut down, when more fall was available.

Notwithstanding this lack of grade available, coupled with the fact of the water-shed outside of the field being at a much higher elevation, many drains of which were laid at a 5 per cent grade, all meaning a large volume of water in a very short space of time, the main drain has proven of sufficient capacity to take care of, not only the ordinary, but the unusual demands of a heavy storm.

The approximate length of the different-sized drains are as follows:

Main drain (20″) 1,150 feet.
Main drain (12″) 300 feet.
French drains (4″) 4,700 feet.
Stone drains 925 feet.

After the drains were constructed, the surface was graded and laid down to grass, and considering the drouth of the early part of the season, already gives promise of a good turf in the near future.

M. J. O'HEARN, *Contractor.*

A correspondent at Grand Rapids, Wis., says a drainage company has been formed there which proposes to drain the extensive marshes in Wood and Portage counties.

The company has purchased as much of this marsh land as can be obtained, but many owners still hold their marshes, as they desire their wild hay each year, which practically costs them nothing excepting the cutting.

The drainage company intends to make ditches as large as creeks through these marshes and the farmers strongly object to such proceedings.

By the construction of ditches the marshes lose all value for hay-raising and as the farmers have large herds of stock to feed the loss of hay each year will be a large item.

TILE DRAINAGE, ITS BENEFITS.

BY J. ARNETT, C. E.

Kind reader, remember that tile, well burned, semivitritied, will not decay. Remember further, that when such tile are laid to a proper gradient with close joints to exclude silt, the benefits increase with time and the improvement does not deteriorate with age, but grows better and better, doing its work promptly, when work is to do, hot or cold, rain or shine, snow or blow, day or night; it is on duty and *never goes on strike*. A. O. Jones, formerly a tilemaker of Columbus, now of Zanesville, Ohio, showed the writer a piece of tile, brought by him from Italy that had lain in the ground 1,500 years.

For all practical purposes such tile may be regarded as indestructible. Tile should be everywhere large enough to do the work likely to come upon it. The writer believed at the time he as engineer began running county ditches that the tile he was putting in was not large enough. Now he knows that it ought to have been at least as large again. Several things conspired to bring about such work. First, farmers were not educated up to the importance of tile drainage. They knew but little about it and cared less. Second, there were no large tile made then as now. Then 2 inches to 12 inches was the output, the latter size being regarded as *ne plus ultra*. Now we have from 3 to 42 inches, the latter delivering an ocean gush of water when a cloudburst puts it on its muscle. Third, then, the price of tile for like sizes was more than double what it is now and of an inferior quality. The writer, for some 200 rods of the outlet of his first county ditch, paid $2 a rod for foot lengths, 12-inch tile. And such tile! An end-view look at a pile gave you, roughly, the circle, the ellipse, the parabola and other shapes to which mathematics, as yet, have given no name, and all with a greater or less unequal length of sides. So the tile had to be laid rather serpentine in the trench to make passable joints.

The benefits of tile drainage are many. The writer will here enumerate a few. Deeply laid tile, 4 to 6 feet deep (reader, don't bug out your eyes, you are not hurt), will aerate and air slake and make porous and friable a hard pan subsoil and give the roots of the growing crops to forage upon underlying the impoverished superincumbent soil skin in which the rootlets of plants, after stomachs are filled, fairly run riot and play hide and seek. How is this? Water and air are coworkers in plant growth. They cannot both occupy the soil at the same time. Water must precede the air in the soil. See that field of growing corn, the soil fully saturated with water and puddles standing here, there and yonder. Now what? The field is deeply underdrained, 4 to 6 feet deep. Its owner was not afraid of his shadow and believing he was doing a work for all coming time and all expenses in ditching were the same except a little deeper digging and a little more back filling, he went down, yes, he went down to his arms, his chin, the top of his head and if need be so he could barely reach the surface, in places, and laid his tile to a proper gradient. And then what? Tile thus well and deeply laid need no bidding to begin the removal of flood waters, but in gushing streams the superabundant water is borne away. What now? See how rapidly the water subsides with the air at its heels in its wakes armed with its chemical laboratory ready for work on the phosphates, hydrates, sulphates, nitrates, etc., left on the roadside by the water in its retreat.

What more about the air? The soil is deeply drained. The tile is not at work for the reason no work is to do. The superincumbent air is as cold as Greenland. And what of that? Volume for volume it is heavier than the air in the tile and soil and rushing in at the outlet of the drain, forces the warm air in the mains, sub-mains, laterals, sub-laterals, out into the adjacent soil and up through the soil to the cold air above. This particular volume of cold air by the absorption of heat from the tile and adjacent soil, has expanded, occupying greater space with same weight is out-weighed by the outlying cold air and by it in its turn is forced out and up through the soil. Does it end here? Nay, verily. It has made only a beginning. This process of warming air in the tile and soil and then forcing it up through the soil to the surface must go on so long as volume for volume the air in the tile drain and soil is warmer than the outlying air.

See the rush of air, as if forced by bellows into your furnace to supply the draft of a 200-feet flue. The relation between the air in the tile in winter and the outlying air is the same as the air in the 200-feet flue, and the external air when the fire in furnace is aglow. There may be a current of water leached from the soil flowing adown the tile while the cold air rushes in the tile drain above. The rippling water in the tile drain is of the same temperature as that of the ground 4 to 6 feet below the surface, and, good samaritan like, gives off its warmth to the cold air above. This flowing in of cold air at the outfall of a tile drain running less than full of water ever continues so long as the exterior air is colder than the air in the drain and subsoil.

There comes a time, however, when the air in the drain and subsoil is colder than the outside air. Then a reverse order takes place. The superincumbent atmosphere is ever pressing upon the ground surface with a force of 14 pounds to the square inch. This pressure forces warm air into all the interstices of the soil and this warm air gives off its warmth to the soil as it goes down. Thus parting with its heat it becomes colder and heavier and being a fluid and meeting in the soil the least resistance in the direction of the drain, the air, like water, flows thither, enters the drain, and like water, flows down the drain to its outfall where it takes the lowest seat.

Thus in a thoroughly and deeply underdrained soil, the air, a God-given chemist, is always on duty.

A new and revised edition of "The Standard Guide to the City of Mexico and Vicinity" by Robert S. Barrett is announced for publication, February 1, by the Modern Mexico Publishing Company of New York. This will be the third edition of Mr. Barrett's book in three years. It contains a vast amount of practical information for tourists, as well as a very fine collection of views of the Mexican Capital. Mr. Barrett, the compiler of this guide, is a young Georgian, now a resident of the City of Mexico, being correspondent there for several prominent United States newspapers.

CORRESPONDENCE

PERU, IND., February 3, 1903.

THE IRRIGATION AGE AND DRAINAGE JOURNAL, Chicago, Ill.:

Gentlemen—The city of Peru is going to receive bids on a 20-inch tile sewer of 3,000 feet in length, to run all the way from 8 feet to 14 feet deep, at their council meeting on the night of February 24, 1903.

And, as a matter of news to you people, I thought I would inform you of the same. Yours respectfully,

WILLIAM O'HARA, City Clerk.

BLOOMINGTON, ILL., February 2, 1903

THE IRRIGATION AGE AND DRAINAGE JOURNAL, Chicago, Ill.:

Gentlemen—Would you kindly give me the address of some manufacturer of the old-fashioned or new-fashioned "Mole Ditch Machine?"

Find stamped envelope inclosed. Respectfully,

B. M. KUHN.

The mole ditcher was quite commonly used thirty or forty years ago on the prairie farms of Illinois before tile drains were thought of in the West, and at a time when they were found upon but few farms in New York and Ohio. The ditcher as then used consisted of a long beam mounted on shoes, carrying a strong steel cutter upon the end of which was the "mole" of conical shape. The mole was set in the ground at the outlet of the proposed drain, and pulled by a strong cable about 200 feet long by means of a capstan operated by oxen. The mole was forced through the subsoil clay, leaving an underdrain usually about five inches in diameter. The depth of the drain could be regulated somewhat, though usually it followed the surface undulations of the ground at a depth of from twenty-four to thirty inches.

Where the surface grade was proper, and the clay was compact and free from stones and roots, some excellent results were obtained. In some instances the drains made in this way lasted six or eight years, in others they were of short duration. We do not know that the machines are now manufactured. While the mole drain under favorable conditions will serve an excellent purpose it is at best only temporary.

Many tile ditching machines have been placed on the market during the last twenty-five years, and have passed into oblivion. They are of two types; the repeater, which completes the ditch by successive passages over the line until the required depth is reached, and the machine which completes the ditch to grade at one passage over the ground. While the farmer has been partially successful, we do not now know of any upon the market.

The Plumb Steam Ditcher was a machine of the latter type and performed excellent work, but on account of its cost the demand for it was so small that its manufacture was discontinued.

The Buckeye Traction Ditcher has been in use for nine years and more nearly meets the requirements of a tile trenching machine than any that have been in the field. It is operated by steam, is compact and easily handled and completes a perfectly graded ditch at one passage over the line. We understand that this machine is meeting with much favor wherever it has been used, and that the number manufactured has been steadily increasing from year to year.

GANADO, ARIZ., January 25, 1903.

MR. D. H. ANDERSON, ESQ., Chicago, Ill.:

Dear Sir—In June, of last year, an act was passed by Congress and signed by the president, which grants me a title to the land which I now occupy. I suppose you have not forgotten me. If you remember, we have had some correspondence on the subject. The survey has been ordered by the surveyor general. Yet it seems to hang fire on account of no surveyor wishing to take the work at the price offered by the department. I had been waiting to have the lines fixed to write you on the subject of putting in an irrigating plant. I have been reading several irrigation articles in your valuable paper, have come to the conclusion that a gasoline pump would be the best thing for me here. I have also concluded to put in the plant this spring. I am very ignorant of the price of machinery of this kind, and also of the quality of the same. I desire to trouble you, asking you for advice on the subject. I desire to build, or, rather, dig, the well close to the bank of the creek, so that when there is not sufficient water in the well, which I doubt not there will be at any time, I can turn the water of the creek into the well. I will build a house over the engine and well. I would like, if not too expensive, to have a feed grinder, or preferably a mill, that would grind whole wheat and corn for the purpose of meal. That is, what the Indians can use for the purpose of making bread without bolting.

Also, a circular saw attachment for the purpose of cutting wood, and one attachment to turn a grindstone. The water in the creek is sufficient to irrigate over four hundred acres of ground, except in very dry seasons. That is the reason I desire a reservoir, as I can then pump water both winter and summer, and let the Indians use the surplus. I would like to get your advice as to what the flume should be made of. I could make it out of pine trees, that are very handy here, not being over eighteen miles, and I can get the work done very cheaply. It may be possible that there might be some steel flumes made that would be cheaper, and would be equally permanent and substantial. I do not think it would be a good idea to make them out of lumber. I would like to have a plan of a house that would be necessary for the above machinery. The cheapest and best buildings in this country are adobe, with a good stone foundation, and a dirt roof, which prevents all danger of fire.

I would like to have information what the above articles will cost. Such as the gasoline engine, mill for grinding meal, pump, and any other thing that may be necessary for the plant. Would also like to get an estimate of what a steel flume would cost for the 750 feet. My intention is to run the engine day and night as long as the water supply is sufficient. I will pay cash for every article bought. I want to ask your advice as to the best that can be bought, as it will not pay to get anything that will go to pieces in a short time. Also would like to ask the parties that would sell this gasoline engine what they would charge for a man to come out here and set up the plant and put it in running shape.

Dr. W. H. Knap will call on you, and he will give you a description of the land; he has been here and will tell you that it will be the means of selling other engines in this country, if successful. Yours respectfully,

J. L. HUBBELL.

The above letter has been referred to firms of known standing, who will furnish the writer all necessary information.

IRRIGATION AGE, Chicago, Ill.:

Gentlemen—I have just received a copy of your paper, and it purports to treat upon a subject of vital interest to this section of the country. I herewith inclose a draft for $1.00 for one year's subscription.

In your issue of December last, on page 42, you gave a view of a watering wheel for raising water for irrigation purposes. I would like some data upon this subject, if convenient. I have a stream running across my property, which is about twenty feet below its highest point. I wish to raise the water to this point, and for so doing have constructed a dam, forcing the water into a space of about six feet in width, which is now about two feet in depth and flows at the rate of approximately five to six miles an hour. During a large portion of the season this water will be some three or four feet in depth and running at a corresponding rate of speed. I wish to construct a wheel which will deliver water into a flume as before indicated, twenty feet from the present level of the water. Can you give me any data as to the construction of such a wheel and its approximate lifting power in gallons? Yours respectfully,

B. J. MCINTIRE.

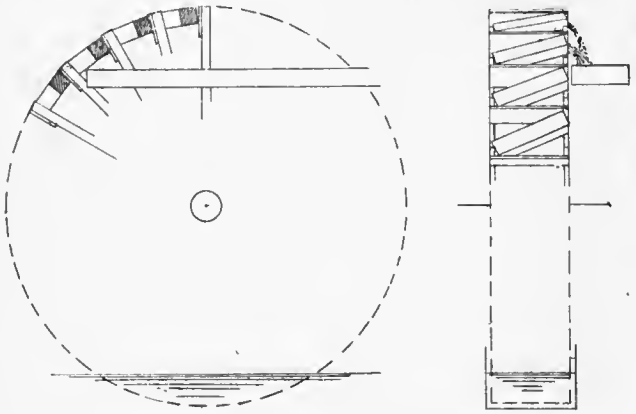
The above inquiry was referred to Clarence T. Johnston, Assistant Chief Irrigation Investigations, and his reply, with illustration, is herewith presented.

CHEYENNE, WYO., January, 31, 1903.

MR. D. H. ANDERSON, 112 Dearborn St., Chicago, Ill.:

Dear Sir—I have your letter of the 27th, with the inclosure from Mr. McIntire. The current described by Mr. McIntire, running two feet deep, which I believe is the minimum, would furnish sufficient power to raise about one cubic foot per second to a height of 20 feet. Figuring on a wheel 26 feet wide, furnished with 24 vanes, the continuous

discharge of practically one cubic foot per second would be procured. The buckets for raising water could be placed, as shown in the sketch, 41 inches apart, five feet long and one foot square on the inside. The wheel would dip two



WATER WHEEL.

feet in the water and extend four feet above the bottom of the trough, which carries it to the ditch. One cubic foot is approximately equal to 7½ gallons, and one cubic foot per second is about 450 gallons per minute.

I return herewith Mr. McIntire's letter. Sincerely,

CLARENCE T. JOHNSTON,
Assistant Chief Irrigation Investigations.

KANSAS CITY, February 4, 1903.

Gentlemen—I think that it was during the latter part of last year that I read in a copy of THE IRRIGATION AGE of issue of that time also, an article regarding rice culture and its profits in either Texas or Louisiana, and previously to that, it may have been in an issue of IRRIGATION AGE of 1901, I notice an amusing method of telling one's age; therefore, if the enclosed 25 cents in stamps is sufficient to send me a copy of both of these issues, postpaid, please forward them to me.

May I trouble in asking you where to buy land that is intended to be irrigated, abutting the main canal, or away from it? Should it be agreeable to you, I would like to know through the columns of THE IRRIGATION AGE, to be answered by anyone, the average number of acres of apple orchard that one man can irrigate and attend to during a season, with and without small crops between rows of apple trees?

Yours truly, C. MYGIND.

Will some of our readers send answers to us covering questions in last paragraph of this letter?

VALUE OF IRRIGATION.

Up to quite recently the general sentiment in the eastern states was antagonistic to the scheme of reclaiming the arid lands of the West by irrigation. They seemed to regard the idea as but a manifestation of the overwrought western brain. But with a better understanding of the subject, irrigation is now more favorably viewed by them. As yet the West has proposed no plan for the future that has anything like the practical value of the reclamation of the desert areas. If results be the criterion, then western railroad building will be dwarfed in comparison. The accomplishment of present designs will contribute incalculably to our national wealth, strength and prestige.

Any one who doubts the value of water as an agent of regeneration in the arid section should look upon the Colorado and Arizona communities that have been benefited by it and be forever rid of his doubts. Not many years ago, Phoenix, in Arizona, was the very heart of a superheated region of desolation, almost as barren of life as the coppery sky above it. But, through irrigation, Phoenix has indeed risen from the fire. That erstwhile baked expanse of sand is now rich with orchards of figs, almonds and citrous fruits and beautiful with long avenues of palms—a new Paradise.

A recent despatch from Washington to the Denver Republican says it may be stated with certainty that the efforts which have been made in the present congress to repeal the various land acts of the country will come to naught.

Bills for this purpose were introduced in the senate and house and referred to the respective public lands committees. The house committee discussed the repeal measure at some length, and informally decided not to make a report upon the repeal bill which had been introduced by Representative Powers of Massachusetts. The senate public lands committee has not considered the repeal bill pending before it, which was introduced by Senator Quarles, and it is not likely to do so. The bill is not known to have a single friend in the committee. Even Senator Quarles, who introduced it, says that he did so by request, and that he has no interest in the measure.

In the meantime there has been considerable alarm on the part of Western citizens lest these repeal measures should be seriously considered by congress, and many letters and petitions have come from all parts of the West protesting against the proposed changes in the land laws.

On the other hand, a large number of stereotyped resolutions and petitions have come to the senate and house from labor organizations in the extreme Eastern and Southern states asking that the land laws be repealed, and "the heritage of the people preserved." The similarity of all of these petitions, and the fact that most of them are in printed circular form, indicates the workings of an organized bureau or lobby which has for its purpose the repeal of the laws under which the West is being settled and developed.

Chairman Lacey of the house public lands committee attributes the unwonted activity and desire on the part of Eastern organizations for the repeal of Western land laws to the agency of George H. Maxwell, who is the representative of the land departments of several transcontinental railways. These companies have large areas of land, acquired through grants of congress, and they find it difficult to sell these holdings while the government is a competitor and offering its land practically free of cost. If the remaining public land can be withdrawn from sale to the public, and can only be acquired through the conditions of the homestead law, those who are seeking to obtain homes and lands in the West will be forced to buy from the railway companies, and the corner thus established in Western land will be greatly to the advantage of these companies.

Much of the literature which now reaches the public, either through the columns of the Eastern press or of the several publications maintained by the railroad lobby, is paid for at much more than space rates by the

railroad companies whose interests it seeks to advance. The general line of attack is to denounce the citizens of the West as land grabbers, or land pirates, and that the lands of the West are being stolen in wholesale quantities by land speculators. These articles lose their weight when it becomes known that their source of inspiration is the land department of a railroad company which wishes to sell its land and put all other owners having lands to sell out of the market.

The Boston Herald of January 23 contains the following report of a meeting of the Commercial Club of that city:

The reclamation of arid lands was discussed at the meeting of the Commercial Club in the new Algonquin Club house last evening, it being the 314th meeting. Professor F. H. Newell, chief engineer of the reclamation service of the government, was the guest and only speaker, his remarks being supplemented by stereopticon views. There were forty-five members present, President Lucius Tuttle occupying the chair.

The dinner over, President Tuttle introduced Professor Newell with one of his famous brief but pertinent talks, declaring that the irrigation of the West is one of the most important matters which have come before the country since the Louisiana purchase.

Professor Newell first called attention to the act of June 17, 1902, and explained that the money to be used in reclaiming the arid lands comes from those states in which the work is to be done. "It is to the direct interests of the commercial and business men of the East," said he, "to build up in the West homes for men who will purchase from the East nearly all of the necessaries of life. Every article used from the cradle to the grave will naturally be bought in the East.

"The government is the owner of the land to be reclaimed, and it owns now over one-half of California, 95 per cent of Nevada and 90 per cent of Arizona. It would be the worst of policies to abandon that land when, by spending a few dollars, it could be made valuable and productive. The barrier to this productiveness is the aridity, and this can be removed by irrigation, and all of the money expended by the government will be returned to its treasury by the states in which it is used."

Among the lantern slides shown were some illustrating the relative rainfall in the different parts of the country, and in comparing the size of the rivers, East and West, the lecturer said that if the Charles River was out in the West it would be nationally known as one of great size. He said that Colorado has the largest area of irrigated land to-day, and the irrigated soil is capable of producing wonderful crops.

The great enterprise having for its purpose the reclamation and settlement of 271,000 acres of land in the Snake River valley, Idaho, was finally and formally launched yesterday afternoon. A strong control in the Twin Falls Land & Water Company passed from the Milner to the Buhl-Kimberley syndicate, so-called, and within the next few hours bids will be sought for the construction of the big dams above the Twin Falls and the more than eighty miles of canals that will supply water to the lands from the Snake river. These canals and the laterals from them through the lands will aggregate something like 1,000 miles in length, and not a stop will be made until the monster undertaking has been rounded out and the beautiful level valley has been peopled with thousands of prosperous and happy inhabitants.

To accomplish all this will require the expenditure of from $1,500,000 to $5,000,000, but with such men as Frank H. Buhl, the multi-millionaire iron operator of Sharon, Pa., and P. L. Kimberley, the wealthy mining operator of the same place, and their associates, as well as Colonel S. B. Milner and others of this city, the chance of failure or delay is believed to be remote.

Since last Monday morning Messrs. Buhl and Walter G. Filer have been going over the details of the undertaking, and yesterday the deal with Col. Milner and his associates, which involved the transfer of considerably more than one-half of the 100,000 shares in the company, was closed and the reorganization of the board of directors took place. F. H. Buhl was made president; Walter G. Filer, vice-president and general manager; M. B. DeLong of Sharon, secretary and treasurer; these, with P. L. Kimberley and S. B. Milner, completing the board.

Manager Filer said he could say little about the details of the undertaking at this time. Bids would be sought at once for the work outlined above, and operations would begin at the earliest possible moment. Things will be made to hum when once he gets them started, and before the year is over a great change will be wrought in the section where the company has decided to build up what they believe will prove to be the greatest commonwealth in the state of Idaho.

Messrs. Buhl and Kimberley both expect to leave for the east again to-day, to return a few weeks later. —*Salt Lake Herald.*

AN IRRIGATION EXHIBIT.

It is pleasing to hear that among the exhibits to be made by the Government at the St. Louis World's Fair is a miniature irrigation system copied after the great Ontario plant in Southern California. The hydrographic bureau of the Geological Survey, which is to produce the exhibit, could not have found a plant which illustrates so strikingly the economical possibilities of irrigation. The Ontario system not only takes all the water from the San Antonio river for irrigation purposes, but it utilizes the water under heavy pressure for generating electricity for lighting and power purposes.

With the announcement of these facts comes an interesting story of the experiences of the Ontario Colony. In the early days of the colony there was thought to be an ample water supply in the mountains to meet all requirements, but with the lessened rainfall of the last few years, and the need of additional acreage, this colony, in common with all Southern California, found it necessary to resort to heroic measures to develop an additional water supply. It was found that there was plenty of water in the earth to be reached by drilling, but pumping from deep wells was expensive, so it was decided to compel the river to furnish the power to pump the wells. It was necessary to conduct water from the river a short distance around the foothills in a ditch to a point where it would have a drop of 700 feet to a power house. The minimum horse power which this fall develops is estimated at 400, while the maximum is 1,200. Even the smaller amount is sufficient to pump all the wells, light the houses and streets of the colony and meet such demands for power as now exist. The fact that the electric plant, as well

as the irrigation system, is owned by the land-owners of the colony, gives to the entire system what is practically public ownership, resulting in the people getting both water and electricity at cost of production. The colonists believe the time is shortly coming when the water users will not only have all operating expenses paid by the sale of electricity, but will actually draw dividends on the water stock on which, until this little feat was accomplished, they had expected to have to meet perpetual assessments.

The subject of irrigation has become one of grave importance to the producers of the western half of the Union, and the great work which is now being prosecuted under Government direction in the arid sections is pregnant with possibilities of good to millions. In the western parts of the great agricultural states of Texas, Kansas, Nebraska and the Dakotas, as well as in the inter-mountain and coast country, scientific information in regard to the possibilities of utilizing the waters which are known to flow in abundance below the earth's surface is being eagerly sought for, and no exhibits that will be made at the World's Fair will command such attention from Western people as such practical illustrations of the science of irrigation.

A recent report from Fort Collins, Colo., says: The financial deals in water were made public here yesterday, the first of local interest and the other involving the entire Rio Grande valley below Wagon Wheel Gap. Former Governor Ben Eaton sold a three-fifths interest in one of his reservoirs on the Cache in la Poudre for $100,000 cash, representing a profit in less than five years of $90,000, aside from the amounts received each year from water, estimated at $100,000 more.

Hay Sayer of Denver was here in the interest of the State Agricultural College regarding the details of a dam which he and Richard Broad intend building on the south fork of the Rio Grande river about 15 miles above Del Norte. The dam will be very small in structure, being located in a narrow canon a short distance above South Fork station, on the Creede branch of the Rio Grande road, below Wagon Wheel Gap. Its cost will probably be less than $5,000, but it will impound a vast amount of water. The site has already been chosen, but the filings in the land office will not be made until some time next week. The estimates of the college people place the value of the dam at a quarter of a million dollars after the selling of water is well under way. The idea is to impound only flood waters, for the appropriations along the stream already exceed the flow by several hundred feet. No accurate survey has yet been made, but the opinion of experts seems to indicate that with a circular dam about 100 feet long and 25 feet high about 200,000,000 cubic feet of water can safely be stored.

The engineering department of the college expressed surprise at the carefully prepared plans made up by Mr. Sayer, who lays no claim to being highly skilled in work of this sort. His idea is to build a semi-circular crib of heavy logs, with the convex side upstream and have the ends abut into heavy piers in the rocky banks. Then by filling the long crib the dam can be made not only very strong, but thick and heavy as well. As soon as the incoming water commissioner is appointed the plans will be laid before him and his consent asked for pushing the work so some of the spring flood water may be impounded.

The announcement of the plan to build the dam will probably cause a rush of locations in the vicinity of the South fork, which drains an enormous area of the San Juan mountains in the Rio Grande country and is in reality the main feeder for the Rio Grande, which is quite a sturdy stream below the junction, especially during the early summer.

The New Mexico Territorial Irrigation Commission has addressed urgent requests to the secretary of the interior for a soil and irrigation survey of the Pueeo and Pecos valleys from the point where the Pecos Valley and Northeastern railroad crosses the Pecos down to the town of Carlsbad.

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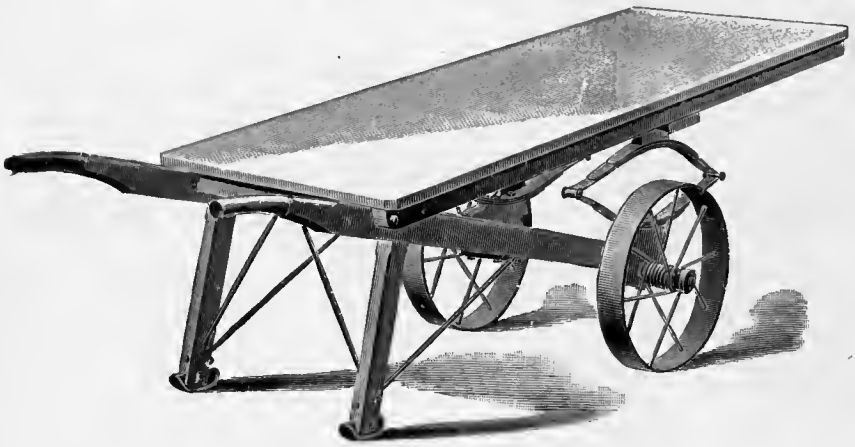

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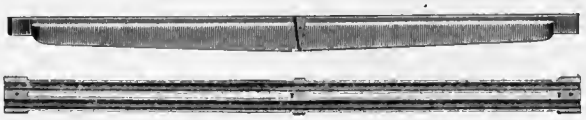

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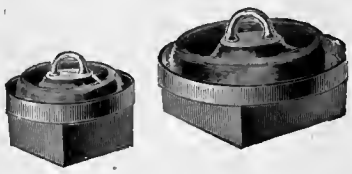

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THE IRRIGATION AGE

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A monthly illustrated magazine recognized throughout the world as the exponent of Irragation and its kindred industries. It is the pioneer journal of its kind in the world, and has no rival in half a continent. It advocates the mineral development and the industrial growth of the West.

EDITORIAL

Self Adjusting Weir. The attention of our readers is called to an article in this issue on a self-adjusting weir, which is well illustrated with pen drawings.

Mr. John Henry Smith. We are showing herewith a half-tone likeness of Mr. John Henry Smith, of Salt Lake City, one of the foremost men of his State, and an active worker in irrigation affairs and development. Mr. Smith is a gentleman of striking appearance, and commands attention as a speaker and diplomat.

G. M. McKinney. THE IRRIGATION AGE is fortunate in securing the co-operation of Mr. G. M. McKinney, of the Southern Pacific Railway, in the preparation of a series of illustrated articles on various irrigation projects along the lines of this company. The first article, to appear in our April issue, will describe an extensive project in California, and will be finely illustrated.

Hon. Angus M. Cannon. Elsewhere in this issue will be found a finely executed photograph of Mr. Angus M. Cannon, of Utah, who has done as much as any one man toward the furtherance of the irrigation industry and the development of irrigation projects in his State.

Mr. Cannon was active as a delegate to the Tenth National Irrigation Congress at Colorado Springs, and labored with the other delegates from Utah to defeat the effort to merge the Irrigation Congress with the Trans-Mississippi Congress.

Irrigation Congress. Do not forget the Eleventh National Irrigation Congress to be held at Ogden, Utah, September 8, 9, 10, 11, 1903, and remember that September is one of the best months of the year to visit that delightful locality. September is a good month for a vacation, anyway, so go and take your family along. You may rest assured that the people of Ogden and Utah generally will extend a royal welcome. Write Hon. Fred J. Kiesel, Ogden, for further particulars.

In Our Drainage Department. In our Drainage Department will be found an article on the Lemonweir Drainage District, Monroe and Juneau counties, Wisconsin. As will be seen by perusal of the article, the usual objections were raised to this undertaking by poorly advised individuals. These objections were finally overcome and thousands of acres of land which was formerly practically valueless have been proven to be capable of producing 100 bushels of oats and 800 bushels of onions to the acre. This is a fair illustration of what intelligent drainage of swamp lands will accomplish, and it is a noteworthy fact that the railway companies whose lines tap large areas of this land have given little or no thought to the possibilities of proper agitation along these lines.

In Wisconsin alone there are, it is safe to say, one million acres of land of this character susceptible of

reclamation, which a few years ago could have been purchased for fifty cents an acre, and is now offered at from one to five dollars per acre, which, with proper drainage, would readily bring from sixty to one hundred dollars per acre. It is our intention to devote considerable space in future issues to this subject as associated with Wisconsin, Michigan, Indiana, Iowa and Minnesota, as well as many of the southern States. Readers who are acquainted with similar conditions in their respective localities are requested to write us, giving full information. The land mentioned in the article is located along the line of the Chicago, Milwaukee & St. Paul Railway.

Modern Irrigation. THE IRRIGATION AGE is glad to note that the publication which succeeds *The Irrigation Era,* now known as *Modern Irrigation,* published at Denver, Colorado, shows healthy signs, and we earnestly wish it all the good that is the due of a cleanly conducted publication. *Modern Irrigation* is published by Mr. George W. Wagner, and the editorial department is in charge of Mr. M. C. Jackson.

It is gratifying to note that this journal takes a flat-footed stand in support of the National Irrigation Congress, and elsewhere in this issue we quote its pleasant comments on Senator J. M. Carey, of Wyoming, and his work for the continuance and separate existence of the National Irrigation Congress.

Running the Government. Judging from printed matter recently issued by Geo. H. Maxwell concerning what he intends to do in the Salt River Valley, Arizona, and a printed slip signed Guy E. Mitchell on the Quarles repeal bill, one would assume that these gentlemen are shaping the affairs of the Interior Department, if not, in fact, running the government. In fairness to the President, Secretary of the Interior and Senator Quarles, these gentlemen should be "called off." But no; a meeting of the National Irrigation Association attended by the two alone would hardly call a halt on themselves.

Correspondence. The publishers of THE IRRIGATION AGE are particularly anxious to publish regularly correspondence from its readers, whether it be in the form of inquiries or experiences along the line of irrigation and drainage study, and for this reason we invite all of our readers to send in inquiries for information, and write us their experiences of both successes and failures, so that our readers may profit by avoiding mistakes made by others, as well as through the adoption of successful methods in actual irrigation experience.

Our readers are urgently requested to send in occasional letters which will prove of value and interest to others.

IRRIGATING PUMPING PLANT.

A. W. CLAPP, C. E

The subject of electric pumping for the purpose of irrigation is one of growing interest in the State of Utah. With the completion of the largest pumping plant in the United States, now under course of construction on the shore of Utah lake at the head of Jordan river, will in part have solved one of the most perplexing questions in irrigation that the several canal companies in and around Salt Lake City have had to contend with for some time.

Utah lake, the largest body of fresh water in the State, covering an area of about 93,000 acres, is located near the center of the State, about thirty miles south of

HON. ANGUS M. CANNON.
Salt Lake City (Father Utah Lake Project).

the capital city, its principal source of supply being the streams flowing from Provo, American Fork and Spanish Fork canyons, together with several smaller streams which flow into it during the spring months. Its only outlet is the Jordan river, which takes its course from the north end of the lake and flows in a northerly direction through Salt Lake City and empties its waters into the Great Salt Lake, the fall of the river for the first ten miles being 2.5′ per mile, while in the next two miles it has a fall of 72′ per mile.

The waters flowing from the lake during the months of June, July and August, irrigation months, are used for irrigation purposes by the farmers of Salt Lake valley. These waters are controlled and distrib-

uted by five large and several small canal companies, one of the largest being owned by the city of Salt Lake, this canal being about thirty miles long and supplying water for irrigation purposes in that city as well as to the original owners of the waters of Parley's Canyon, the waters of which have passed, by exchange, from the farmers to the city.

The several canal companies have, by right of

FOUNDATION CONSTRUCTION.

agreement with the owners of land adjacent to Utah lake, the privilege of raising the waters of the lake to 3' 3½", compromise level, at which point the discharge into the Jordan is about 500 feet per minute, and when 3' below compromise point the flow is about 90 per second. At the present time (October, 1902) the lake is lower than at any time in its known history, as a result of which the discharge is less than 75' per second. This condition is caused by deficiency in precipitation

PUMP RUNNER.

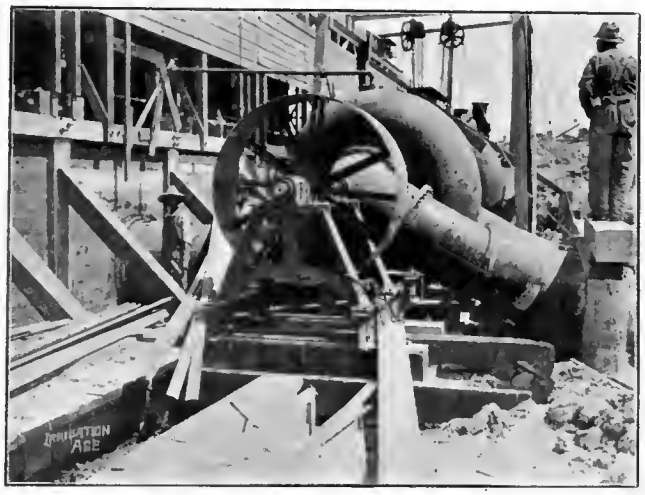
during the past winter, as a result of which none of the canals are able to supply the demands made upon them. Foreseeing this, in July of the present year, and to save several thousand acres of standing grain, three of the canal companies voted to install a pumping plant at the outlet of Utah lake for the purpose of lifting the waters of the lake into the Jordan river and thence into the canals.

This undertaking was placed in charge of F. C. Kelsey, late city engineer of Salt Lake City. Surveys and plans were made and the contracts for the installation of machinery and the building of foundations were given to Gardner & Ingalls, of Lehi, Utah. Buildings to be built by the canal companies.

The plant, when completed, will contain four 40" double suction special low running centrifugal pumps, feed with "Y P" suction of 40" diameter, with a discharge pipe of 48", giving a capacity of 100 cubic feet per second of time for each pump under a 5.5' head. Each pump will be separately driven by a 100 H. P. Westinghouse Type "C" induction motor, running at a speed of 580 revolutions, electric power being furnished at potential of 16,500 volts to the motors through step-down transformers at 440 volts.

The entire plant, when complete, will have a capacity of 400 second feet of water per second; and the guaranteed efficiency of this completed plant from the low tension side of the transformers when lifting 400 second feet of water 5' will be 40 per cent.

What is known as the two upper canals divert waters from the Jordan at a point about eight miles



ONE OF THE PUMPS.

below its outlet from Utah lake; two of the others have their intake 52' below what is known as the upper canals. From this point two miles below is located the Salt Lake City Water & Electric Co., one of the largest power plants in the State, furnishing power for the power plant; the canal companies controlling the pumping plant agreed to furnish to the electric power company, for generating power to operate their plant, one-third of the amount of the water in excess of the natural flow of the river, this water, upon passing through the power plant, part of it discharging into two of the canals 52' below, the balance into the river 72' below. The power company enlarged the Utah & Salt Lake canal from its head to the plant to a sufficient size to carry the water used by the power plant in addition to the regular supply carried by the canal.

The practical success of the pumps is not doubted, and barring the institution of injunction suits, as has been threatened by the owners of land bordering on shallow Utah lake, the beneficial effect of producing a largely increased flow of water the river for the canals ought to be immediate within a few hours from starting to raise the lake waters over the outlet bars. It is feared by the lowering of the lake level to an

abnormal degree by artificial means, as is likely to be objected to by the Utah county people, will necessitate the adoption of conciliatory tactics by bringing a larger flow of water into the lake from new sources, and possibly the continuation of pumping time, so as to supply the cold weather needs of the people along the river, who would be unable to get any water without the constant running of the pumps.

The success of the pumps will be watched with interest by irrigators and those who have favored the plan of straightening the river channel down to the tight dam at the intake of the canals and the dredging of the outlet and river bars as a means of drawing off river water from the lake without pumping. This plan contemplated the storage of more water in the lake at flood time and the contraction of the lake evaporation surface by means of dykes.

While the scheme would cost several hundred thousand dollars, it is claimed by experts that it would afford permanent relief from failure of water supply at less expense at the end than by pumping. If this were done and the city canal made to do its fullest duty on a

PARTLY COMPLETED BUILDING. PUMPS IN FOREGROUND.

higher line, it would be possible to carry into effect the plan of exchanging canal water with owners of Big Cottonwood creek, thereby enlarging an adequate supply of water to be piped into Salt Lake City from this most desirable source.

The city of Salt Lake will pay one-fourth of ten per cent of the cost of the pumping plant to provide for the wear and tear of machinery, the amount thus paid to apply on the purchase price, and will also pay one-fourth of the operating expenses and the interest on the investment, and will receive one-fourth of the water pumped into the Jordan river. The entire cost of plant, when completed, will be about $50,000, costing about $2,000 per month to operate.

Unfortunately, the relief from the pumps will come rather late for this season (1902), but the farmers whose crops have failed to come to maturity on account of the drought, and the municipality of Salt Lake, which depends upon its canal for irrigation supply and water for exchange with owners of Parley's canyon creek, will not fail to appreciate the new pumping plant.

To live nobly in this world one must forgive much, forget much and forbear much.

LAND PIRATES AND CORRUPT POLITICIANS.

Professed Friends, Disguised Enemies of Irrigation

BY ALFRED F. SEARS, C. E.

M. Am. Soc. C. E.—M. Nat. Soc. C. E. of Peru, S. A.—Cor. M. Geographical Soc. Lima, Peru.

Oregon has safely passed the incubating session of its Irrigating convention; it has brought forth a State Irrigating Association.

In the December Age (p. 57) appears an extract from the Spokesman-Review, to the effect that "the election of Devers as President is considered a victory for the adherents of Government Irrigation as against private enterprises under the Carey act," which is a mistake, shown by the resolutions adopted as the result of the convention's deliberations.

The truth is, the instigators of this convention, who organized a "State Association", to be the creature of Maxwell have met a most significant defeat. When the National Irrigation Congress adjourned certain delegates from Oregon met and formed themselves into an "Oregon Irrigation Association", which then and there elected officers and called a State convention. This act, forestalling popular action was un-American, like some others proceeding from that "National" Association. The active spirit in this affair, was one Williamson, Member of Congress elect from the eastern district of Oregon, who has been floated to the top with other froth in the boiling of the political cauldron. His home is in the heart of the arid district of the state, Crook county, containing 4,964,000 acres, sparsely populated, the settlements of 4,000 souls being scattered along the banks of the streams. Of this vast territory, more splendidly fertile and more accessible to irrigation than any other section of our state, less than 56,000 acres are improved in farms, or a trifle over one per cent, while less than 14,000 acres are under irrigation.

All this magnificent empire is roamed over by the sheep and cattle of a corporation of wealthy stockmen, the backers of Williamson, who employ him to prevent the opening up of the region to settlement.

Under the Carey act parties have surveyed and prepared to irrigate, if pending contracts are closed, some 240,000 acres of the land lying in the valley, accessible to the waters of the River Des Chutes. This active spirit of enterprise has roused the resentment of the land pirates, whose guardian angel is Williamson. They behold in the construction of such works the loss of that free pasturage, they have been usurping for the last thirty years till they claim it their's by right of possession.

Through subtle machination, well understood by the cunning politician, this element of hindering wealth succeeded in securing, under Republican protection, the election of its candidate to Congress in our last election. This man, an obscure aspirant, save as he has bobbed to the surface occasionally in our biennial legislatures, had been shrewdly preparing himself for his part, by avoiding all public expression of opinion on the subject of irrigation, and managed things so adroitly, that when Mr. Newell of the Hydrographic Bureau visited his region, he absented himself, although he had received a week's notice of the mission, the importance of which was recognized by every friend of the public welfare, and Mr. Malcolm A. Moody, the M. C., whom Williamson succeeds was with the party. After his nomination by the party, Williamson

started to canvass the district and took with him a staff writer of the Oregonian, the most powerful, able and influential newspaper in all this Northwest region. Mr. Holman's ability as a writer and his high character as a reliable correspondent were valuable reinforcements in the campaign. His first letter, written from Prineville, the capital of Crook county and the candidate's home, told the people that "the people here are opposed to irrigation." The influence behind that statement was apparent. It was well understood that the Oregonian's correspondent had been permitted to meet and talk with only those parties, whom it suited the candidate and his stock-raising supporters to have him meet.

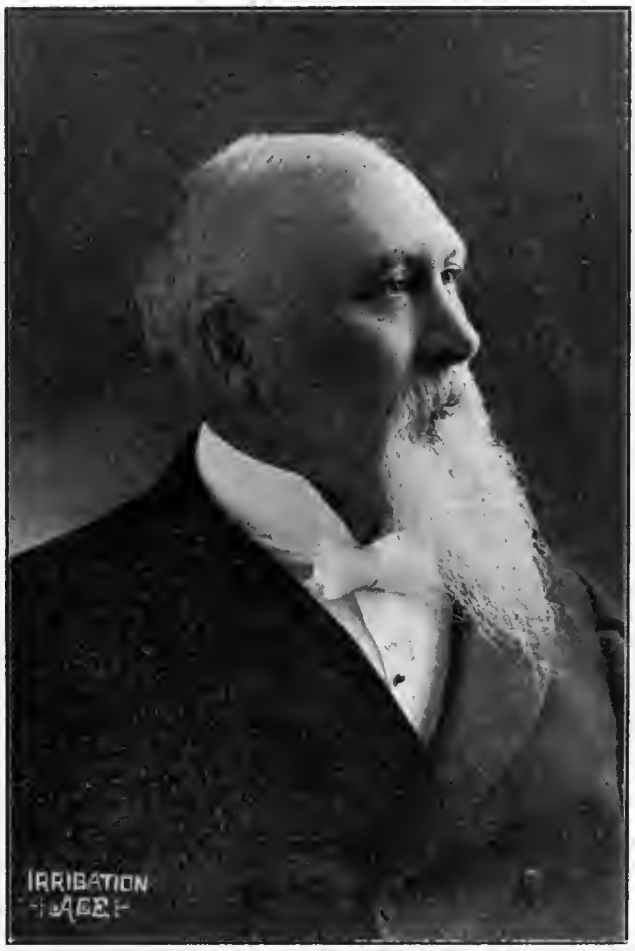
The statement raised a howl as being false representation of opinion; but Williamson was equal to the emergency. He had made a mistake; the people every where wanted irrigation; they must be humored. It would not answer to have their representative appear the enemy of the most popular relief measure yet offered that constituency. No, he did not mean to oppose irrigation; what he meant, was to oppose that dreadful system by which, "under the Carey act, great and greedy corporations could come into their beautiful county and gobble up the land." "Let us have the National system and no other," he cried and the "people" swallowed, while his employers winked at each other and said "he's all right." He now proceeded to advocate vociferously the system of National Irrigation, while he denounced the Carey act, which, as yet, is the only practical system yet offered for that immense area of Crook county. He understood as did his clients, that with Williamson in congress the National Irrigation system would never come to molest the piratical interest of the stock raisers. He will be patriotic and let it go to other counties.

He was the active party in organizing the Oregon Irrigation Association, which has elected Mr. Devers, a delegate to the National Irrigation Congress, its president because he is a citizen of Portland, the commercial center of the state. A public spirited man, who has undeviating faith in Williamson's devotion to irrigation, a subject of which he does not profess knowledge.

It has been one of the frauds practised by men, who are so wrapped up in the National System of Irrigation, to discredit citizens, who favor all other systems, including the Carey system. Especially are the advocates of the Carey act in the valley of the River Des Chutes, made the subjects of their curses. I send The Age a copy of Williamson's speech in the convention, from which may be learned his bitterness towards those who have dared expose his Jesuitical professions. To make it plainer I enclose with it the letter of the present writer to the people of Oregon, dealing with the gentleman's conduct. They are forwarded only to illustrate the difficulties, that honest intention to irrigate land, where stock-raisers have usurped the territory, is forced to encounter in the members of that very legislative body, which has prepared the way for them. And this corruption in the legislator will seek to impede the progress of improvement in home-building all over the arid region. You will discover that in order to kill irrigation by the Carey act, Williamson professes patriotic approval of the National act.

At last, in dispatches to the *Oregonian* of the 18th instant, comes the revelation of the Maxwell scheme, exposed by the Chairman of the Public Lands Committee in Congress, who holds the man up as an attorney of the great railroad corporations and declares that his plan if successful will kill irrigation, it being nothing less than the repeal of all the desert, timber and homestead laws in the interest of his clients. This is the clan of which our new member of congress is a factor. It is however felt by the friends of irrigation, that his defeat in the convention has taught him the folly of pursuing the course he opened for himself in the convention and has intimidated him with the fear of political death.

The truth is, the trick was not understood, when that body met. Williamson came here with 37 del-



MR. JOHN HENRY SMITH, SALT LAKE CITY

egates (claquers) from his county, the representatives of his sheep raising clients, who, with their heels and howls gave acclaim to every word condemning the Carey act or lauding their man, who had promised more than half of them lucrative places in the government service. The ultimate situation was saved by Mr. Ernest Bross, the managing editor of the *Oregonian*, who proposed by motion, that the committee on resolutions should be composed of one member from each county, and thus utterly disconcerted the claquers from Crook, for whom Williamson had already drafted a resolution, making the convention condemn the Carey act. In the language of the *Oregonian*, the resolutions will be seen to be nicely worded. By the diplomacy which they reflect, the convention steered clear of the Scylla of the private irrigation companies and the

Charybdis of the advocates of Government irrigation entirely. The private companies offered a resolution in favor of enterprises under the Carey law. The opposition proposed a resolution radically to the contrary. The resolution committee steered between the two extremes. The following clause of the resolutions of the convention is full of significance:

"Resolved, That the co-operation of the State Land Board and all commercial bodies of the State of Oregon is respectfully requested in this movement for the advancement of the general welfare of the State through the promotion of all irrigation projects. And this association and all of its members pledge their earnest support to any effort that may be made for the reclamation of the arid lands of Oregon."

The reader of the proceedings of this Oregon State convention, will find in every address except Williamson's, a defense of the Carey act and a determination to protect the interests involved in its execution under the State contracts. Speaking for myself, an engineer, commissioned by the State for professional service in devising an important project in the Des Chutes valley, I am certain, that the arid States will reap a greater benefit of settlement and home-building through any and every private enterprise whether it be the Carey act or any other than by a "National" system that can be manipulated by corrupt politicians, who are in Congress "for what there is in it," for themselves.

If irrigation, not simply irrigation schemes, but actual irrigation, come by the way of the National act, every correct citizen will gratefully hail it and do all in his power to extend its blessings. But the sheep and cattle pirates of the ranges will continually obstruct the people's will and be aided by men like Williamson, a thing impossible under the Carey act having State protection, the only home rule wanted in any part of the arid region.

But I predict and warn our rulers, that only by firmly establishing the administration of the National System on the independence of the Geological Survey, in the agricultural or Hydrographic Bureaus, can the National act be made to produce the results for which it was designed.

The Maxwells and the Williamsons must be locked out of the management.

The preceding article from the pen of Col. Alfred F. Sears, of Portland, Oregon, illustrates the danger to be apprehended in the progress of enterprises so necessary to our national growth, from the temptation it offers to the corrupt politician, always ready to avail himself of the public necessity and the popular passion, for his own personal ends.

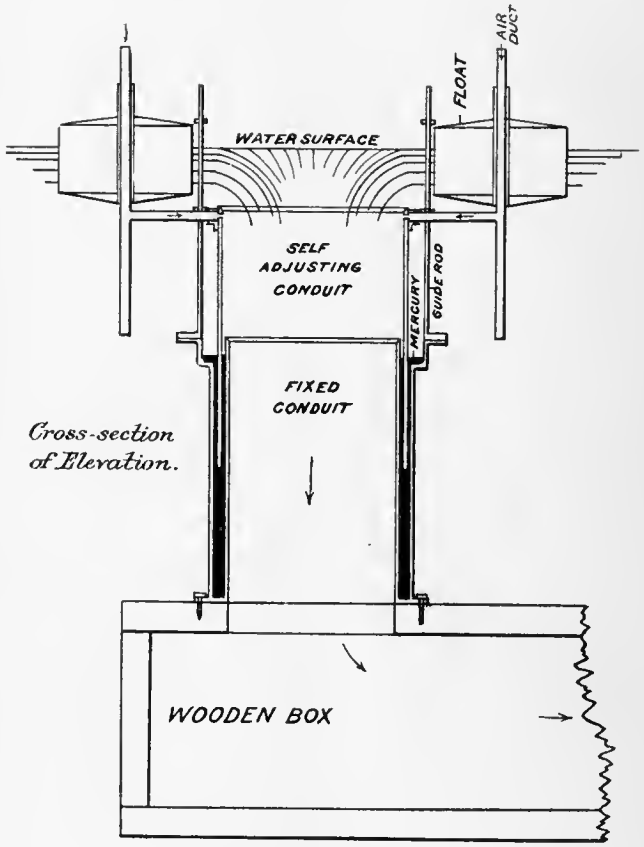
Col. Sears is late assistant general manager of the Mexican Central Railway, was chief engineer of the Atlantic Division of the Costa Rica Transcontinental Railway, Inspector of Railways of the North of the Republic for the government of Peru, chief engineer of the Irrigation Commission for the Department of Piura, Peru, and has held many other position of importance under this and other governments. He is therefore eminently qualified to handle any subject bearing a relation to public works as associated with irrigation.

A man can often improve his manners by dropping some of them.

A SELF ADJUSTING WEIR.

The invention of a self-adjusting weir and headgate will interest all farmers who irrigate land, as well as canal and ditch companies who transport and sell water. Such a machine was recently invented by Mr. C. C. Carlisle, now assistant State engineer of Wyoming. The sweeping claims made for the invention, if supported by field tests of the weir, may cause an abandonment of all the inaccurate, expensive, and unsatisfactory methods of measuring water now in vogue wherever irrigation is practised. The inventor claims for this module that it is:

1. Simple in construction, comparatively inexpensive, easily placed in position, occupies small space, will not leak, and will be durable.



SELF ADJUSTING WEIR AND HEADGATE.

2. Its discharge may be regulated as to volume, will be uniform, and will not be affected by a rise or fall of water in the source of supply.

3. The exact discharge in cubic feet per second or in miner's inches may be read at once upon a simple scale.

4. The module will not need watching and it will do accurate work to its full capacity when a fall of an inch is obtainable.

5. It may be securely locked when set for any desired discharge.

6. Its use makes the common ditch or canal headgate superfluous because diversion and measurement are simultaneous accomplishments; and two expensive machines, the water register and current meter, which require great technical knowledge in their successful

use, will no longer be required in measuring water for irrigation.

7. The size of any module desired will be determined by the maximum discharge required, and each module may be set to discharge any volume between zero and its maximum capacity.

8. It may be established in position by any farmer who can handle a corn-planter or a mowing machine.

For very few water-measuring devices used in irrigation can half of these virtues be claimed, and the

SIMPLE METHOD OF ESTABLISHING SELF-ADJUSTING WEIR IN A DITCH.

most important of them, such as uniformity of discharge, no matter whether the water in the stream or canal rises or falls, and accuracy of discharge with immediate reading of the amount, are not claimed for any other module so far as known. The claims that the machine, which will be made of metal, will be durable, will not leak, needs the assistance of neither dams nor commonly understood head-gates, and may be established by any farmer, are also interesting. The chief value of the machine is centered in the imper-

SELF-ADJUSTING WEIR IN A RICE CANAL.

vious and frictionless mercurial joint which permits the floats supporting the movable conduit to raise or lower the crest of that conduit, which is a circular weir, as the water rises or falls in the canal.

The demand for a device which will measure water accurately and under the varied conditions which obtain along a ditch, canal, or river, is very great and should this invention meet this demand, difference of opinion as to amount of water given and received between farmers and canal owners or between either party and officials dividing water, would be a thing of the past.

TRIBUTE TO CAREY.

To Senator J. M. Carey, of Wyoming, more than to any other single delegate, are the friends of the National Irrigation Congress indebted for the continuance and present existence as a separate, distinctive organization. The surprise that was sprung, the long, labored, eloquent appeals of our United States congressmen, delegates from Utah, the orators from California and Kansas, will long be remembered by those present, in their appeal and endeavor to convince the National Irrigation Congress, when in its late session at Colorado Springs, of the *great importance* and *untold benefits* to be derived by *merging* with another national association entirely foreign to our interests, to drop our name, our identity, and, in fact, to pass out of existence as an irrigation congress. The older, faithful delegates that had followed and attended every Irrigation Congress since its inception, were amazed by the sudden outburst of eloquence, and especially on the last day and at almost the last hour. They were loath to give up that which they had so earnestly worked for and had learned to love—for its broad principles and humanitarian objects—especially, immediately after the magnificent recognition the Congress of the United States had given the principles they were laboring for, so generous and substantial support by passing its National Irrigation Act. We will long remember that at the very moment it seemed the advocates of merging had carried the day, Senator Carey took the floor and eloquently pleaded for hours for rational thought and discussion over the action the Congress was about to take. Finally his earnestness and manly plea appealed to delegates, and the merging was defeated for at least another year, and, from talk after the heat of the discussion was over, we doubt if another attempt will be made next year at Ogden, Utah, to destroy the usefulness and individualism of the National Irrigation Congress.—Modern Irrigation.

The agricultural appropriation bill reported to the national House of Representatives carries an appropriation of only $25,000 for the irrigation investigations now conducted by the Agricultural Department under the direction of Mr. Elwood Mead.

In explanation of this small appropriation the committee said that, while it was believed that the investigation was valuable, the work could be done for a much smaller amount than that appropriated for the current year, which was $65,000.

In this the committee is mistaken, and the bill should be amended in the House to make the appropriation at least what it was for the current year. It looks as if certain influences hostile to this investigation have been at work. The purpose of this opposition is to cripple the investigations of the Department of Agriculture in connection with irrigation in order that as far as possible irrigation work under the direction of the national government may be confined to the Department of the Interior and the Geological Survey. To this the members of Congress should not yield, for there is no need of conflict between the two branches of the government in relation to this matter.

The work of the Department of the Interior is connected with the reclamation of arid land through the construction of ditches and reservoirs, whereas that of the Department of Agriculture is for the purpose of promoting agriculture by irrigation in places where the land has already been reclaimed. The investigation Mr Mead is conducting is below the ditches; that of the Geological Survey is above. Their jurisdictions are entirely distinct, and to promote the interests of one there is no occasion whatever to cripple the other.

Doubtless some members of Congress from States outside the arid region do not appreciate the value of the investigations which the Department of Agriculture is making in connection with irrigation and the methods of applying water to land. If they understood it, they would recognize that, viewed from the standpoint of agriculture, they are but little if any less important than the reclamation of new land now arid.—*Denver Republican.*

A GOOD POND.

The Oklahoma Agricultural Experiment Station bulletin No. 91 contains the following valuable suggestions concerning water storage:

"The winter season may be very profitably spent in building ponds on farms where there is not an abundant natural water supply. A constant supply of water of good quality is essential to success with live stock and there are but few farms on which the present sources of supply could not be improved. Water for household purposes must be obtained from wells, cisterns, or springs. The last are not common and the water from wells is very variable both in quality and in amount. The Oklahoma experiment station at Stillwater has analyzed waters from wells in practically every part of the territory and while they are usually free from organic contamination, a large proportion of them contain too much dissolved mineral matter to make them either palatable or healthful. Cisterns, if properly constructed and looked after, constitute a very desirable source of pure water for drinking and cooking.

Unless there is a natural stream that contains water throughout the year, the source of stock water is either wells or artificial ponds. Where more than a few head of stock are kept and watered from a well, a windmill is almost a necessity and while Oklahoma has the reputation of being a very windy country, there are many days and even weeks at a time when windmills do not turn. If a windmill is depended upon there must be a storage tank of sufficient size to hold a supply for calm periods. Thus the outfit must consist of a well, a pump, windmill, and storage tank if this plan of securing stock water is resorted to. The cost of this will vary from one hundred to three hundred dollars and the outfit requires constant attention to keep it in good working order.

Thousands of ponds have been built as sources of stock water but very few of these ponds have been properly made. Water for any use about the farm should be as clean and pure as it is possible to make it. Pond water at best is not ideal, but the average pond is constructed with every facility for the making of the water of the pond the worst possible. Cattle and hogs stand and wallow in it, then drink of it or refuse to do so and go without water. Then they become sick for some "unaccountable reason" when there was plenty of water in the pond. Too often, the pond gets the drainage of the barnyard, being located solely with reference to proximity and with no regard to the kind of water that will flow into it.

"A pond which is to furnish water for stock should be located so as to receive its water from native prairie hay land; if this is not possible, then from native prairie grass pasture. More water will run off from such land than from cultivated fields, it will be cleaner, and will not carry with it so much sediment that will in time fill the pond. The pond should be fenced so that no animal can get into it and if any fence on the farm is kept in perfect repair, it should be the fence around the pond. A galvanized iron pipe should be laid through the dam at such a point that it will completely drain the pond and the end of the pipe inside of the pond should be staked up out of the mud and be provided with a fine strainer. A cut-off may be placed either inside or just outside of the pond bank and the pipe should be at least a foot below the surface of the soil where it comes out of the bank. Nearly everyone knows how to build a pond bank. The chief cause of leaky ponds is failure to remove the sod where the bank is to be. The sod in time rots and causes leaks. On some sandy soils, the hauling of clay may be desirable but this is seldom necessary.

"Up to this point the cost of construction of the pond, where the ordinary natural advantages exist, will be about the same as digging a well. If the pond is in a pasture, a galvanized iron stock tank with an automatic float valve should be connected with the pipe just below the pond bank. If water is wanted at other places on the farm, it may be piped if sufficient fall can be secured and this should be taken into consideration when locating the pond.

"Such a pond as this, with a capacity of about one million gallons and full of water now, may be seen on the experiment station farm. It is on a hill in the pasture and gets its water from sod land above it. Water is piped to all of the feed lots, including the hog pasture lots, and flows by gravity to the second floor of the barn. As it runs from the faucets, it is as clear as the average well water and it tastes good. The cost of building the pond and of piping the water for about one-third of a mile was about four hundred dollars. Barring unusual accidents, it should cost nothing for repairs and it doesn't cost a cent to operate. It is possible that in time the pipes may become clogged with sediment, the fall being so slight that the water does not go through the pipes with sufficient force to keep them clean. But if taken in time, when first indications of trouble are noticed, and water is forced through with a force pump, the job of cleaning the pipes will be a small one. This will in all probability not occur in several years.

There are few farms where a pond could not be constructed in the same manner and but few cases where so much piping will be required. Ponds built during the early winter have time to settle and the spring rains will fill them and insure a supply of water throughout the summer. But it does not pay to neglect reasonable precautions and the expenditure of a little money in providing good water is economy of the best sort."

IRRIGATION IN INDIA.

In strong contrast with the selfish and ruinous financial policy of the British government in India stands its beneficent and broad-minded program of internal improvement, which compares more than favorably with our Pacific railroads and Panama canal and with Russia's Siberian highway.

In the last forty years, says a writer in the Chicago Inter-Ocean, the British government for India has expended $100,000,000 on irrigation works and as much more on railroads. The railroads, measuring 25,000 miles, extend across the arid regions as well as along the river valleys, and the irrigation canals water 14,000,000 acres of land counted as arid before the construction of the canals. The question as to whether investment in canals and railroads has paid is answered in the Indian commercial reports just published.

It is gleaned from these official reports that the value of the products from the irrigated lands, *in a single year,* exceeds the $100,000,000 expended on canals and other works. The railroads have devel-

oped interior districts which were inaccessible before their construction and have built up some of the greatest cities in the east.

Parallel with this favorable experience in India stands the prediction made in the current report of the division of hydrography of the United States Geological Survey, to this effect:

"The open range of the arid region in the United States is generally stated to be capable of supporting one cow to every twenty acres. The same land, when watered and put in alfalfa, will frequently feed ten cows to every twenty acres; or, in orchards at favorable altitudes, will support a family of three, or even five, persons. The open range may have a value of 50 cents an acre, while under irrigation the selling price may jump to $500 an acre. Thus the values of the lands are directly reversed, the grazing land having the greatest extent and the least value, and the irrigated land the least extent and the greatest value."

The general effect of internal improvements in India, despite the bad influence of an enforced and unwelcome old standard, is strongly shown in the figures which represent the foreign trade of that empire. The commerce of India in 1857 was $72,000,000 in imports and $128,000,000 in exports. In 1902 the imports were $264,000,000 and the exports $392,000,000. India has grown in forty years to be one of the great exporting countries in the world, standing sixth in the list. The increase in commerce, to say nothing of the great increase in internal trade has resulted *mainly from irrigation* and railway building. In Egypt the same system has been carried out by the British, and the revenues of the government and the wealth of the country have been increased tenfold. In Ceylon irrigation works have brought wealth to the agricultural districts.

It is further demonstrated by the official reports that in India the heretofore arid regions have become *more productive under irrigation* than are the lands in the rain belts, where natural moisture is reasonably certain. Yet in India, according to official data, the extreme between heavy rainfall and little or no rain is greater than in any of the arid districts in our Western states or territories. The Nile river in Egypt has been more difficult to control than any of our Western rivers would be, but in India and Egypt public and private capital has found profitable investment in irrigating works.

Based upon the wide importance of the topic—upon its general effects as to railroads and internal commerce—it is needless to add that the forthcoming irrigation report of the geological survey, now in the hands of the printer, will be received with interest and closely perused. It may well point to India and Egypt as examples to follow.

DEEP IRRIGATION.

BY G. M. HAWLEY, EL CAJON.

The object of irrigation is to make available the plant food that the soil may contain, for the benefit of the growing crop. This being established, the next question is the best method of securing these results. There are practically three systems of irrigation in use; the basin system, the furrow system and the subsoil, or deep irrigation system. The first two accomplish practically the same results, leaving the surface wet or saturated and require immediate cultivation as soon as the soil is dry enough to permit, in order to produce a dry earth mulch to prevent evaporation. The advocates of this system assume that the plant food that nourishes the crop is nearly all in the surface soil, and to become available this should be kept moist. While their theory seems good, there are certain qualifying conditions that make the practice bad, and it is not in accordance with facts. Prof. Hilgard assures us that in counter distinction to the east, the California subsoils contain plant food from many feet in depth that can be made available if the roots can be got down there. By making a reservoir of the subsoil instead of the surface, these results can be accomplished and the attended evils of surface irrigation avoided. By surface saturation there is a tremendous evaporation going on until a dry mulch is formed; its tendency is to form an irrigation hard-pan or plow sole just below the cultivated surface. It also brings the feeding roots near the surface necessitating frequent irrigation and incapacitates them to stand the effect of hot, dry winds.

With deep irrigation we make the furrows apart, usually following with a subsoil plow, breaking up the bottom of the furrow and running the water a much longer time in each furrow than by the other method.

My practice for winter irrigation is to make the furrows nearly on a level, so that when we turn in the water there is practically no current and the water goes straight down until it meets a resistant surface, which is the bottom of my soil reservoir, and there begins to spread out and is retained where there will be the least possible chance for evaporation. If your furrow is steep so as to form much of a current or, in other words, if you flush your furrows, there is a sediment that forms on the bottom that prevents perpendicular and promotes horizontal saturation. In land that has a good depth of soil and is filled with water, drainage is very slow, varying with different soils and conditions. With proper cultivation this moisture may be retained in some instances for several years.

To retain winter rains I would cultivate the surface thoroughly and then plow, using no clod crusher or cultivator. This will tend to prevent the baking and assist in perpendicular seepage of water.

In conclusion, deep irrigation tends to educate the roots downward and make them drought-resistant, it prevents in a large measure the formation of an irrigation hard-pan, requiring less frequent irrigation and much less cultivation, and gives much better crop results with the same amount of water. Having practiced this system for over three years, I am confident that it has increased the productive value of my farm over fifty per cent. My raisin crop this year was a hundred per cent larger than last year, and last year's crop was a hundred per cent larger than the year before. My orange crop, the first year I practiced it, averaged five pounds heavier to the packed box than any other crop brought to the packing house. The next year they took the first premium at the San Diego county fair, and have given a large increase in productiveness each year. My attention was first called to this method at a Farmers' Institute, and I believe these institutes have been worth more than they have cost to the horticulturists of Southern California.—*Cal. Cultivator.*

WICHITA FALLS, TEXAS.

A correspondent at Wichita Falls, Texas, has the following to say concerning the possibilities of this growing town. He says in part: This is an ideal town for the employment of the principles of civic pride. A magnificent lake lies near by. Its water is brought by an irrigation canal to the city. It can not be said that the people of Wichita Falls are using as they should the waters of this lake, the best gift of nature, for the adornment of their homes and surroundings. It is true that strangers often see in towns and cities neglected opportunities and advantages. It is true, too, that strangers judge a town and its people by the appearance of their homes and surroundings. The opportunities of Wichita Falls are greater, perhaps, than very many of the towns of Texas. Natural advantages do not always count in the progress of a community, but any town that possesses such advantages is considered fortunate.

The people of this section until very recently have been completely wedded to the one-crop idea. The discussions in The Age of diversified farming and the advantages of irrigation have changed the views of many, and it is believed that the time of 1,000-acre wheat fields is near an end. Instead, many now discuss the advantages of the ten-acre patch under irrigation. The growing of sugar corn, Irish potatoes, melons, onions and vegetables of every kind is not in the experimental stage at Wichita Falls. This was tried last fall by many people in the town, who used from the city waterworks the water from Lake Wichita, with most satisfactory results.

Wichita Falls presents a rich and inviting field for the wide-awake nurseryman. Thousands, yes, tens of thousands of trees and vines should be planted all over the town. The soil is rich and deep, and with sand enough to be most congenial to plant life. The waters of the lake are abundant, and for irrigation are absolutely free of objectionable qualities.

As I look around me here and think of the possibilities of beauty and adornment I can not help but mourn that many are wasting opportunities that the passing of time will render it impossible for them ever to enjoy. Shade trees, green grass and lovely flowers are now within the reach of all, and would transform this city into a place of great beauty. The large courthouse square, with shade trees, well-kept lawns and comfortable seats placed in the shady nooks, would be a most inviting place as the summer sun warms up the town.

The season of fishing is not yet at hand, but the black bass are growing fat in the big lake. The tales of fishing sport are heard about, and the boating pleasures for summer are discussed.

Thousands of ducks and geese have found a winter home upon the lake. Wheat fields extend to the very water's edge, furnishing the necessary food for the ducks and geese.

While the thoughts of home adornment and civic pride are centered in the big irrigation lake, it is looked to as the source from which may be expected much lasting good for the country. It is known that in Colorado, not far away, the truck farmers are growing rich; that the cantaloupe plat, the onion field, the cabbage ground, the berry patch, all produce annually returns of several hundred dollars per acre. The people marvel, why has not irrigation been tried sooner? It has always rained as it does now. There have been annual floods and certain drouths, and truck patches have been withered and scared by the hot July sun ever since the waters of the Wichita flowed within its banks. The thoughtless ones, and the strangers, too, look out on the muddy fields and wonder what all this talk of irrigation is about. The knowing ones go on their way and figure that the season of sunshine and drouth is sure to come again.

It has required a great deal of money to construct the big irrigation dam, more than a mile and a half long, but it has formed a lake more than three miles wide and stretching far back up stream. The dam forms the barrier to the escape of the storm waters of a large section of country, and a lake is made covering more than 2,600 acres of land. Below the lake stretch out the valleys of the Wichita; irrigation ditches conduct the water upon these lands. A great object lesson is being taught. The value of storm waters has been shown, and the proof given that all over Texas, its creeks and rivers carry away and waste in the sea a wealth of water that figures in the millions as an annual loss to the growth of crops.

It is not profitable to despair over what has gone. To the present and the coming generations in Texas there are and will be opportunities as great as those of the past, and not least among the chances, profitable gardening, fruit growing and farming by means of irrigation. With water, work and sunshine, there is no end to the value of the production of land. There is a pleasure in a work that nature gives its rewards in proportion to the labor done. This is true of the irrigation farmer's toil; his hands are full of remunerative work and he is the happiest of all men. The farmer who irrigates is master of the seasons, and can plant and grow his crops at will, fearing nothing except the winter frosts.

The lands under irrigation at Wichita Falls will afford, perhaps, the best place in the State for the practical truck grower and crop diversifier. The railroad facilities for handling crops are first-class, the climate is fine, the seasons are long, and every condition favorable for success exists.

The profits of farming by irrigation are so sure that the farmer feels able to give his children the advantages of a good education. He surrounds his home with green grass, shade and fruit trees; he adorns it with beautiful flowers and provides it with the comforts of life. Home happiness comes to the wife and little ones. Children raised in the midst of such surroundings grow to be strong, intellectual men and women. The day will come, and it is not far distant, when country life and the profit of farming will call, from choice, thousands of the best young men and women from our now overcrowded cities. Diversified crops, intense farming done by labor, not by machinery, and irrigation will do their part.

You may know a man's principles by the things he has an interest in.

The Drainage Journal Department

DRAIN TILE FOR THE DISPOSAL OF HOUSE SEWAGE.

BY C. G ELLIOTT.

Country life with city conveniences is sought for by hundreds of people who, having experienced the artificial atmosphere of the crowded city, long for more freedom, more sunshine and the untainted breezes of the fields. A change from the busy streets and bare walls of the city to the quiet lanes of the suburb or more ample grounds of the country place often imparts new life to the city man, especially if he has a relish for rural affairs. It is not strange that he should attempt to introduce some of the conveniences to which he has been accustomed into his country home. In addition to the vine-covered porches, kitchen garden and ample lawns, he wants the inside water supply and bath conveniences of the city house. The attractive natural surroundings and simplicity of his residence do not lessen his desire for some of the fittings of the more pretentious residence.

Nor is a desire for these things limited to the people who have become accustomed to city sewers and lights. The thrifty farmer who receives his market reports by telephone and his letters at his door, and the country merchant whose tasty residence is an ornament to the village, are fully alive to the comforts which their city cousins enjoy.

As a result of this demand it is not uncommon to see electric lights and waterworks in our unpretentious villages, while their streets are but country roads and their methods of sewage disposal by open vault and cesspool remain unchanged. That serious results from the lack of city sewerage facilities in small towns have not followed is contrary to the prediction of sanitarians. Not that warnings on this score should not receive careful attention from all householders, especially in the older settled towns, but all of the local conditions affecting health are not always grasped by sanitary reformers.

It was frequently predicted by eastern people, when emigration to the level lands of Illinois and Indiana was fast dotting those States with farmhouses and towns, that the country could never be made healthy; that the malaria incident to subduing a country so level would be a permanent inheritance of the people who had been allured to the prairies by the attraction of cheap and fertile farms. The development of the country has shown that these predictions have not come true. On the contrary, it is more often the town which adorns the hillside or is found in some picturesque valley of the more undulating country which heads the record for unhealthfulness. The reason for this is not difficult to find. In order to make the level lands productive in the highest degree, soil-drainage was necessary not only for farms, but for towns. The depressions found upon the surface of the country were but suggestions for the location of artificial channels found necessary for drainage. The better defined streams were deepened and otherwise improved. Interior drainage was provided for the purpose of drying the soil. Towns constructed underdrains along their streets and residents drained their cellars and gardens with drain-tile. Stagnant water in all cases suggested the desirability of more complete drainage. In this way the soil of both country and town became capable of receiving and appropriating a large amount of waste. The open condition of soil produced by underdrainage encourages the work of bacteria which require free air in the soil. These, together with growing vegetation, appropriate much matter in the soil which would otherwise be a menace to health. Drainage water, instead of flowing over the surface, carrying with it such waste as may be found in its course, or sinking into the earth to find its way through unknown underground channels and become concentrated in a few localities, passes directly downward to the floor of the drains and is carried by them to the open stream. This gives more nearly a pure soil, that essential to good health so much emphasized by the Greek sanitarian, Hippocrates, than any other process that can be named.

Many of our most healthy towns are found in level sections of States where the only drainage is that found necessary for agricultural improvements. In point of sanitary merit they lead the list. Briefly stated, the difference is owing to the kind and efficiency of the drainage accomplished. In natural drainage the waste from one residence may be carried and concentrated upon a neighboring situation in a manner which cannot be followed out and prevented until its presence becomes known by its injurious effects.

Col. Geo. E. Waring, a close observer upon the sanitary effects of drainage, writing upon this subject, says: "The agricultural drainage of land in and about towns, and the soil-drainage which is usually effected even where no special provision is made for it by the ordinary works of sewerage, have fully demonstrated the sanitary benefit arising from the removal of stagnant water, or water of saturation from the soil. The earth acts upon foul organic matters much in the same way that charcoal would do, having, though in a less degree, the same sort of capacity for condensing within its pores the oxygen needed to consume the products of organic decomposition. But no soil can do that as long as its spaces are filled with water, and in order to make it an efficient disinfectant it is necessary to withdraw its surplus moisture and thus admit the atmosphere within its pores."

It may be added as a demonstration along this line that Col. Waring employed drain-tile in distributing house sewage by subirrigation, a method of disposal used successfully for farm residences, small factories, and suburban places. In this plan the receptacle for the liquid wastes is a tight tank holding from 100 to 200 gallons, placed under the surface of the ground outside the dwelling, equipped with an automatic siphon which acts when the tank is filled, discharging its contents in about one-half minute into a system of tile drains. The drains are laid as branches to the main which receives the sewage from the tank, their depth being about ten inches and distance apart twelve feet. The plat of ground which receives the contents of the tank should be a back lawn or meadow, with a gentle slope, such as may be provided near any dwelling. The disposal con-

sists of emptying the tank as frequently as once in twenty-four hours, and distributing its contents underneath the surface of the soil periodically (not continuously) so that it will be absorbed and appropriated by growing vegetation. It should be noted, however, that the soil has its limitations in the quantity of material it will care for, and, further, that in time solid matter accumulates in the branch lines of tile which of course have no outlet, requiring that they be taken up, cleaned and relaid. The system serves an excellent purpose, according to reports from localities where it has been used during the last twenty years, and has proved much regarding the sanitary value of a drained soil.

To those who desire the conveniences of city plumbing for country residences, nothing offers a better solution of the disposal problem than the septic tank which is now receiving the careful attention of drainage engineers. It is called by some the biological method of sewage disposal, a high-sounding term, yet one which is possibly more suggestive of the true office of the tank than any other. It claims a place in country sanitation for the reason that it may be put in operation at a small cost, and the effluent may be discharged into ordinary soil drains without fear of any deleterious effects.

The tank should be proportioned in size to the number of persons occupying the house which it is intended to serve. For an ordinary residence it may be circular, four feet in diameter, and seven feet deep, built of brick laid in cement mortar, and made watertight by an inner coat of mortar. It is set flush with the surface of the ground, and made tight at the top with an iron or stone cover. The sewage from the house is brought to it by a pipe laid below the frost line and discharged into the tank through a downward bend. The effluent passes out through a similar pipe placed directly opposite. The action upon the contents of the tank is accomplished by bacteria which are anærobic—that is, they live and work without free air or oxygen. A coat or scum forms upon the surface of the contents of the tank after about a week has elapsed. The bacteria consume a large part of the organic matter and deposit an ash which settles to the bottom. The liquid which flows away is thus deprived of from 50 to 90 per cent of the organic matter, the completeness of action depending somewhat upon the length of time which the sewage is allowed to remain in the tank. The effluent, purified to this extent, may flow off through soil or field drains, where, coming in contact with air, another change takes place, which is accomplished by another kind of bacteria, known as ærobic, or those which require air for their development and growth. Some sludge gathers in the bottom of the tank, which may be removed as necessary, but from reports given of some tanks, the amount of solid matter left is small.

With the aid of tanks of this description for the complete change and disposal of house sewage, the country resident may avail himself of the conveniences of the city house at but a fraction of the cost to him of his city sewer system, and enjoy that freedom of life so conducive to health and congenial to his tastes.

These matters have been but briefly outlined for the purpose of showing the recent developments in sanitary matters and to suggest to the lovers of country life that they need be deprived of but few of the conveniences usually considered the peculiar perquisites of city life. The details of the plans described may properly form the subject of another article.

TRACTION DITCHING.

C. J. VAN BUREN, FINDLAY, OHIO.

The age in which we live is progressive. The same methods that were in vogue even a very few years ago are no longer in accord with the spirit of the times. It matters not what subject is under consideration, the fact holds true.

The subject I wish to discuss this time is traction ditching. There was a time in some localities when it was a comparatively easy matter to get men who were quite expert in the digging of trenches for drainage purposes. This was before the days of the traction ditcher. The same thing holds true of men in the harvest field. Almost any of us can remember when, in any grain growing locality, one could count the men who were experts with the cradle by the score. Greater acreage became a necessity. Hand labor was no longer adequate in this field. So the self-rake made

C. J. VAN BUREN, FINDLAY, OHIO.

its appearance; later the harvester, and then the self-binder, until today a man using a cradle in a harvest field would be so great a curiosity that passers-by would stop and look at him.

Drainage is as yet in its infancy, but even now in some sections the man with the spade is getting to be a curiosity. Hand labor is being superseded by machinery all around us, and yet hand labor seems to be getting scarcer all the time. New fields are constantly being opened up for labor, so that when the demand is lessened for it in one place, there are always new demands created.

But I am getting away from my subject, traction ditching. Drainage by hand can be accomplished only in spring and fall, or in an open winter, while the earth is moist and soft, for at other times the work is entirely too expensive by this method. Here is where the traction ditcher comes to its own.

The machine to be successful for this work must needs be able to cut the trenches while the earth is moist and soft, but also when it is dry and hard. It must be able not only to work when the conditions are fine, that is, comparatively loose earth, but where hard-pan (which, by hand, is impossible to cut, excepting with picks or by blasting) is encountered, which is sometimes strewn with gravel and boulders. It must

also be able to cut its way through wood-lots, as well as through swamp lands.

Given such a machine, the rest is comparatively easy, for, by it, grades can be cut, which, by hand labor would be quite impossible. That is, impossible to keep the cost within proper limit. There are a few things which are done by machinery which it is possible to accomplish by hand, but at a much greater expenditure of time, and time is money.

In these days of fierce competition, the annihilation of time in the performance of any given work is desirable. Hand labor compared with traction ditching is at about the same ratio as is the difference between the cradle and the self-binder. If anything, the difference is more marked in the former than in the latter. Especially so is this the case where there is not much fall. Of course, where the fall is, say, ten per cent, hand labor is much more expeditious than is the case where the fall is only one or a fraction of one per cent. Perhaps I should make my meaning as to per cent more clear. By a ten per cent grade, I mean one foot in ten, or ten foot fall in one hundred feet of length. And a one per cent is one foot fall in one hundred feet of length. But when the fall is only a few inches per mile in length, then the difference between traction ditching and spade ditching is more marked. In traction ditching, one grade can be cut as cheaply as another. The power required in each case is the same. The operating speed in each case is the same, the only differenece being that it requires more care on the part of the operator.

The difference in the cost of cutting drainage ditches by hand labor or by traction power is perhaps not as great as is the cutting of trenches for pipe line work. Last season was perhaps the first time this field was invaded by the traction ditcher to any great extent. In pipe line work in Ohio last season machines were used, which, operated by three men, did easily the work of from 25 to 100 men, according to the size of the machine. There were instances in which one machine cut over one mile of trench per day, by using two crews to operate it, one night and one day. The trenches in this case were from three to three and a half feet in depth.

These pipe lines were not laid out with regard to getting nice soil to work in, for the reason that iron pipe is very expensive, and the trenches were laid out with the paramount idea of making the distance as short as possible from one town to another. In this way machines were working in adverse conditions nearly all the time. Enough machines to complete this work in the specified time could not be secured, and hand labor was employed, in some cases at a cost of $2.00 per day, and even at that price the number of men desired could not be obtained. Cutting ditches by hand is hard, laborious, back-breaking work, and when the demand for labor in other lines, where the duties are not so onerous, is so great, a laborer can hardly be blamed for not wanting to get in the trenches, even though the recompense promised is greater than he can get elsewhere.

A machine propelled by horses is not traction ditching, nor is it, I think, treating fairly man's greatest friend to put him at work which in a very few months will make him old before his time, and fit him for no other place except the boneyard. It is a hard pull all the while, and will break a horse down more quickly than the street car ever did. Bone and sinew cannot compete with iron and steel.

Traction ditching is no longer an innovation. It has come to stay, and has made itself as much of a necessity as has the trolley car, the bicycle and the automobile. And until such time comes as inventive genius shall devise some method more expeditious, the Traction Ditcher will continue making more friends and doing more work as the years roll by.

THE LEMONWEIR DRAINAGE DISTRICT.

The Lemonweir Drainage District comprises some 15,000 acres located in Monroe and Juneau counties, Wisconsin. The district has been before the court over a year, and has met with determined opposition from some of the people affected from a belief that the cost incurred would not be compensated in the advantages obtained. The town of Cutler, in Juneau county, filed a remonstrance against the proposed ditch on the ground that as the outlet of the ditch in the Lemonweir river lies in their town, so much water would be poured on to them as to make it impossible for them to maintain roads and bridges. After a number of hearings and continuations, the Circuit Judge finally overruled all objections and the construction of the ditches was ordered. The judge appointed, as commissioners, Mr. B. C. Dame, of Oakdale; Mr. W. S. Fryer, of Tomah, and Mr. Chris Wagensen, of Camp Douglas.

The soil in the Lemonweir Drainage District may be divided into two classes. Portions of the district are overlaid with peat with a sand and clay subsoil. It is believed that ditches four and six feet deep will drain this land very effectually. Other portions of the district are heavy clay soil, which will require deep ditches and close tile drains to make the drainage a success. It is the intention of the commissioners to furnish an outlet for every land-owner in the district, so that after the mains are constructed each one can drain into the mains in such a way as he thinks best.

Tile drainage is as yet used very little, but is bound to be in great demand as soon as the outlet ditches are constructed. As an example of what tile drainage will do for this land, the case of Mr. B. C. Dame, one of the commissioners, may be cited: Mr. Dame had a field of 100 acres. Most of this was wet swamp, producing only wild hay. He tiled this land, or the wet portion, with three and four inch tile, laid three and four feet deep, and eight rods apart. As a result, Mr. Dame has one of the finest pieces of land in the county, and 100 bushels of oats or 800 bushels of onions per acre is a common yield from this land.

The plans and surveys made call for the construction of about twenty-seven miles of mains and laterals, with a depth of four to eight feet and widths of eight to sixteen feet. Bids will be called for soon and contracts let, so as to begin work the coming spring. Contractors can get further information by addressing any of the commissioners.

THE DYING CALF.

An amateur sportsman had mistaken a calf for a deer, and the calf was breathing its last.

"T-tell mother," gasped the dying martyr, addressing the sympathetic sheep who stood near by, "t-tell mother t-that I died game."—*Chicago Daily News.*

A correspondent at Sterling, Ill., sends in the following information concerning the work of draining the swamp known as the Green river bottom, extending through Lee, Whiteside, Bureau, and Rock Island counties, a distance of fifty miles.

This has been completed and the great pumping station in the Meridocia swamp is now throwing 3,000,000 gallons of water into the Mississippi river every hour, day and night.

The drainage system now completed has reclaimed 200,000 acres of once valueless land, but now worth $75 per acre. The work began fifteen years ago and cost $2,500,000.

This land was redeemed by the digging of large drainage ditches. The size of these ditches ranged from an ordinary small ditch to a ditch the size of a regulation water canal. There are forty-seven of these ditches. They are on the average of five miles apart, and so arranged as to completely drain the entire swamp lands.

The biggest undertaking was the draining of the Meridocia swamps. This swamp lies in the northern part of Rock Island county and the southwestern part of Whiteside and is bounded by the Mississippi on the west. The Mississippi river surface is a few feet above the level of the swamp. To overcome this difficulty a great pump has been installed at the lowest part of the swamp and the water is daily being pumped from the swamp. It is said that the pump is one of the largest of the kind in the world, and hourly throws millions of gallons of water into the Mississippi river. This pump is running night and day, in addition to smaller pumps.

Several of the reclaimed farms have sold as high as $90 an acre. It is considered to be one of the most fertile regions in Illinois and is the great corn belt of the state. New villages have sprung into existence, every village being a corn center. The farmers have become independently rich, and school houses and churches dot the land that formerly was mud and water.

The following is from The Kansas City Journal of recent date:

"A sewer pipe combine is the latest. Yesterday contractors and builders received notices from the makers of sewer pipe in Kansas City that the prices on that commodity would advance 3½ per cent from the present rate, beginning February 1, and that those who wanted to save money would better get their orders in before the first of the approaching month.

"'I have a contract for a big sewer,' observed a sewer contractor at the city hall yesterday, 'but I cannot begin the work before the frost is out of the ground in the spring. I based my bid on the work on the present prices, and this threatened raise will bankrupt me and cause me the loss of a big pot of money.

"'When I received the notice of the advance after February 1, I went to the several sewer pipe makers who have entered into the combine to boost prices, and told them of my fix. The only consolation they would give me was that I could buy the pipe prior to the raise, but this means to me more money than I have at my command to tie up. Their excuse for the advance is that owing to the high price and scarcity of coal and the increase in wages demanded by labor, they have been forced into it.'

"'They didn't say anything about the scarcity of clay, did they?' cheerfully asked a sidewalk contractor, as he looked down upon an accumulation of about three inches of clay on his shoes."

The Isle of Pines, lying south of the Island of Cuba, is supposed to be the original of Stevenson's "Treasure Island." Professor John Finley recently paid a visit to the island which he will describe in the February *Scribner's*. He found there at the present day a man digging for treasures.

TWO BOYS.

(Original.)

BY HARRY H. TRAVERS, WOODSTOCK, WIS.

"Tommy, my boy," said grandpa one day,
"Come here and I'll tell you about
Two little boys I used to know,
Whose names were Merry and Pout.

"They lived side by side in a queer little town
Of the name of Tweedle-tee-dee.
Merry was glad from morning till night,
While Pout was glum as could be.

"Merry was a very good little boy;
He helped his mamma each day;
Carried the water and brought in the wood,
And always was happy and gay.

"Whenever he chanced to have
An apple, or peach, or pear,
He always was sure to give
His sister the largest share.

"Every one who lived on his street
Loved him because he was good;
Because he was kind and cheerful,
And never saucy or rude.

"Now Pout was a different kind of boy,
Quite a different kind was he.
He was always finding fault with things,
With the toast, or the eggs, or the tea.

"The toast was always a trifle too brown,
The tea too weak or stout,
Or the eggs too done; he always found
Something to grumble about.

"He never would share his apple or orange
With his sister so small,
But would say, 'Tis too small to divide,'
And selfishly eat it all.

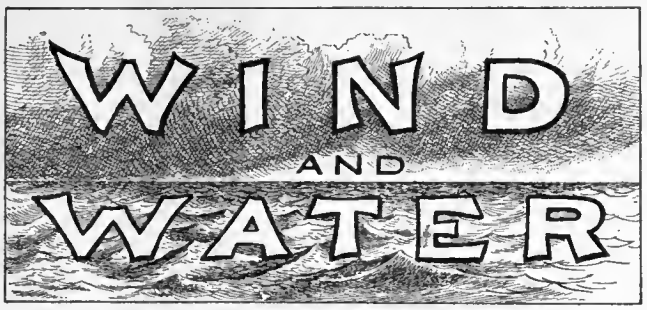
"He liked to idle the days away,
He hated to do a thing;
He would let his mamma bring in the wood
And the water from the spring.

"And no one who lived on his street,
In this town of Tweedle-tee-dee,
Loved this Pout I have told you about,
Such a selfish boy was he.

"Now, Tommy, my lad, of these two boys
I have been telling about,
Which would you rather be—
Happy Merry or grumbling Pout?"

And from wee Tommy, whose golden hair
Clustered about his head,
Quickly the answer came:
"I'd rudder be Merry," he said.

A good deed is never lost. He who sows courtesy reaps friendship, and he who plants kindness gathers love.



Under the heading, "An Expert Investigation," the *Charleston News and Courier* of recent date, has the following:

A paragraph in the *News and Courier* yesterday noted the fact that Mr. Elwood Mead, chief of the Irrigation Investigation Office of the United States Department of Agriculture, and Mr. C. S. Elliott, a drainage expert, had arrived in the city from Washington to investigate the region hereabouts, with a view to the development of the rice industry. Their first move, it was added, would be to take a trip up the Cooper river yesterday to inspect the lands about the headwaters of that stream, which, it is believed, would be rendered much more productive and valuable by a proper system of drainage; and Mr. Mead will also ascertain later whether there is any practicable way to provide the rice plantations with an ample supply of fresh water.

We regard the investigation as of so great importance to Charleston and to this general region of the State that we desire to call especial attention to it, and to suggest that the representatives of the agricultural and other business interests of the region should co-operate with the experts heartily and in every way to enable them to make their work as comprehensive and thorough as it can be made in the time they may have to devote to it. The area which might be improved and employed in rice culture alone is very large, and it does not nearly comprise all the lands that could be redeemed by proper drainage, and made vastly productive for other equally or more valuable crops by such drainage in connection with a modern irrigation system. We do not think it is at all amiss to say that there are thousands of long idle acres between Charleston and the Santee river, without considering those southwest of the city, which could be converted into farms that would rank with the most profitable ones in the county, if only they could be dried and watered as they should be for agricultural purposes. And the cost of putting them in that condition should not be either prohibitive or discouraging. Experience with similar lands in other sections has proved that the whole expense of their redemption has been recovered in the crops of a single year or of a very few years at most; and an increase of a hundred fold in the market value of large tracts immediately following the first steps in their development has not been a rare occurrence. The story of the recent redemption of the marshes of Louisiana and of their sudden advancement to a leading place among the farms of the country reads like a fairy tale, and even more wonderful things have been accomplished on the plains of the more western States by the irrigation of their arid soil.

It is certain that the swamp lands of this region can be drained, and as certain that those which lie about the headwaters of the Cooper and Wando and Ashley, or a large body of them, can be irrigated as well, and in large part by the same system of canals that would drain them. We are not disposed, of course, to try to anticipate the findings of the experts who are now investigating the subject, and shall await their verdict with great interest, but we feel assured beforehand, from information that has been printed in past years, that they cannot fail to be impressed with the favorable conditions of the district between the city and the Santee for both drainage and irrigation purposes.

Our hope is that, while the experts are here, they will be kept well employed in the important work they have undertaken, and will receive all the aid they need to make their investigation thorough and general. They have come into the field very modestly, without any heralding or beating of tom-toms; but, in our opinion, it has been long since this region has received any visitors who were capable of rendering it more valuable service.

A correspondent at Fort Collins, Colo., sends us the following:

"Two financial deals in water have just been made public here, the first of local interest and the other involving the entire Rio Grande valley below Wagon Wheel Gap. Former Governor Ben Eaton sold a three-fifths interest in one of his reservoirs on the Cache la Poudre for $100,000 cash, representing a profit in less than five years of $90,000, aside from the amounts received each year from water, estimated at $100,000 more.

"Hay Sayer of Denver visited the State Agricultural College yesterday regarding the details of a dam which he and Richard Broad intend building on the south fork of the Rio Grande river about fifteen miles below Del Norte. The dam will be very small in structure, being located in a narrow canon a short distance above South Fork station, on the Creede branch of the Rio Grande road, below Wagon Wheel gap. Its cost will probably be less than $5,000, but it will impound a vast amount of water. The site has already been chosen, but the filings in the land office will not be made until some time next week. The estimates of the college people place the value of the dam at $250,000.

"The engineering department of the college expressed surprise at the carefully prepared plans made up by Mr. Sayer, who lays no claim to being highly skilled in work of this sort.

The announcement of the plan to build the dam will probably cause a rush of locations in the vicinity of the south fork, which drains an enormous area of the San Juan mountains in Rio Grande county and is in reality the main feeder for the Rio Grande, which is quite a sturdy stream below the junction, especially during the early summer."

The next great irrigation project under the Carey act will throw open 45,000 acres of rich land in Routt county. After the land is irrigated under this act it may be sold to settlers in lots of any size up to 160 acres, at fifty cents an acre. The proceeds go to the State fund for desert lands. The irrigation company receives its remuneration from the water rates, which must not exceed a yearly charge of $12.50 an acre. The route will be along the Snake river from the middle of the northern part of the county to the Godiva ridge. The main canal will be forty-nine miles long and the first section, twenty-five miles, will be forty-five feet wide at the surface and thirty-five feet at the bottom and five feet deep.

The grade will be 1.32 and the capacity 632 cubic feet a second. The estimated cost is: Right of way, $2,000; dam and headgates, $10,000; fluming, $6,000, and grading, $183,500. Total, $201,500.

The surveying for the flume and power house for the Shoshone Water Power and Irrigation Company will be completed in a week, and plans for this immense work drawn up. Mr. DeRemer, the instigator, says this plant will eventually supply power for irrigation on land immediately above a river or stream. He says nearly all the mesa land between Glenwood and Grand Junction can be watered by means of the power supplied from this plant, at a nominal expense.—*Glenwood (Colo.) Avalanche.*

ONION CULTURE.—Part II.

The following bulletin on Onion Culture has reached us from the New Mexico College of Agriculture at Mesilla Park:

The "new method" of onion culture, which is the growing of onions from plants started in a seed-bed and transplanted to the field, is becoming more popular and is quite extensively practiced in other sections of the country. The operation of transplanting onions is slow, and usually considered an expensive one, and the inexperienced onion-grower is liable to think it is too laborious and not a paying proposition. But as a matter of fact, it is no more expensive than the thinning out and transplanting in the vacant spots of onions started in the field. It is slow work to thin out the small onions and leave in place, at the proper distance in the row, the plants that are to be left without disturbing them. If the onions are quite thick, or have come up in bunches, and if the soil is at all hard or sticky, the thinning is still slower and more expensive. The onions, which are transplanted in the vacant spots in the rows, make the fields look uneven. This is due to the transplanted onions not recovering for some time from the operation, while the plants left intact in the rows continue to grow and consequently their growth is larger. This unevenness of growth, while not a serious drawback, does not occur in a field where all the onions have been transplanted.

As stated in Press Bulletin No. 69, the results of last year's work with onions at the Station show that it was cheaper to transplant from the seed-bed than to thin the onions grown in the field and transplant in the vacant spots. A plat of one-tenth of an acre was transplanted with onions grown in a cold-frame. The rows were 300 feet long by 15 inches wide, with the onions 4 inches apart in the row, making 900 onions to the row or 9,000 to the plat. The onions were irrigated immediately after transplanting. The cost of transplanting this plat of the 9,000 onions amounted to $2.95. This included the cost of the first irrigation, bringing the onions from the cold-frame to the field, and the dropping of them about the proper distance in the row. It was observed that better time could be made by having a man drop the onions a little in advance of the man setting them. At this rate it would cost $29.50 to transplant an acre, or 90,000 onions. The thinning and transplanting in the vacant spots of a similar plat cost $4.10. The estimated cost of thinning an acre would be $41, practically one-fourth more than in the former case.

The distance to plant onions varies, but the most common one (when hand culture is practiced) seems to be from 12 to 15 inches between the rows and from 4 to 4½ in the row. Many of the authorities on onion-growing give 100,000 to 160,000 onions to the acre.

Onions are very expensive to grow, but, as a rule, they are one of the best paying crops. The following is the cost of growing one-tenth of an acre of onions at the Station last year:

Plowing and leveling land	$ .30
Marking and bordering land	.20
Transplanting	2.95
Cultivating and irrigating	2.90
Harvesting, topping and hauling	2.95
Seed	.35
Growing seedlings, or sets, about	1.05
Total cost of plat	$10.70
Estimated cost of one acre	$107.00

This plat produced 1,185 pounds, which was quite low. The low yield was largely due to the crop being set out so late in the season and partially to the hard adobe soil in which the onions grew. It is believed that by starting the crop earlier the yield can be very materially increased, and the cost of production can also be reduced. The onions were sold in the local market at 2⅓ cents per pound. The crop sold for $27.65, which, after deducting the cost of production, gave $16.95 profit. At this price the estimated profit per acre would be $169.50.

—*Fabian Garcia.*

CORRESPONDENCE

7644 Emerald Ave., Chicago, Ill., Feb. 15, 1903.

The Irrigation Age, Chicago, Ill.—

Gentlemen: Below is a short article on surface drainage that you may care to publish; it was written from my personal observation while passing to and fro through the farmers' country of the middle states.

Yours very truly,

C. N. Southup.

SURFACE DRAINAGE.

It should certainly be encouraging to the promoters and upholders of surface drainage to note the rapid advancement that has taken place in that line during the past three years. The farmers of the middle states are at last beginning to realize the necessity and advantages of surface drainage. As my business has carried me through the farmer's territory of the middle states time and time again, I have each year noted with satisfaction the changes that have taken place simply by a few ditches being run in the right places, transforming farms that heretofore had been practically swamps during the winter and spring months into comparatively dry lands.

Chicago, February 6, 1903.

The Irrigation Age, Chicago, Ill.:

Gentlemen—We have an inquiry from Mr. Milton S. Dewey, Mazon, Ill., who asks for information in regard to the manufacturers of tile ditching machinery. We beg you will advise him in regard to this if you have the information at hand. Very truly yours,

Windsor & Kenfield Pub. Co.,
Daniel Royse, Editor.

One can arrive at a better understanding of one's self through an hour of self-disgust than through years of satisfaction.

ODDS AND ENDS

In a recent report Secretary Hitchcock of the Interior Department has the following to say: "The thirteen states and three territories within which reclamation work can be carried on embrace, with the exception of Texas, the largest political divisions of the United States. While it is not possible for any one man to know the topography and hydrography of all these sixteen states and territories, yet in a general way the opportunities for completing works of reclamation have been discovered by the engineers of the division of hydrography. Out of the wealth of localities offering favorable opportunities it is possible to select one or another place with reference to the wishes of the people. Other things being equal, the attempt has been made to consult the desires of the business men, commercial organizations, or public officials who have given most thought to the subject. But in the preliminary surveys and designs the considerations outweighing all others are the practicability of reclaiming the largest area of good land, of dividing this into the greatest number of homesteads upon which families can prosper, and of ultimately returning to the reclamation fund the cost of the works. Neither sentimental theory nor political expediency has had any influence in outlining the work to be performed under the reclamation law. With the corps of men selected solely for experience and efficiency, and with localities chosen to yield the largest results, it is hoped to secure ultimately the confidence and approbation of the people of the entire country and to justify the wisdom of the advocates of national construction of irrigation works."

He further states that immediately upon the passage of the law, as soon as a few of these larger matters had been determined, various tracts of land were temporarily withdrawn for examination and survey. A description of these lands and of the operations will be transmitted to congress in accordance with the law at an early date, showing all of the details of the work now in hand.

The secretary states that the actual work of constructing reservoirs will begin as soon as it can be done with the exercise of caution in successfully completing the important preliminary steps.

While the people of the west are agitating a leasing law and several other foolish things regarding the range, it must not be forgotten that irrigation is after all the salvation of the country. The open range of the arid region is capable of supporting only one cow to every twenty acres, and all the wire fences on earth cannot change this ratio. The same land, when watered and put in alfalfa, will frequently feed ten cows to every twenty acres, or, in orchards at favorable altitudes, will support a family of three or even five persons. The open range may have a value of fifty cents an acre, while under irrigation the selling price may jump to $50 an acre or if in orchards to $500 an acre. Thus the values of the lands are directly reversed—the grazing land having the greatest extent and the least value and the irrigated land the least extent and the greatest value. The progress of the west is so dependent on the amount and the intelligent use of its water supply that we must not overlook the importance of irrigation in all its branches.—*Field and Farm.*

So extensive has become our irrigation system here in Colorado, says *Field and Farm*, of Denver, that over 4,500 ditches and canals are now in operation. One canal—the Fort Lyon—is operated for a distance of 113 miles. There are fifty canals over fifty miles in length and fifty-one canals over twenty miles in length. Over 500 large reservoirs are in operation, ranging in area from 2,000 acres to five acres, and with capacities of from 90,000 acre feet to fifty acre feet. The estimated acreage under ditch is over 4,000,000 and the acreage actually cultivated 2,500,000. It is a well-known fact that irrigation development in the west has been retarded more by lack of settlers than from capital. The money invested in irrigated lands can yield no return unless we have people to settle upon and farm the lands reclaimed, and these people must come as small farmers and home-builders. Heretofore they have been kept away by the high price of land, by mistakes in the management of ditches and by lack of knowledge and prejudice against irrigation which has not been fostered by liberal advertising as might have been done and as has been done in other States with lesser attractions.

IRRIGATION IN SAN SABA.

The dam for the San Saba irrigation system will have an extreme height of fifty feet. At its greatest depth the base will be thirty-seven and one-half feet; its top width will be ten feet; its length at bottom of creey will be 300 feet; length on top, 800 feet. Available storage, 15,000 acre feet of water.

On the main ditch it is intended to construct two other storage reservoirs, one of 5,000 acre feet and one of 6,000 acre feet, to be held by earthen dams. The main ditch will be fifty-seven miles long. At the head the bottom will be fourteen feet; slopes of sides, two horizontal to one vertical; depth of water in ditch at maximum flow, six feet. As laterals are taken out the main will be reduced until the lower section will have a bottom width of but five feet, with a depth of only two and one-half feet.

There will be 150 miles of laterals and sub-laterals from six feet bottom width down to one and one-half feet, and a depth of from three feet of water down to six inches.—*San Saba County (Texas) News.*

Among the great irrigation failures of the far west are three canals in the Pocatello country of Idaho, known as Idaho Falls, the Idaho and the Reservation canals. After having gone through the customary litigation they were sold the other day to a reorganized corporation for $100,000. The property, which has been in the hands of a receiver for the past year, was bid in by the Idaho Canal and Improvement Company, a corporation recently organized by J. H. Brady of Pocatello, which is the headquarters of the new concern. It is the intention of the new company to give the system a complete overhauling, and extend the canal, which will be an event of great importance, opening thousands of acres of rich agricultural land.

Some of the sugar-beet growers of the Arkansas valley have been surprised by receiving notice from the American Beet Sugar Company cutting their contracts

down to one acre each for this year. No explanation of the reduction is given, but it is supposed the company is unable to handle the acreage now raised at its one factory and does not care to erect another at this time. Some of those cut down have been among the most successful growers in past years, and they are wondering why they should have been sidetracked in this peculiar manner, but will manage to employ their lands in producing other and possibly more profitable crops.—*Exchange.*

FARMING IN COLORADO, UTAH AND NEW MEXICO.

The farmer who contemplates changing his location should look well into the subject of irrigation. Before making a trip of investigation there is no better way to secure advance information than by writing to those most interested in the settlement of unoccupied lands. Several publications, giving valuable information in regard to the agricultural, horticultural and live stock interests of this great western section have been prepared by the Denver & Rio Grande and the Rio Grande Western, which should be in the hands of all who desire to become acquainted with the merits of the various localities. Write S. K. Hooper, G. P. & T. A., Denver, Colo.

"THREE WISHES."

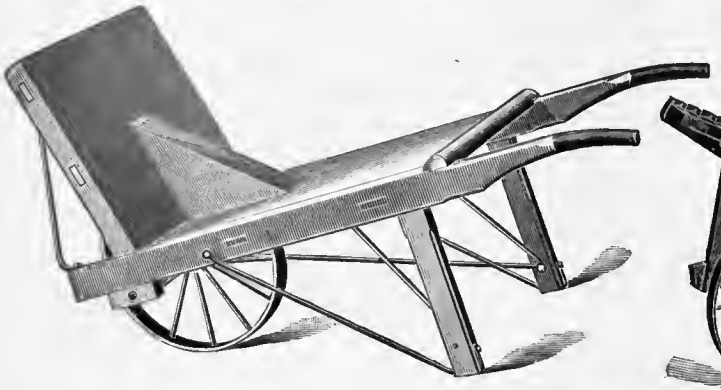
It was down at the orphan asylum one day
That three little maids sat 'round the fire,
Each telling the thing she wished for most
If she could have her heart's desire.

"I'd like a pony as white as snow."
Said Maud, "and I'd ride it each day, of course;
And the people would stop as I rode along
And say, 'Look at that child on a snow-white horse.'"

Said Alice, "I'd like to own a ship,
And I'd sail clear 'round the world, I guess,
And bring back a present for all the girls,
And a beautiful crutch for dear little Bess."

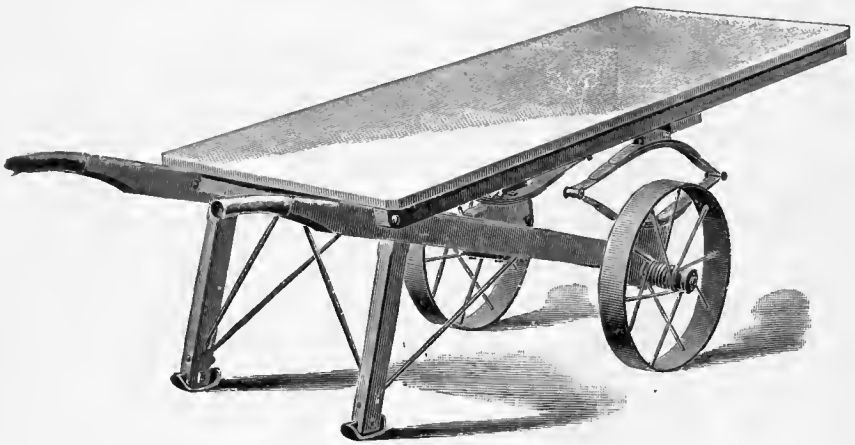
Then lame little Bess, with her gentle voice,
Said, looking 'round from one to the other,
"I'll wish for the loveliest thing in the world—
That every one of us might have a mother."

SUPPLIES for Brick, Tile and Sewer Pipe Manufacturers

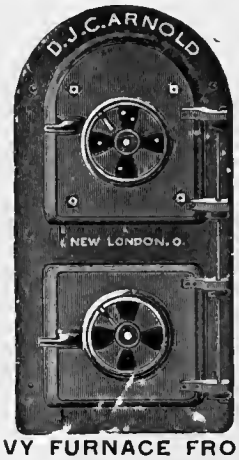


TILE BARROW

SEWER PIPE BARROW



TILE TRUCK



HEAVY FURNACE FRONT

These Trucks and Barrows are made of first-class material, and the workmanship is the best. Special trucks and barrows to suit customers, made to order. Prices quoted on receipt of specifications.

BAND TIGHTENERS AND DOOR CONNECTORS

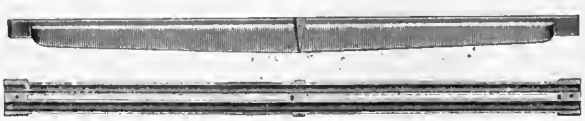
CLASS B

CLASS C

TUPPER STYLE GRATE

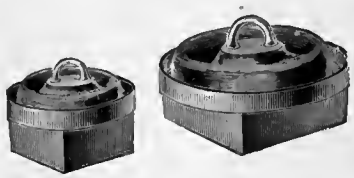
Sections 6 inches wide. 36, 42, and 48 inches long

STRAIGHT GRATES



Any length. Sections 3 inches to 3½ inches wide. Weight average about 1 pound per inch in length.

CAST IRON KILN COVERS



VENTILATORS

We also make Kiln Bands complete with sections cut to length and rivet holes punched. Rivets furnished and tighteners riveted on to end sections. Prices quoted for anything in this line upon application.

Address **The Arnold-Creager Co.**

NEW LONDON, OHIO **or Cor. 6th and Vine Sts., Cincinnati, Ohio**

A WONDERFUL OFFER.

YOU, Every Member of Your Family and All Your Friends Are Personally Interested. . . .

IRRIGATION AGE Delivered to You for One Year,

The New York Magazine of Mysteries Delivered to You for One Year,

AN ASTROLOGICAL DELINEATION OF YOUR LIFE
By ZAMAEL, The Greatest Living Astrological Seer,

ALL ONLY $1.50

WERE YOU BORN

Between December 23d and January 20th, included? If so, you were born in Capricorn. You are high-minded and self-confident; lover of the beautiful; love literature and science; public-spirited; independent and a natural leader; executive and aspiring. You are liable to become blue and depressed. Read carefully this advertisement and see how you can get your horoscope cast by the world's greatest astrologer, Zamael.

WERE YOU BORN

Between January 21st and February 19th, included? If so, you were born in Aquarius. You are a good judge of human nature; are fitted to deal with the public; are conservative; are fond of public entertainments; are a good companion; are practical; Zamael, the Great Seer, in your horoscope will show you how to achieve great success. You are inclined to be nervous, and have gloomy forebodings. It is absolutely necessary that you should have your horoscope. This advertisement tells you how you can get it.

WERE YOU BORN

Between February 20th and March 21st, included? If so, you were born in Pisces. You are sensible and thoughtful; anxious to gain knowledge; have mechanical ability; are positive in your opinions; when determined are successful. You can become very successful if you will follow the advice that Zamael will give you in your horoscope. Wealth, health and happiness come to all Pisces people when they listen to the Mystic Astrologers. Send $1.50 for our paper for one year, a year's subscription to *The Magazine of Mysteries* and an astrological delineation of your life.

WERE YOU BORN

Between March 22d and April 20th, included? If so, you were born in Aries. You are earnest and sincere; full of life and activity; can do wonderful things if you study occult and psychic forces. The horoscope that Zamael will prepare for you can help you in a wonderful way. We are offering in this advertisement to have this world-famous astrologer prepare a horoscope for you, send you our paper for one year and *The Magazine of Mysteries* one year, all for $1.50.

NOW READ CAREFULLY.

Our great offer to you is to send you our paper for one year, *The Magazine of Mysteries* for twelve months, and give you an Astrological Delineation of your life, all for $1.50. This is certainly a tremendously liberal proposition, as our paper alone would cost you $1.00 for that length of time, the year's subscription to *The Magazine of Mysteries* (that wonderful magazine teaching Health, Wealth and Happiness) costs $1.00, and an Astrological Delineation varies in cost from $1.00 to $25.00, according to the reputation and ability of the astrologer. The horoscopes which we offer you are prepared by Zamael, one of the world's greatest living astrologers.

ASTROLOGY IS AN EXACT SCIENCE. It is the science that shows the young man or the young woman in what trade, occupation or profession they will best succeed. It points out the way for the parents to educate their children and develop their natural capabilities. It keeps the old and young from making mistakes, and protects all against disease. Every living human being should have their horoscope cast by a reliable astrologer. In the horoscope which Zamael will prepare for you, he will give your natural tendencies and indicate what you should do to make life a success and to guard against disease.

If you are now taking our paper and have paid for any time in advance, we will extend your subscription for one year and will also see that your subscription to that wonderful and interesting publication, the New York *Magazine of Mysteries*, is started immediately, and that your Astrological Delineation will reach you without delay. Be careful to give the exact date of your birth, mentioning the year and month and place of your birth.

THE MAGAZINE OF MYSTERIES is the most wonderfully interesting monthly magazine of the Twentieth Century. It is entirely new and is the only publication of its kind in the world. It gives to all the knowledge of Perfect Health, Happiness and the Secret of Prosperity. Address

Subscription Dept., Irrigation Age, Chicago, Ill.

THE IRRIGATION AGE.

CHICAGO, ILL.

Gentlemen:—I herewith accept your Great Offer, and enclose you $1.50 to pay for your paper one year, the New York MAGAZINE OF MYSTERIES for one year and an Astrological Delineation of my life by the world-famous astrologer, Zamael.

Yours truly,

Name_____

Address_____

Be sure to fill out these blanks for the benefit of the Astrologer:

PLACE OF BIRTH_____

DATE OF BIRTH, YEAR_____ MONTH_____

DATE OF MONTH_____

WERE YOU BORN

Between November 23d and December 22d, included? If so, you were born in Sagittarius. You are earnest, honest, frank, jovial, fearless, combative, generous, friendly; very sympathetic and outspoken; you detest deception; are quick-tempered and impulsive. Be careful to curb your anger. You are often misunderstood. The astrological delineation that we offer you in this advertisement will help you, and will point the way to success and fortune. Send $1.50 for our paper for one year, *The Magazine of Mysteries* one year, and have your fortune told by Zamael.

WERE YOU BORN

Between October 24th and November 22d, included? If so, you were born in Scorpio. You have great vital forces; capable of endurance; have magnetic and hypnotic powers which ought to be developed in a scientific way. The most helpful men and women come out of this sign, and the world should rejoice every time a Scorpio person is born. The astrological delineation that we are offering in this advertisement will be of untold value to you.

WERE YOU BORN

Between September 24th and October 23d, included? If so, you were born in Libra. You are modest and retiring; your inner nature is receptive, intuitional, sensitive and poetical; you are naturally persistent and competent; your foresight and judgment are excellent; and you can win success if you follow closely the advice given by Zamael, in the astrological delineation that we offer in this advertisement.

WERE YOU BORN

Between August 24th and September 23d, included? If so, you were born in Virgo. You have a cool, calm, confident bearing; you ought to be very successful, as you can excel in anything you undertake. You have everything to live for and can have prosperity and happiness by following strictly the advice of Zamael in the horoscope we offer to give you in this advertisement. Send us $1.50 to-day. It will pay you to do so.

WERE YOU BORN

Between April 21st and May 21st, included? If so, you were born in Taurus. You live in the realm of sensations and emotions too much; very fond of good living; can acquire great wealth if you go about it right. Zamael tells you how to become fortunate and happy. Learn how to get great occult powers. Send $1.50 immediately and get our paper for one year, *The Magazine of Mysteries* for one year, and your horoscope cast by the great astrologer, Zamael.

WERE YOU BORN

Between May 22d and June 21st, included? If so, you were born in Gemini. You have a vivacious, restless and anxious nature; intensely aspiring and energetic; suffer much at times because you do not know how to use your wonderful occult powers. Mysticism is your realm. The full astrological delineation prepared by the astrologer, Zamael, will show you how to command the unseen forces which will bring to you health and happiness.

WERE YOU BORN

Between June 22d and July 23d, included? If so, you were born in sign of Cancer. You have a sympathetic and emotional love nature; are model housewives or husbands; love home and family; can amass fortune and be very happy if you will give attention to psychic and occult powers. The full astrological delineation that we give, as per this advertisement, will give you the mystic way of having fortune and health.

WERE YOU BORN

Between July 24th and August 23d, included? If so, you were born in Leo. You are jovial, sympathetic, free and friendly, kind and loving. Be careful and guard against selfishness. Your will power is very strong, and the horoscope prepared by the famous Zamael will show you how to develop and apply it properly. Read this advertisement and take advantage of this grand opportunity to get an astrological delineation of your life.

THE IRRIGATION AGE

VOL. XVIII. CHICAGO, APRIL, 1903. NO. 6.

THE IRRIGATION AGE

THE D. H. ANDERSON PUBLISHING CO.,
PUBLISHERS,
112 Dearborn Street, - - CHICAGO

Entered at the Postoffice at Chicago, Ill., as Second-Class Matter.

D. H. ANDERSON, Editor.

SUBSCRIPTION PRICE.

To United States Subscribers, Postage Paid, ... $1.00
To Canada and Mexico, ... 1.00
All Other Foreign Countries, ... 1.50

In forwarding remittances please do not send checks on local banks. Send either postoffice or express money order or Chicago or New York draft.

A monthly illustrated magazine recognized throughout the world as the exponent of Irragation and its kindred industries. It is the pioneer journal of its kind in the world, and has no rival in half a continent. It advocates the mineral development and the industrial growth of the West.

EDITORIAL

Read. Read article in this issue on Influences in the National Irrigation Program.

Irrigation Convention. Our May issue will contain a complete report of the Irrigation Convention to be held at Garden City, Kansas, April 16-17.

Artificial Glaciers. In our May issue will appear an article on Artificial Glaciers, which will describe a California scheme coincident with a similar suggestion for Colorado. While the idea is not entirely new, it will be interesting.

Senator Carey on Land Question. In our issue for May will appear an article on the land question in connection with irrigation, from the pen of Senator Joseph M. Carey, Cheyenne, Wyoming. Senator Carey is fully qualified to handle this subject, and his opinions will be found highly interesting.

A Request. Will our readers in the various sections of the West send us a short communication giving their manner of cultivating before and after irrigating; depth of plowing, kind of soil and quantity per acre of principal crops? It is our intention to collate this information and add suggestions which may be of practical value in the way of improvements. Any assistance of this character from our readers will be heartily appreciated.

Irrigation Congress. Keep in mind the 11th National Irrigation Congress at Ogden, Utah, September 8 to 11. Recent letters from that city state that an elaborate program is being prepared and many interesting features in the way of entertainment will be offered.

Administration of Streams in Irrigation. Our May issue will contain a finely illustrated article from the Journal of the Western Society of Engineers on "The Administration of Streams in Irrigation." The data for the article is from a paper read before that society by Elwood Mead, Chief of Irrigation Investigations, Washington, D. C.

Both for $1.50. The Primer of Irrigation, the first chapter of which appears in this issue of THE IRRIGATION AGE, will, in its completed form, make a volume of over 300 pages bound in cloth and finely illustrated. The price will be $1.00. Those who wish to order the book may secure it and THE IRRIGATION AGE for one year for $1.50. We will not have it ready for delivery before August or September of this year.

Prof. O. P. V. Stout.

In this issue will be found a photo half-tone of Prof. O. P. V. Stout, Irrigation Engineer on the staff of the Nebraska State Board of Agriculture. Prof. Stout is a native of Illinois, but has spent the greater part of his life in Nebraska. He graduated in civil engineering from the University of Nebraska in 1888, and was employed for a time in railway and municipal work. In 1891 he was appointed to an instructor-

PROF. O. P. V. STOUT,
Lincoln, Neb.

ship in the department of civil engineering in the University of Nebraska, and since 1893 has been in charge of that department. Prof. Stout has also engaged extensively in outside practice, and has given considerable attention to hydraulics and irrigation. In addition to private engagements along these lines, he has been for a number of years resident hydrographer of the United States Department of Agriculture.

Anderson's "Primer of Irrigation."

We have in course of preparation, a standard, practical book on irrigation, the first chapter of which appears in this issue of THE IRRIGATION AGE, and other chapters will follow in subsequent numbers.

It is our purpose to reduce the whole art and science of Agriculture connected with Irrigation, to the plainest language, within the comprehension of every one who desires valuable, practical information on the subject. In its bound form the matter will fill a volume of over 300 pages.

The time is ripe for a practical and comprehensive book on the subject, years of experience having demonstrated the fact that irrigation is the most profitable means known to agriculture to secure profit in farming.

In its scope, the book begins with soils and their nature, expressed in clear language, takes up Arid and Semi-Arid lands, and shows plainly the benefits to be derived from irrigation and proper cultivation, in every branch of agriculture. The book is really a work on farming for profit, whether the farmer raises cereals, or limits his productions to a vegetable garden.

It tells how to utilize any kind of soil, how to raise the proper kind of profitable crops, how to irrigate, how to feed plants with the proper food, and how to avoid failure. Anyone who reads this book will find in it just what he wants, just what he has long been looking for without being able to find it, and how to utilize every foot of ground he owns or controls.

There has never been a similar book put before the farming community, and when we say it is to be the "standard," we mean that there may never be another book with so much practical information, and so complete in every detail. It is a book every farmer who practices irrigation needs to attain success for his labor. The work will be finely illustrated.

Influences in National Irrigation Program.

We begin elsewhere in this issue a discussion of some of the influences that are affecting the program of national irrigation provided for by the National Irrigation Act of June 17, 1902. This discussion has been prepared by the editor of this journal with the sole purpose of telling the truth about the operation of one of the most important and far-reaching enterprises that has been launched by Congress in recent years. We have hesitated to publish the facts presented because we believe that a work of such magnitude and importance as is contemplated by the National Irrigation Act should receive the unqualified support of a united West, and that, if possible, all shortcomings in administration should be allowed to correct themselves through the further experience of those in charge. We have also hesitated lest a plain statement of the truth might seem to reflect adversely on some of the public-spirited men who have unselfishly and unremittingly given their support to the movement for national aid to irrigation. Among these none has been more conspicuous than Mr. Thomas F. Walsh, the president of the National Irri-

PROF. CHAS. M. HALL,
Fargo, N. D.

gation Association, and others who have been identified from the start with the movement conducted under the name of this association. The part these men have voluntarily played has been both praiseworthy and commendable and nothing could be farther from our desire than to connect them with what is uncalled for and unwarranted in the present national irrigation program. We believe that these gentlemen have been placed in false positions by those who have sought to

influence the expenditure of the reclamation funds toward corporate and selfish ends, and we further believe that when once they know the truth they will cease to stand sponsor for the acts of Mr. George H. Maxwell and the interests he represents. We reach this conclusion from the fact that many of those who have been most influential in the National Irrigation Association have already withdrawn their support from it. It is these men who, with state officers, irrigation officers,

ADDISON J. McCUNE,
State Engineer, Denver, Col.

irrigation associations, newspapers and newspaper correspondents, have provided the material on which the discussion is based.

It is the desire of the AGE to use its utmost effort in support of what is right in carrying out the provisions of the National Irrigation Act. In doing this we shall give our unqualified endorsement to all, whether individuals or public officers, who stand squarely on the side of an honest and wise expenditure of the funds made available by the act. The expenditure of these funds is a trust from the whole people for the benefit of the whole people, and we cannot idly see this trust misplaced through the machinations of corporate agents.

His Mistakes.

From Montana newspapers we glean that the Executive Chairman of the National Irrigation Association, Mr. George H. Maxwell, has been misusing the prestige of his position and all the facilities afforded by the N. I. A. to prevent needed irrigation legislation in that state. This action by Mr. Maxwell is foreign to the purpose which most members of the N. I. A. regard as its legitimate function. His persistent interference in state matters, his wilful misrepresentations concerning meritorious measures have hindered instead of aiding irrigation; the result to Mr. Maxwell is merited loss of influence and esteem in Montana.

Montana credits him with some good done in helping to create sentiment for national aid, but charges he has been guilty of utilizing the literary bureau of the N. I. A. to mislead by unfair statements concerning laws and to circulate malicious attacks on a government official who has an untarnished record for able irrigation work. Just what Mr. Maxwell's motive is beyond personal dislike is not shown, but those familiar with his past believe time will disclose that his aim is entirely selfish.

Noting last fall that the Montana papers were emphasizing the need for better irrigation laws, Mr. Maxwell tried to forestall action by a long open letter to Senator Gibson, in which he condemned, what two years before he had in publications and in a brief before the California Supreme Court, praised very highly, viz.: the Wyoming law. He referred to it as the Mead "theory" of State control, with its army of political appointees, predicted conflict with the federal government if any legislation was enacted, and plead for no action. He did not investigate conditions in Montana, as he should have, he ignored the special reports made by the Government, he suppressed the fact that what he designated as a "theory" had for twelve years in Wyoming, for seven years in Nebraska, and for eight years in the Northwest Territory, been in successful operation to the great satisfaction of irrigators. That in these two States, under it, there had been over 5,000 claims adjudicated with slight expense and trouble to claimants, and so justly decided that only about a dozen appeals to court had been taken.

To befog the situation he made "home rule in irrigation" a slogan. Soon after his initial attempt to deceive Montanians, a report was made to the Governor recommending a law based on the Wyoming law and containing some of the law proposed for California by her able State commission. In that report it was shown that Mr. Maxwell had not been fair in his presentation, and a controversy resulted.

Maxwell vociferously asserted that serious complication with the national government would ensue if the State enacted an irrigation code, but he failed to show how or why a law which embodied recommendations made by the Government would hinder the national irrigation law, or why of necessity any conflict between State and Nation should arise. The position taken by the State, or rather in the report to the Governor was "The federal and State governments each have interests in the arid lands within the State, each have a work to do in connection therewith that the other cannot perform; there is no necessity for conflict of authority, there need be no friction between them and the proposed laws makes easy their effective co-operation for the common good." A statute to aid the government in construction of reservoirs and other means of saving flood waters was included.

It is significant that despite Mr. Maxwell's statements as to what the Government would do, it has out of nine projects selected six in States having State control of water.

Mr. Maxwell's "home rule" idea proved a misnomer. In November *Forestry* and *Irrigation* he is on

record, viz: "Every drainage basin should do business with the *national government* as a unit 'the water-users of which' can adopt any rules or regulations desired or approved by the Secretary of the Interior." Is that "home rule?" Or is it irrigation government through and by agents at Washington, and the adjustment of claims by political appointees of the national government? Up to date the Government has not manifested a desire to carry out his plan.

During the controversy Mr. Maxwell circulated a thirty-two-page pamphlet in which a malicious attack on Elwood Mead was the leading feature. This and a flooding of the Legislature and newspapers with misrepresentations confused many. Mr. Maxwell had achieved some reputation by his campaign for the N. I. A., and was by many considered well informed, and was therefore given a hearing. The result was that not one of several bills introduced to amend the irrigation law was passed. The proposed law based on Wyoming was carefully studied by a large number of irrigators who approved and desired its enactment, but the limited time of the legislator and other matters prevented.

Meantime Mr. Maxwell has suffered among those who investigated the merits of the controversy, because of his evident unfairness, his effort to mislead and his unwarranted interference.

IN MISTY MARCH.

Above the bridge upon a day
When wintry chains no more
Extend their rigid tyranny
From helpless shore to shore,
I watch the waters rushing down
From somewhere thro' the mist
That hides the sources of the flood
In veils of amethyst.

Above the bridge—ah! who shall say
How many hopes and fears
Float out upon the seaward tide
To meet the unknown years.
The laughing wave that dances on
Unmindful of its fate,
May learn to know the bitterness
Of some dark maelstrom's hate.

Above the bridge—the mystery
Of life's beginning lures ;
Below—the winding of the stream
Leads my long way—or yours.
We may not change the constant course
Nor well the tide resist—
Here on the bridge it comes and goes
Thro' veils of amethyst.

—George E. Bowen.

Prof. Rudolf Eucken, of Jena, discusses in the April-June *Forum* "The Present Estimate of the Value of Human Life." He traces the causes of the recent tendency to pessimism, but maintains that this conclusion is not justified.

"John!" whispered the good woman in the dead of night, "there are burglars down stairs."

"You go down, dear," replied John; "they wouldn't hurt a woman."

INFLUENCES IN THE NATIONAL IRRIGATION PROGRAM.

BY D. H. ANDERSON.

That irrigation is essential to the arid region has been amply demonstrated; that the highest type of agriculture is represented there is evident to one visiting Colorado, Utah or California; that the government has failed to do its whole duty by the pioneer farmers of the west is each year more fully recognized. The irrigated area of the western states is six times as great as the entire area of Rhode Island. The crops grown are more diversified than those raised in the Eastern Atlantic States and their value exceeds the product of any equal area elsewhere in the United States. Object lessons abound from the fruit farms of Washington to the rice lands of Louisiana and Texas and from the wheatfields of Montana to the orange groves of Southern California. In one place the water supply has been fully used by the husbandmen; in another, both land and water lie idle, awaiting the quickening influence of capital. Irrigated Spain is represented in California, Egypt in Arizona and Italy in Southern Colorado and Utah. The possibilities for further development in each state and territory are great, and the time may come when the area irrigated in several of these may equal or exceed that brought under cultivation in any one of the older countries. Whether this is accomplished or not depends upon how far the work of reclamation is directed to aid the homeseeker and investor. It will not take place during the life time of the present generation if the trust recently imposed by Congress is not lived up to in good faith. It will be a death blow to further extension of national aid if representatives of corporate interests are permitted to manipulate the reclamation service of the government. The object of this discussion is to bring to public attention the dangers which now threaten the prosecution of this important work. The Age has been slow to make a move in this direction and the step has not been taken without due study and consideration. Those who wish evidence on any point raised in this paper can, we are persuaded, be satisfied, should they bring the matter to our attention.

CHARACTER OF WATER RIGHTS AND STATE SUPERVISION.

Before entering upon the principal subject for discussion, it is thought best to briefly review the character of water rights in the various states and outline in as few words as possible, the existing systems of state control. The west was settled before laws came from the east. Strict local regulations prevailed in many districts where it was impossible to protect the settlers in any other way. Judge Lynch held sway where peaceful and law-abiding communities now flourish. The first law introduced governing the diversion and use of water was aimed to protect the miner. He often went before the irrigator. When the latter appeared, he found that he could secure a water right, so-called, by simply posting a notice at the point where he proposed to divert water. This was an extremely simple procedure, and until new comers began to encroach upon the supply, it was held in high esteem. Cases in court grew out of neighborhood quarrels and now the only way for a person to secure a right to use water in many of the western states and territories is to institute legal proceedings. When two irrigators appear in court they establish, in a way, their relative rights. A third party who may feel aggrieved by the award can re-open the litigation at any time. In the second suit there may be

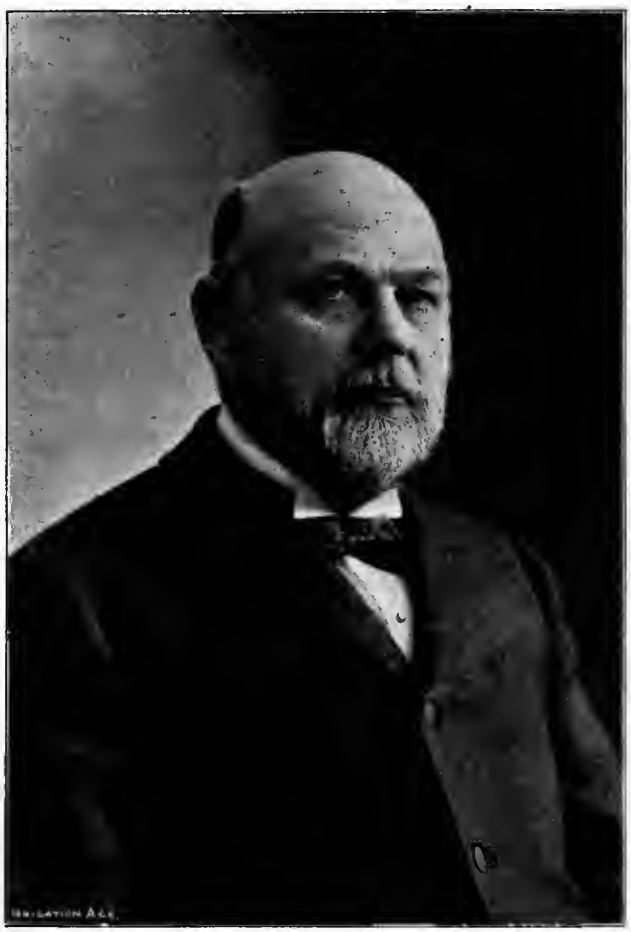
one or several defendants. If all who have already been to court do not again appear they may be deprived of the rights decreed to them in the first suit. This may go on indefinitely, and even to-day there is no orderly proceeding under the law of most of the western states and territories whereby all of the irrigators interested may appear at one time and secure a division of the water on a permanent basis. It is denied by those who are in a position to be better informed that litigation over water has been no more common than that relating to the title of other property. The truth is that the heart has been eaten out of many irrigation communities by constantly recurring strife in the courts.

As has been often said, water, and not land, is the chief basis of value in an irrigated country. A ditch leading through a prairie may serve land just below it worth from $100 to $500 per acre, while the grazing land just above could hardly be sold for $2 per acre. The government has disposed of the public land in a systematic and business-like way, but has left the water problems with the states and territories. This latter has been disputed, but the contention has been overruled by the United States Supreme Court. A recent decision of that court, (Thomas C. Guiterres et al., appellants, v. The Albuquerque Land and Irrigation Company) emphasizes other decrees of similar character. The decision states that Congress has recognized state and territorial legislation relating to the diversion and use of water by two acts, one of 1866 and one of 1891, and in the specific case sustains the territorial statutes of New Mexico providing for the appropriation of water for beneficial uses and overrules the contention that such water is the property of the United States and not of the territory. With but few exceptions the states have not wholly accepted the responsibility thus imposed, and in consequence, water is generally left to be quarrelled over. Until within the past few years no organized effort has been made to obstruct reform irrigation legislation. What opposition has been felt has arisen from local sources. That water should not be treated as personal property, but should belong to the land irrigated, and that the volume furnished should be limited to the quantity that can be beneficially applied, are among the principles which have been indorsed by the leading thinkers and writers on irrigation matters. These along with other meritorious provisions were first incorporated in the laws of Wyoming, which state is considered to at least be abreast of the reform movements to improve the condition of the irrigator. It might be said that the laws of the Dominion of Canada are similar to those of Wyoming and that Montana, lying between the two, has no law providing a means whereby claims to water can be equitably, cheaply and definitely settled.

There are people in every state who realize the inefficiency of the laws in force, and who endeavor to make public their defects that reform may be brought about. The farmers of the west would still be quarreling over their land titles and farm boundaries if the government had not provided that each should be given title to a definite area having a fixed boundary. There is no good reason why the rights to use water should be any less definite in character, and we believe the time is rapidly approaching when a reform along this line must be carried out. The influences which are now operating to delay or altogether prevent such a reform will be dealt with later in this paper. That the motives of the agents thus employed are selfish, will, we believe, be made evident. Our object is to improve conditions in those districts where reform is needed and where the irrigator is now giving up his hard-earned money to protect his water right.

EARLY AGITATION TO ENLIST NATIONAL AID.

The early settlers of the west realized that the government should do more than give title to land to enable the pioneer to compete with the more fortunate farmer of eastern districts. In Colorado, meetings were held during the early seventies to bring the matter to the attention of the government. This move has steadily grown and while partial success has finally been achieved, we should not permit ourselves to believe that



HON. JOSEPH M. CAREY,
Cheyenne, Wyoming.

recognition from Congress has been gained through any single influence. Colonel E. S. Nettleson was one of the early pioneers in this agitation and a man who understood irrigation from both a theoretical and practical standpoint. He took an active part in the irrigation development near Greeley and saw that that colony could have but slow growth unless outside aid were to be enlisted in the construction of irrigation works. The colony has grown, and in thirty years has become the foremost in the country in the culture of several staple crops. The injustice that was done many of the early irrigators through a lack of central control of the water supply and a failure to establish rights as soon as the normal flow of the stream was exhausted has retarded settlement and made the development of the country difficult. The people of the Greeley colony

were not the kind to turn back, however, and not being able to secure aid from the government, they did all they could for themselves.

These people believed that the government should build irrigation works as an inducement to settlement, and that the national treasury would be fully reimbursed through the rapid development of the west. The homesteader in Iowa had no great difficulties to surmount. He had an ample rainfall for the growth of crops and no timber to clear away before grain could be planted. Why should one go to Colorado where the labor of taking out irrigation ditches would consume at least one season's time which might be employed more profitably further east? The government was spending money for the benefit of the commerce along the Missouri. Why not extend this aid to the pioneer farmer of the plains?

At a later date, the American Society of Irrigation Engineers was organized and also advocated government construction of irrigation works of too great magnitude for private capital. The Society held regular meetings at which times irrigation topics of the time were discussed. The members were engineers, with whom practical questions were of greater interest than were the legal and theoretical problems which always arise in irrigated countries. The leading men of the west who have become intimately acquainted with practical irrigation and who have sympathized with the policies advocated by this society, have stood as a unit in favor of national aid, provided it should be direct, that existing rights should not in any way be interfered with, and that the control of the water should be left with the states.

THE IRRIGATION CONGRESS.

One other organization has always stood for national aid. This is the Irrigation Congress which was organized to further irrigation generally and bring together those who had special knowledge of the subject, that an exchange of ideas might be possible. Meetings have been held almost annually since the early nineties. Interest in the Congress has fluctuated somewhat owing to the partial control gained over it at times by men whose motives have not been entirely praiseworthy. During the past few years the leader of the railroad lobby at Washington has exercised a baneful influence in the executive committee of the Congress. It is believed that this influence has largely been removed and that henceforth the deliberations of the Congress will be carried on by those who desire to be of public service.

One of the unfortunate features of the Congress is that almost anyone who so desires can be appointed a delegate. Consequently, one or two sessions have been largely controlled by agents of manufacturing concerns. Delegations from localities where irrigation is of no consequence have stood for policies of local importance which should never be brought before such a body for consideration. At one session, in particular, politicians had the floor most of the time. These men were not of national repute, but were state and county aspirants for public honors who were not competent to speak on irrigation subjects except in a very general way. Under programs thus conducted those who have made a study of irrigation have been prevented from appearing and as a result the Congress has been voted a failure by the delegates who went to learn something regarding irrigation practice in neighboring states. The enthusiast has been on hand to tell the assembled delegates how the banks of the Missouri are lined with homeseekers looking toward the west, awaiting the time when a tract of irrigable land should be furnished with canals and ditches. Those better informed have generally remained silent at such times, not desiring to destroy the pleasant delusions under which the enthusist was laboring.

The question of the west to-day is one of people; this, and not irrigation, has been the more urgent problem of the past twenty years. Canals have gone ahead of settlement and the people do not come to till the soil and use the water that has been made available. This is the reason for the failure of many a promising irrigation enterprise launched by private capital. Land and water have been brought together but not in a way to attract settlers in time to save the enterprise to the investors. The argument in favor of the recent act of Congress is that the government loans the money and charges no interest. It makes no difference, therefore, whether a tract of land is settled in one or fifty years. Whenever it is settled, the homsteader is given ten years in which to pay for his land and water. If some of the land is never taken, the government must raise on the general assessment, or lose a portion of the money invested.

Among the substantial men who have regularly attended the meetings of the Irrigation Congress are the state engineers. These officers have always favored a broad policy aimed to benefit the people of the states represented. The professional men from universities and agricultural colleges have always been valuable delegates as have also the representatives from canal companies and irrigation engineers engaged in a general practice. Utah invariably sends a delegation to which she can point with pride. Such men as Colonel Young, Colonel Holmes, John Henry Smith and Fred J. Kiesel are to be found with those who sympathize with the irrigator and strive to lessen the difficulties which he can not overcome unaided. Ex-Senator J. M. Carey, of Wyoming, is another example of genuine public spirit. Of recent years the Congress has suffered from the influence of certain men whose purposes will be explained in some detail in future issues more as a matter of current history than because they should occupy a prominent place in solving the irrigation problems of the west.

(To be continued.)

PRETTY GOOD PLACE.

Treats a feller purty well, this ol' world of ours,
If you mog along an' do yer best.
Allers lots o' sunshine sandwiched in between the showers;
With the hard work comes the peaceful rest.
Lots o' days that's fair an' bright,
Spite o' clouds sometimes in sight.

Treats a feller purty well, this ol' world of ours,
Even when the days look sad and drear.
When the thorns are pushed aside you will find the flowers,
Smiles will make the heartaches disappear.
Purty good ol' world, I say,
Gittin' better every day!

Treats a feller purty well, this ol' world of ours,
There's a smile fer every tear an' sigh;
There's a rainbow peekin' through every cloud that lowers,
Tellin' of the sunshine by and by,
Likely place, this here, to dwell—
Treats a feller purty well!

—E. A. Brininstool.

AN IRRIGATION EXAMPLE.

BY J. W. PRICE, CASPER, WYOMING.

It seems to be a prevalent notion, even among people who are interested in irrigation, that a satisfactory irrigation system cannot be constructed without a larger outlay of capital than is possible to the ordinary ranchman or association of ranchmen.

In various parts of this great arid region, there are comparatively large areas of land where it seems impracticable to get the water on the land on account of what seems to be difficult feats of engineering and great expense.

That it is possible to have an eminently satisfactory system on quite an extensive scale with no great outlay of actual money is shown by operations in this locality.

I would refer the readers of IRRIGATION AGE to the Goose Egg Ditch Company as one such example. This company was formed in 1897, and was composed of five ranchmen of comparatively limited means, whose capital was their energy and appreciation of the value of irrigation.

These men were located in the Bessemer Bend on the Platte River in central Wyoming. The fall of the Platte is not sufficient to divert water for irrigation purposes without enormous expense, but there is a spring on the north side of the river, commonly known as the Delaware Springs, which have a flow of water of twenty-seven cu. feet per second. Various propositions were discussed by the ranchmen for getting the water across the river, but they were all discarded on account of the expense, until the idea occurred to them of building a wooden flume across the stream for which the cash outlay necessary would be that of surveying, lumber and salary of the overseer, who was the writer.

A company was therefore incorporated, composed of the following named ranchmen: Alex. Mills, D. N. Speas, Edward Kerns, John McClure and W. D. Rhoades, and work was at once begun. Logs were hauled from the mountains and cribs built in the river; upon these as a foundation a superstructure of logs was erected in the form of "bents" to support the flume proper, which was constructed of native lumber, 40,000 feet of two-inch plank being required. The flume when completed was 1,100 feet in length, four feet wide, fourteen inches deep and thirty-five high from low water mark of the river.

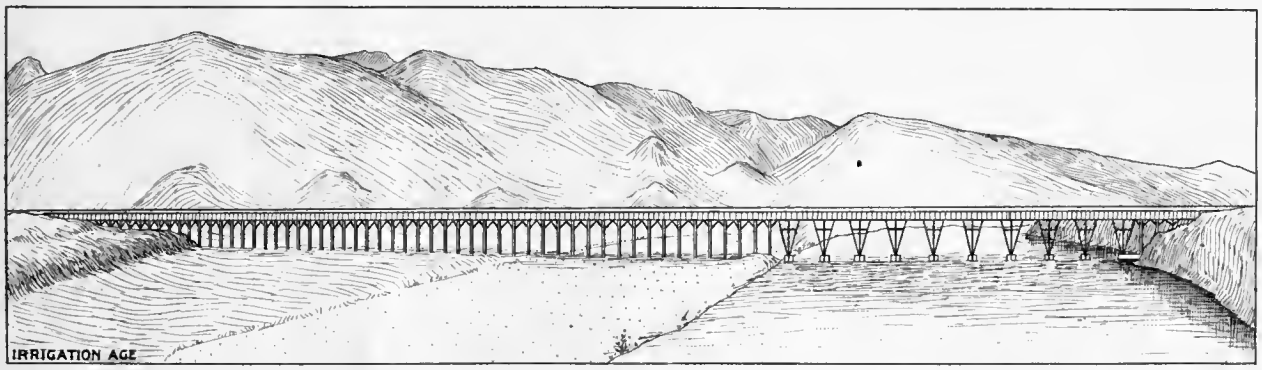
The system, when completed, consisting of the flume and three and one-half miles of ten-foot ditches, successfully irrigating 800 acres of bottom lands, and making six productive ranches, cost the sum of $2,500, of which only about $600 was actual cash, the balance being team work and day labor done during the winter time, the ranchman's leisure season.

Where there was once arid lands and ranchmen making a bare subsistence, there are now bright and happy homes and men independently well off.

While there are no two localities where the conditions are identical, still this goes to show what can be done with very little capital when men see their opportunities and have the energy to take advantage of them, by using man's greatest resource—his own toil.

Lives of other men remind us
We may toil and sweat and sigh,
And, departing, leave behind us
Just what room we occupy.

A correspondent at Salt Lake, Utah, states that L. M. Taylor, government engineer in the arid reclamation service, passed through Ogden on his way to Nevada to begin the work of land reclamation. He says that work will begin within two weeks damming the lower Carson river. Two hundred thousand acres southeast of Wadsworth will be reclaimed by this dam, furnishing homes for 1,250 families.



FLUME OF GOOSE EGG DITCH COMPANY ACROSS PLATTE RIVER, CENTRAL WYOMING.

LET HIM KNOCK AGAIN.

Luck tapped upon a cottage door,
A gentle, quiet tap,
And Laziness, who lounged within,
The cat upon his lap,
Stretched out his slippers to the fire,
And gave a sleepy yawn;
"Oh, bother! let him knock again!"
He said, but Luck was gone.

Luck tapped again, more faintly still,
Upon another door,
Where Industry was hard at work
Mending his cottage floor.
The door was opened wide at once;
"Come in!" the worker cried,
And Luck was taken by the hand
And fairly pulled inside.

He is still there—a wondrous guest
From out whose magic hand
Fortune flows fast—but Laziness
Can never understand
How Industry found such a friend.
"Luck never came my way,"
He sighs and quite forgets the knock
Upon his door that day.

PRIMER OF IRRIGATION.

BY D. H. ANDERSON.

Chapter I.

Soil in General—Its Formation, Characteristics and Uses—Fertility and Sterility.

The mere planting of a seed in the ground is not sufficient to insure its growth, or development into a useful or profitable plant. This fact is well known to everybody, but what is not so well known is, the reason or cause why a seed grows up into a vigorous plant capable of reproducing seed similar to the one from which it sprang, and how it does it.

There are certain elements which are essential to the growth of every plant, the development of every germ, for without them it cannot live; these are heat, light, air and moisture. A few grains of wheat discovered in the coffin of an Egyptian mummy after three or four thousands years' deprivation of the four essential elements, were found inert, that is, they were not alive, neither were they dead, for upon giving them the essentials above referred to, the wheat sprang into life and produced a plentiful supply of grain.

PLANTS ARE LIKE ANIMALS.

Still, notwithstanding the necessity of heat, light, air and moisture, plants cannot flourish without proper food. In this respect plants are similar to animals. Among animals there is no universal specified diet, some eating one kind of food, others another. We see many that eat flesh exclusively, others whose sole diet is insects. Certain animals eat herbs and grass, others grain, and when we reach man we find an animal that will eat anything and everything, hence we call man "omnivorous."

It is the same with plants, some devouring in their fashion a certain kind of food, some another, and so on all along the list. Plants are substantially like animals that possess a stomach, they eat and digest, absorb and assimilate the food they obtain. If the plant is not furnished with its proper food, or if it is prevented from obtaining it, it shrivels, droops, withers and dies just like an animal that starves to death.

There is another striking resemblance between plants and animals, which is the instinct and power to seek food. The plant being a fixture in the soil, cannot of course, "prowl" about in search of food, but it throws out roots, fibres and filaments in every direction, its instincts reaching in the direction of food as surely and with as much certainty as the nose of an animal scents its prey, or the eye of an eagle sees its quarry. Not only does the plant seek food beneath the surface of the earth, but it thrusts shoots, branches and leaves up into the atmosphere for the purpose of extracting nourishment there also.

It is, however, from the soil that plants receive the principal supply of food necessary for their development, hence an acquaintance with its chemical and physical properties is important in helping us to understand the nutritive processes of plants, and the operations of agriculture.

Volumes of books have been written on the general subject of agriculture, but they are more adapted to soils upon which falls sufficient rain to dissolve the salts necessary to produce a crop. In a book devoted to irrigation, the principles of agriculture and the adaptation of the various elements of plant food in the soil, are all the more important as the water employed in irrigation—which is nothing but artificial rain—is absolutely within the control of man, and not dependent upon meteorological uncertainties. One fact should, however, be constantly borne in mind by the practical irrigator, that pure water is absolutely sterile so far as plant food is concerned, and if poured upon a pure soil, which is also sterile, there can be no crop of any sort raised. A remedy for supplying a defect of plant food in irrigating water will be given in detail in another chapter, the scope of this chapter being limited to soils that contain plant food, or are arable, in which case the quality of the water is of secondary importance.

ORIGIN OF ARABLE SOIL.

Arable soil owes its formation to the disintegration of minerals and rocks, brought about by mechanical and chemical agencies. The rock may be said to stand in about the same relation to the arable soil resulting from its disintegration as the wood or vegetable fibre stands to what is called the humus resulting from its decay. To be fertile, however, the soil must contain disintegrated vegetable matter. There is no fertility in a heap of sawdust, nor is there in a heap of powdered rock; indeed, the two might be combined and still remain sterile, it is only after both have been disintegrated by chemical or mechanical action that they become plant foods capable of nourishing and maintaining plant life.

From this it results that soil consists of two grand divisions of elements: inorganic and organic. The inorganic are wholly mineral, they are the products of the chemical action of the metallic, or unmetallic elements of rocks. They existed before plants or animals. Life has not called them into existence, nor created them out of simple elements. Yet these inorganic mineral elements of soil become part of plants, and under the influence of the principle of life they no longer obey chemical laws, but are parts of a living structure. Through the operation of the laws of the life of the plant, these mineral elements become organic and so continue until death comes and decay begins, when they return to their mineral form.

Organic elements are the products of substances once endowed with life. This power influences the elements, recombines them in forms so essentially connected with life that they are, with few exceptions, produced only by a living process. They are the products of living organs, hence termed organic, and when formed, are subject to chemical laws. The number of elements in the inorganic parts of soil is twelve: Oxygen, sulphur, phosphorus, carbon, silicon and the metals: potassium, sodium, calcium, aluminium, magnesium, iron and manganese.

The number of elements in the organic parts of soil does not exceed four: Oxygen, hydrogen, carbon and nitrogen.

The great difference between these two divisions is, that while the inorganic elements are combinations of two elementary substances, the organic are combinations of three or four elements, but never less than two. These three elements, however, are variously combined with the other elements to form salts which enter into the great body of vegetable products, in fact they are continually changing, the mere change of one element, or its abstraction forming a new product. It

is this susceptibility to change, and the constant assumption of new forms by vegetable products which is the foundation of tillage, and the essence of the knowledge of irrigation.

HOW PLANTS FEED.

We do not know and we may not understand what life is, nor how plants grow, but it is a knowledge which comes to the most superficial observer, that all plants feed upon various substances their roots find in the soil, which substances are called "salts," and they are prepared for the uses of the plant by the action of organic matter on the inorganic or vice versa. That is to say, vegetable matter combines with decomposed rocks or minerals and forms a plant food without which the plant cannot live. We know as a fact that the silicates or rock elements and minerals or metallic salts compose all the earthy ingredients of soil, and are always found in plants, the ashes of any burned vegetable or plant showing this. But these silicates and salts do not make fertility in soil. Fertility depends on the presence in the soil of matter which has already formed a part of a living structure, organic substances in fact. It is this matter which causes constant chemical changes in which lies the very essence of fertility. To make this quite clear, it will be sufficient to refer to the fertility in the valley of the Nile in Egypt caused by the overflow of the river and the deposits, upon the silicates and minerals or metallic salts, which in plain language means the sands of the desert, of a layer of mud containing decomposed vegetable or organic matter. The consequence is, chemical action takes place and a rich harvest follows. The result would be the same in our arid plains where the soil contains all the ingredients necessary to plant life, but the element of moisture to dissolve and unite them is absent. Here, irrigation creates fertility. The oxygen and the hydrogen in the water supplies the soil with the elements it lacks to manufacture plant food.

There is a curious, not to say mysterious, fact connected with the transformation of the organic and inorganic elements in the soil into plant food, and that is, the chemical change does not take place except through the intervention or agency of the living plant itself. It is life that is necessary to the process and this life of the plant gives life to the inert elements around it. The mere presence of a living plant gives to the elements power to enter into new combinations, and then these combinations occur in obedience only to the well-known, established, eternal laws of chemical affinity.

If, on a dry day, a wheat or barley plant is carefully pulled up from a loose soil, a cylinder of earthy particles will be seen to adhere like a sheath around every root fibre. This will be also noticed in the case of every plant. It is from these earthy particles that the plant derives the phosphoric acid, potash, silicic acid, and all the other metallic salts, as well as ammonia. The little cylinders are the laboratories in which nature prepares the food absorbed by the plant, and this food is prepared or drawn from the earth immediately contiguous to the plant and its roots. This demonstrates the importance of the mechanical tillage of the ground. Cultivated plants receive their food principally from the earthy particles with which the roots are in direct contact, out of a solution forming around the roots themselves. All nutritive substances lying beyond the immediate reach of the roots, though effective as food, are not available for the use of the plants, hence the necessity of constant tillage, cultivation of the soil, to bring the nutrition in contact with the roots.

FORMATION AND USE OF EARTH SALTS.

A plant is not, like an animal, endowed with special organs to dissolve the food and make it ready for absorption; this preparation of the nutriment is assigned to the fruitful earth itself, which in this respect discharges the functions performed by the stomach and intestines of animals. The arable soil decomposes all salts of potash, of ammonia, and the soluble phosphates, and the potash, ammonia, and phosphoric acid always take the same form in the soil, no matter from what salt they are derived.

It is essential that these "salts," as they are called, should be understood, for without them there can be no fertility. Unless these "salts" exist in a soil in certain quantities the organic elements, or what are known as "humic acids," are insoluble and cannot be absorbed into the plant through its roots, and so there can be no fruit or vegetable. Yet there is such a thing as an excess of these same salts, and then there is barrenness. A common illustration of which may be seen in what are termed "alkali lands," which will be treated in detail in another chapter.

To simplify an acquaintance with these various salts, we shall divide them into three general classes depending upon the acids formed from them, all of them nutritious to plants.

First—Carbonates.
Second—Nitrates.
Third—Phosphates.

The carbonates compose a very large portion of the salts used in agriculture, and include limestone, marble, shells. These salts are set loose from the rock, that is the decomposed rock already alluded to, by the action of the living plant, and their business is to dissolve, or render soluble, the organic matter in the soil, so that the plant may absorb it through its roots. When there is an excess of these salts, or of lime or alkali, the organic matter is rendered insoluble, that is, the plant cannot absorb it, and then the soil is barren. There are, however, certain plants known as "gross feeders," which flourish in such soils, but of them more will be said in another chapter.

The second class of nourishing salts is the nitrates, and includes saltpeter, nitrate of potash, nitrate of soda, and all composts of lime, alkali and animal matter. This class of salts produces ammonia which hastens the decay or decomposition of the organic matter, and prepares it for absorption by the plant. All the nitrates act under the influence of the growing plant and yield nitrogen which is essential to its life, indeed, if there are any salts which can be called vegetable foods, they are the nitrates, and they hold the very first place among salts in agriculture.

The third class of plant nourishing salts is the phosphates. They are found in bones, liquid manure, and in certain rocky formations which are abundant in the United States, and ground up, are largely used upon land to add to its fertility and increase the supply of plant food.

The phosphates act much like the nitrates, their acid forming a constituent of the plant.

The proper, proportionate quantity of all these salts in the soil, is generally in the order already given;

the carbonates in the greater quantity, the nitrates in less quantity, and the phosphates least. The quantity of any salt which may be used to advantage, however, will depend upon the demands or necessity of the plant which will show for itself the salt proper for its well being and perfection.

To still further simplify the idea of the use and operation of these salts and their necessity, it will be well for the reader to again imagine a similarity between the plant and an animal. The stomach of the animal secretes, or produces, gastric juice and other acids which come from practically similar salts, by the action of which the organic matter—the meat and vegetables—put into the stomach, are digested and distributed to nourish every part of the body. If there were no gastric juice, or other acids formed from the salts of the body, the organic matter put into the stomach could never become food, and the body, left without nourishment, would starve and die.

So it is substantially with plants. The main difference being that the plant has no stomach within itself, but it requires food just the same as the animal, and if it does not receive it, it starves and dies. By the active principle of life in the plant as in the animal, the salts of the soil are brought into the presence of each other to form acids which act upon the organic matter in the soil, or the humus, in very much the same manner as the gastric juice and other acids of the animal stomach, convert it into prepared food, so to speak, and the plant absorbs it, is nourished by it and grows to maturity.

SILICATES AS ESSENTIAL TO FERTILITY.

There is one important prevailing element in all soil which can neither be overlooked nor ignored, in fact, its power of fertility is unlimited; we refer to the silicates. Salts are spoken of as the inorganic substances acting upon humus or organic matter to produce nourishing foods that can be absorbed by the plant, but behind these salts, there is another substance which really constitutes the framework of the plant structure, the bony framework of the plant, the sinew of the soil.

Silex, or silica, which is the earth of flints, is, in its pure state, a perfectly white, insipid, tasteless powder. Glass pulverized is an illustration, so also is a sand heap. But earth of flints, sand heaps, are barren and worthless, as much so as a peat bog, but put the two together, and there is astonishing fertility. This silica unites readily with the mineral substances or bases, forming what are called "neutral salts," to which is given the name "silicates." Thus we have the silicate of soda, of potash, of lime, of magnesia, of alumina, of iron and of manganese, a class which forms the great bulk of all rock and soil.

The action of the silicates is simple and easily understood. When humus, or decomposed organic matter —manure for instance—is mixed with silica, that is added to a common sand heap, there is an immediate decomposition of the silicate of potash, which we have said is a neutral salt, and it becomes an active salt of potash which dissolves the humus, or organic matter and fits it for plant food. So the same process goes on with the other silicates as the various plants growing in the soil may demand for their nourishment. They are converted into active salts, which are capable of dissolving organic matter, whereas, as neutral, inactive salts or silicates, they are powerless to act.

Were it not for these silicates, the various active salts and acids would lose their virtue, but as it happens, the silicates hold them in a firm grip, intact, until the action of plant life demanding food, sets them free to aid in preparing plant food.

The base, or fixed element of the earth called silex, or silica—keep in mind a sand heap and it will be easy to remember—is "silicon." It is pure rock crystal, common quartz, agate, calcedony and cornelian. All these are silicon acidified by oxygen, and hence called silicic acid. It is this which forms, with potash, the hard coat of the polishing rush, the outer covering of the stalks of grasses. It is the stiff backbone of cornstalks which stand sturdily against the blast. Wheat, rye, oats, barley, owe their support to this silica, and where grain is said to "lodge" during a heavy storm, the trouble may be traced to a deficiency of silica in the soil. It cases the bamboo and the rattan with an armor of flint so hard that from it sparks may be struck. Entering into the composition of all soil, and hard and unyielding as it appears, forming not only the solid rock, but the delicate flower, combining with the metals of soil whose gradual decomposition is the birth of fertility, silica, or the sand heap, may well be likened to the bony structure or framework of the animal.

The next chapter on particular soils will give more in detail, the component elements which enter into their composition, and present a series of tabulated analyses showing proportions favorable to the growth of various products.

No sweeter voice was ever raised
To greet the dawn of day;
The joyous spring birds—Lord be praised—
Are with us now to stay.

PUSSY WILLOW.

Prithee, pretty pussy-willow,
Tell me truly what you dream
In the springtime sunlight mellow,
As you nod above the stream.

Are you dreaming in your swaying
O'er the torrent surging high,
Of the gentler waters straying
'Neath a laughing, summer sky?

Of the music of the meadows
When the clover calls the bees;
Of the silence of the shadows
Up among the forest trees?

Are you dreaming, softly dreaming,
Of the nights when lovers sail
Thro' the glamour and the gleaming
Where your fairy fingers trail?

Pussy-willows, dreams are fleeting
As the fancies of the day.
Tho' your heart may be entreating
All their luxury to stay.
Yet the dreamer, nothing daunted,
Points toward the dearer view
Till the dreams his soul have haunted
Come to make his summer true.

—GEORGE E. BOWEN.

WORK TO BEGIN.

SECRETARY HITCHCOCK HAS APPROVED FIVE IRRIGATION PROJECTS TO BE DEVELOPED UNDER THE PROVISIONS OF ARID LAND RESERVATION ACT OF JUNE, 1902.

After nine months of careful investigation the geological survey has decided upon and Secretary Hitchcock has approved five irrigation projects to be developed under the terms of the arid land reservation act of June, 1902. These projects are to be located at Sweetwater Dam, Wyoming; Gunnison Tunnel, Colorado; Truckee and Carson Rivers, Nevada; Milk River and St. Mary's Lake, Montana; and Tonto Creek, Arizona. Roughly estimated, they will make possible the irrigation of 1,000,000 acres of land at a cost of $7,500,000, an average of $7.50 an acre. As a matter of fact, however, much of the area that may be reached by water is unsuitable or unavailable for cultivation. It is not expected that more than 60 per cent of the total will be found worth irrigating, which will increase the average cost to something like $12.50 an acre. The cost is eventually to be paid by the owners of the land reclaimed in ten annual installments. That is the policy of the government. Much of the land is already in the hands of private individuals, and undoubtedly that which still remains will be taken up by settlers as soon as the plans are made known, but the government will require pledges that the cost of the reclamation will be refunded according to the provisions of the law.

The irrigation bureau of the geological survey will encounter many complications and legal difficulties in securing reservoir sites and rights of way, and the riparian laws of the several states must be observed in every particular. The agents of the government understand that the reclamation scheme is still in the experimental state and have been proceeding with the greatest caution in order that the first step may be successful and attended by no serious errors. In selecting locations the first consideration is to insure a return of the costs of construction to the government, which depends entirely upon the availability of the land for cultivation and the disposition of settlers to own or occupy it. They will not venture upon any estimate or prediction as to the time required to complete the five projects mentioned. They must feel their way and modify their plans as difficulties and obstacles may develop.

Sweetwater Dam is to be located on Sweetwater River at Devil's Gap, forty miles west of the town of Casper and a similar distance north of Rawlins, Wyo. The total area to be reached by irrigation is 100,000 acres, and originally it was supposed that nearly all of it was susceptible of cultivation, but subsequent investigations have discovered large patches of alkali, which will have to be eliminated from the estimates. Detailed inspection will determine the exact amount of lands that may be reclaimed and only those suitable for agriculture will be included in the project.

The Gunnison tunnel scheme is expected to reclaim nearly 100,000 acres near Montrose in central Colorado, but upon closer inspection this area will undoubtedly be cut down.

In Nevada it is proposed to divert water from Lake Tahoe, California, and its outlet, the Truckee River, into the Humboldt Valley, and supply settlers in the vicinity of Reno. It is believed that nearly 200,000 acres may be reclaimed there.

The Milk River project in northern Montana is expected to reclaim nearly 500,000 acres in the vicinity of Malta and Glasgow, but this enterprise is attended by serious complications, because a part of the water supply comes from Canada.

At Tonto Creek, eighty miles above Phoenix, Arizona, immense impounding reservoirs are to be located to provide a supply of water to irrigate about 200,000 acres in Salt River Valley, which is already thickly settled. There is a private irrigation system already in operation, which makes it necessary for the government to establish its source of supply at a higher level than the canals already built.

The land necessary for ditches and reservoirs, which is now owned by private individuals, must be secured by comdemnation proceedings. Public land within the area to be irrigated cannot be entered except under the homestead laws in tracts of not less than forty nor more than 150 acres. When the plans are finally decided upon the Secretary of the Interior is required by the law to give public notice of the location of lands to be irrigated, the number of acres that may be entered by any one person, the charge per acre for the water and the number of annual payments required. No sale can be made to any but bona fide residents, at least one-half of every entry must be irrigated, and the reclamation charges assessed against the claim must be paid before a patent can be issued.

It is a well known fact that the large canals and most of the smaller ones along Salt river, in Arizona, take out all of the normal flow of the water of this river, leaving its channel dry immediately below the headgates of the canals. This condition of the river bed, says a recent press bulletin by the United States Geological Survey, continues sometimes for many miles and then water again appears in it, increasing in quantity until it becomes great enough to be diverted into another canal, when the same condition of the channel again obtains.

Similar conditions exist along Gila river, as along many other rivers of the arid region where irrigation is practiced. It is thought that a large portion if not all of the water that appears in the river channels below points where all of the water is diverted for irrigation purposes is seepage water from the irrigated land.

For several years the Hydrographic Branch of the United States Geological Survey has been making investigations and collecting data in different parts of the arid region for the purpose of determining the relation existing between the quantity of water diverted for irrigation and the quantity that returns to the channel of the stream by seepage. Such investigations were made in Salt River Valley during the summer of 1902, to supplement data obtained in previous years.

The Inyo Development Company, with office at Carson, Nev., are at present installing a 44 horse power Fairbanks-Morse gasoline distillate engine for the purpose of operating a 12-inch centrifugal pump, the plant being part of their equipment for producing the borax from the highly saturated waters of the lakes of that region.

The engine and pump are to be located out in the center of the lake, and will deliver some 4,000 gallons of water per minute through considerable length of pipe line to the plant where the water will be taken into the plant proper.

The centrifugal pump supplied at this plant was tested in the shops to an efficiency of over 80 per cent, and is to be driven by the 44 horse power engine, using for fuel a crude oil from the Pacific coast.

A plant of this character will be a very efficient adjunct to the work, and will enable the Company to produce their product at a cost much less than has formerly been expended.

ARTESIAN WELLS.

There are fifty-two artesian wells on Mrs. H. M. King's ranch, forty-three of them being in Nueces County and nine in Cameron County. These wells were made by T. Herring, King Machine Company, A. W. Ferguson, Tom Leary, A. B. Fuller and J. C. Curry and range in depth from 382 feet to 1,364 feet. Three of the wells flow 400 gallons per minute; six, 300 gallons or more per minute; seven, 200 gallons or more per minute; nine, 100 or more gallons per minute, and the balance flow less quantities.

The deepest well, 1,364 feet, flows only sixty gallons, while the shallowest, 382 feet, flows seventy-five gallons per minute.

One of the 400 gallon per minute wells is only 525 feet deep, while another well is 989 feet and flows only ten gallons per minute.

The Kennedy ranch has twenty-six flowing wells, all in Cameron County. These were made by Wm. Turcotte, Guffey & Galey, White Bros., W. P. Gano and N. G. Allen.

The deepest well is 1,175 feet, and flows 500 gallons per minute, while another well is 710 feet deep, and the flow is 1,000 gallons per minute. Ed C. Lasater has eleven artesian wells, six in Starr and five in Hildago County.

Laureles ranch, Nueces County, has four flowing wells, Mrs. Anna Collins has fourteen artesian wells in Nueces County; Robert Driscoll, three; Andres Canales, two; Ragland & Herring, one; Chas. Weil, one; Seeligson ranch, four, made by Chas. Premont, manager. Major J. B. Armstrong, three artesian wells; Gunter & Jones, two, and Col. D. R. Fant, two, all in Cameron County.—Alice (Tex.) *Echo.*

The Drainage Journal Department

MEXICO'S CANAL.

SANITATION, HEALTH AND COMMERCIAL PROSPERITY AT ONCE ACCOMPLISHED BY THE GREAT DITCH THAT SERVES MANY PURPOSES.

This stupendous piece of engineering is entitled to take the first rank in the solution of modern sanitary problems. We have as a result the capital city of the republic rendered safe from future inundations, the ground water of the valley kept at a desirable level, the sanitary condition of the City of Mexico comparable to that of any other on the continent.—*Journal of the American Medical Association.*

Thus do great engineers and leading scientific publications unite in declaring the great drainage canal of Mexico, just completed, to be one of the most wonderful achievements of the century. It has wrested the City of Mexico from the grasp of disease; fortified it against the, heretofore, ever pending danger of being wiped from existence by threatening floods; made the erstwhile barren lands around to blossom with gardens and fruit

MAIN CANAL UP STREAM. 22ND MILE.

farms; beautified the City of Mexico and made her capable of competing for commercial supremacy with the leading cities of the continent. Such is the good work a great engineer can do when he is honest and conscientious. And what this engineer of Mexico has accomplished with the monetary allowance and facilities at hand ought to put Chicago and Boston to shame when they compare the results. The entire cost of the work, which began in 1886, has been only $16,000,000. The Sanitary and Ship Canal of Chicago has cost more than twice that amount and will have cost $100,000,000 before it is completed. Boston's sewage compares not more favorably in cost and results.

The present elaborate scheme for the proper sewage of the city and drainage of the valley of Mexico was inaugurated by President Diaz in 1879. The *Journal of the American Medical Association* in a very comprehensive report on this canal, says:

"The works are composed of three principal parts, a canal, a tunnel and discharge cutting. The canal starts on the eastern side of the city and continues on that side of the Guadalupean range, between it and Lake Texcoco. The canal has a total length of nearly thirty miles. It has a uniform grade of two feet per thousand. The depth of the canal below the surface of

MAIN CANAL, UP STREAM FROM SANTA CLARA BRIDGE.

the starting point is sixteen feet and at the commencement of the tunnel, sixty-five feet. The sides have a slope of forty-five degrees and the width at the bottom is sixteen feet for the first sixteen miles and twenty feet for the rest of the canal. The first sixteen miles may be considered as a prolongation of the sewer since it chiefly receives the sewage. The rest of the canal has communication wtih Lake Texcoco, and is intended to govern its waters, as it is the lowest in the whole valley and can receive the waters from all parts for which

MOUTH OF CANAL FROM LAKE TEXCOCO.

reason the canal is designed to carry the largest volume that could pass through the tunnel, 616 cubic feet per second. The canal is crossed by four aqueducts and thirteen bridges, four of which are steel for railway

service. The canal ends in a dam, the walls of which are built of stone and the front of which is strengthened by pilasters. The upper part, where the mechanism is placed for moving the sluice gates, has a width of twenty-five feet. These gates are moved on rollers in frames set into masonry. These raised, the water rushes out in a cascade on account of the difference of level

FRONT ELEVATION OF DAM

between the bottom of the canal and that of the tunnel, amounting to about eight feet. The object of the dam is to control the current whenever found necessary.

REAR ELEVATION OF DAM.

The entrance of the canal which receives the waters consists of an arch with a radius of sixteen and one-half feet, supported on vertical walls. This section gradually diminishes until it is reduced to that of the tunnel, so that between the commencement and the final point of reduction it is the section of a cone.

The tunnel is a little over six miles long, the height is fourteen feet and the width thirteen. The tunnel has a brick lining of sixteen inches.

The tunnel opens into a discharge cutting, which is the third and last of the principal parts that compose the work, and was the first to be completed. It is a mile and a half in length and was formed by opening a natural excavation made by the waters in the ravine Acpalan, the stream having been turned by a special canal. All the water flowing through the canal and tunnel is utilized for motive power and afterward discharged into irrigating ditches and used for purposes of fertilization."

DRAINAGE IN MISSOURI.

Mr. Otto Kochtitzky, of Cape Girardeau, Mo., writes: "I have read with interest the article upon Irrigation in the Nile Valley, and am impressed with the thought that our Mississippi Valley, which needs only drainage and protection from overflow, is several times larger, and in many ways susceptible to a development far beyond what is possible in Egypt. This is an era of great undertakings, and we should have the reclamation work of the Mississippi Valley brought under a system.

"There is a large drainage ditch under way in the north part of Remiscat County, and buyers of real estate regard that section as an attractive field for investment. Mr. Pollard, the veteran dredging contractor of Illinois, is pushing the work vigorously.

A. V. Wills & Sons, of Pittsfield, Ill., have been working at a large dredging contract in Stoddard County. They have recently secured the contract in New Madrid County for the dredging of four ditches eight miles long, which will form a continuation of the work in Stoddard County. They are now building two new machines for this work."

It is probable that this year we will organize for the construction of the main drain for Little River and Castor River throughout this valley.

A project has been worked out, says the Earlville (Ill.) *Leader,* for a big drainage ditch in Freedom Township, which is thus described by that paper:

"The mouth of the ditch is to be at or near the west side of Crooked Leg creek bridge, just below Freedom postoffice, and it will follow the creek northwesterly across Sections 10, 9, 4, 5 and 6, in Freedom Township, and will be about five and one-half miles long. It is planned to follow the general course of the creek as far as possible, but the kinks and crooks will be taken out of the stream, and it will run on section lines so far as practicable. It will drain some 7,000 acres of which probably 550 at a rough estimate, are now of little value for tillage, and the crops on these 500 acres will in two years pay the expense of reclaiming them. There are now two miles of tile drain that have a very poor outlet and in some cases absolutely no outlet at all, all of which may be diverted into the ditch, which will be an open water way, probably twenty feet wide and of an average depth of say six feet. Of course, at places it will be deeper and at other points not so deep.

Frank Hackman, who has circulated a petition and is the prime mover in the proposed improvement, obtained the signatures of forty-three of the fifty-three farmers whose land will be affected by the ditch."

DRAINAGE OF ALKALI SOILS.

The Bureau of Soils of the Department of Agriculture has just completed the tile drainage of an experimental field of tweney acres near Fresno, Calif. The object of the work is to demonstrate the practicability of washing out the excess of alkali from the surface soil by irrigation, and by proper after cultivation and cropping to restore the soil to its former fertility. The land is now (March 20) being prepared for the first flooding.

LARGE ENTERPRISE.

A Council Bluffs, Ia., correspondent states that according to a report filed recently with County Auditor Innes by Commissioners J. K. McGavren, of Missouri Valley, and Robert B. Wilson, of Carson, the cost of the proposed drainage ditches in Harrison and Pottawattamie Counties, Iowa, will be $87,467.73. The commissioners estimate that 155 square miles of land in the two counties will be directly benefited. This report will come before the boards of county supervisors of the two counties at their regular meeting in April. J. K. McGavren is the commissioner appointed by Harrison County, and R. B. Wilson is the commissioner appointed by Pottawattamie County. They have selected Thomas Tostevin, of this city, as engineer in charge of the work.

The commissioners before making their report went over the ground and made a thorough investigation of the existing conditions and the need for the proposed drainage ditches. As a result of their investigations they have to all intents and purposes accepted the surveys made by County Surveyor Cook in Pottawattamie and those made in Harrison County by Surveyor J. S. Wattles. They recommend only a few minor changes in the two surveys.

The commissioners recommend the construction of two ditches in Harrison County, which will meet in Pottawattamie County at a point in Rockford Township, and from there be merged into one large ditch which will drain into the Missouri river. The total length of the ditches will be about thirty-seven miles.

LOCATION OF DITCHES.

The two ditches in Harrison County are designated as the Willow creek and the Allen creek ditches. The one in Pottawattamie County is designated as the Boyer Cut-off ditch. The Willow creek ditch will start about five miles north of Missouri Valley, passing directly through that town and after merging with the Allen creek ditch in Pottawattamie County will tap the Boyer river at a point about one mile south of Loveland. The Allen creek ditch starts in Raglan Township, in Harrison County.

These two ditches come together in Pottawattamie County about one mile north of the Boyer river, and from this point they form one ditch until they tap the Boyer. From the point where they enter the Boyer, a ditch to be known as the Boyer Cut-off ditch, will be constructed in almost a straight line to the Missouri river. This ditch will be about one and one-half miles in length, and will strike the Missouri river in Section 29, Township 77, Range 44.

The Boyer river formerly ran directly to the Missouri, but of late years has followed an erratic course and from the point where the two ditches enter it is eleven miles to the Missouri river. By making the Boyer Cut-off ditch one mile and a half in length, ten miles will be saved and for most of the way the old course of the Boyer can be utilized.

ESTIMATES ON THE WORK.

The total amount of excavation which the construction of the ditches will necessitate, the commissioners estimate at 834,831 cubic yards, divided as follows: Willow creek ditch, 418,848; Allen creek ditch, 322,836; Boyer Cut-off, 93,147.

The estimated cost of the drainage scheme is placed as follows: Cost of excavating, at 8 cents per cubic yard, $66,786.48; cost of right-of-way, $16,681.25; expenses of commissioners and engineer, $3,000; appraisers, $400; miscellaneous expenses, $600; total, $87,467.73.

The commissioners in their report state that during the last year the larger part of the area which will be benefited by the drainage ditches has been flooded severely, injuring or totally destroying the growing crops. The conditions in Pottawattamie County, they say, are similar to those in Harrison County.

Regarding their suggestion that the water from the proposed ditches be carried to the Missouri river by means of the Boyer Cut-off ditch instead of following the present course of the Boyer, the commissioners say that the Boyer river, having an approximate water shed of 900 square miles, with a channel varying from forty to sixty feet in width and from twelve to fourteen feet in depth and for many miles in Pottawattamie County having practically no fall, it is unable to carry the overflow of the proposed ditches. As it is at present, it is only able to carry its water through by the force of head or weight of the water above.

The commissioners say there is no foundation for the report that the sewerage of Missouri Valley would be drained through the Willow creek ditch, which passes through that town. The work of constructing the ditches, they say, can be completed in one season.

The Boards of Supervisors of Pottawattamie and Harrison (Iowa) Counties yesterday took favorable action on the petitions for drainage ditches extending from Harrison County across the boundary line into Pottawattamie County.

Harrison County appointed as its commissioner in the matter, J. K. McGavren, of Missouri Valley. Robert Wilson, of Carson, was appointed as the Pottawattamie County commissioner. These commissioners will elect a surveyor, who will either make a new survey or accept the plat and surveys already made by County Surveyor Cook.

It is expected that the commissioners will have their report ready for presentation to the two Boards of Supervisors by their April meetings. If the plans reported receive the approval of the Supervisors the work will be ordered and will at once be commenced.

The Harrison County people interested in the construction of the ditch yesterday paid the expenses incurred by this county in the ditch matter heretofore, amounting to about $1,000, and put up a bond for future expenses.—*Omaha World-Herald.*

The following bill was recently introduced in the New York Legislature by Senator Fancher, entitled, "An act to provide for the promotion and preservation of the public health in the Conewango Valley in the counties of Cattaraugus and Chautauqua, and making an appropriation therefor," reads as follows:

"Section 1. The sum of fifty thousand dollars or so much thereof as may be necessary, is hereby appropriated out of any moneys in the treasury not otherwise appropriated, to be expended by the superintendent of public works in payment for the drainage of low swamp lands in the Conewango Valley in the counties of Cattaraugus and Chautauqua, done by and under the direction and supervision of commissioners appointed by the judgment of the Supreme Court, adudging and decreeing that the public health required that such lands be

drained, and appointing commissioners for such purpose and directing them to proceed with the work of drainage. The Superintendent of Public Works is hereby authorized and empowered to pay so much of such moneys as may be necessary, to the said commissioners to be used by them in paying for the work done under the said judgment of the Supreme Court; and for such purpose the comptroller is hereby authorized to pay such moneys to the Superintendent of Public Works.

"Section 2. This act shall take effect immediately."

The bill was referred to the Committee on Finance.

TO IMPROVE BADGER MARSHES.

Representative Davidson has been engaged during the past month in consultation with the officials of the Department of Agriculture at Washington regarding plans for draining and utilizing the marshes and peat bog lands in central Wisconsin, notably those in Waushara and Adams Counties, with a view to ascertaining what can be done by the experts of the Department to make those lands useful for agricultural purposes. Mr. Davidson has talked over the matter with Chief Witney, of the Bureau of Soils, and it is the plan of that official to make an investigation of the State during the coming season.

Under the drainage laws of 1897 certain duties connected with construction and maintenance of State ditches are imposed on county commissioners. County commissioners are not mentioned in the title of the 1897 enactment, and as a result of the omission some commissioners have blocked ditch work by declining to recognize the law. Mr. Perley would remedy the situation by a bill introduced in the House yesterday.—*St. Paul Globe.*

A syndicate of capitalists of St. Louis are to construct a dredging machine at a cost of $50,000 to take gravel out of the Mississippi river between the Hannibal bridge and the wharfboats for railroads entering the city. The gravel will be used as ballast. One dredging machine has already been constructed to take out gravel for the Burlington.

A Michigan City (Ind.) correspondent says: "Treasurer Bohland has sold the drainage bonds, amounting to $79,500 for the construction of the Kankakee river ditch, to the New National bank of Columbus, Ohio. The bonds commanded a premium."

BAREFOOTED WEALTH.

Oh, barefoot boy so brown of hue,
In truth, I'm envious of you!
Your battered hat, your sunburned cheeks,
Your knowledge of the woods and creeks
The careless whistle you possess
Are wealth I would again profess.
The future without bounds is thine—
The meager, narrowed past is mine.

Oh, barefoot boy dost know that thou
Art richer than thy father now?
To feed the calf thy weight of care;
The world thine own if thou but dare!
Thy father toils from day to day,
Forgetful of himself alway.
As men count wealth, a poor man he,
And yet—all things are his in thee.

CORRESPONDENCE

TACOMA, WASH., April 1, 1903.

EDITOR IRRIGATION AGE:

In your issue of February, the answer to B. J. McIntire's inquiry (p. 117) attracted attention, from there being a seeming endorsement of the undershot wheel. There is a system with a special plant which is so far ahead of the undershot wheel that it is almost absurd to make comparison. I will state, for the information of your readers, that a test of a machine used in this system was witnessed by myself and several others, in which, under a 54-inch head, a small model generated ¾ horse power. The model had only 13-32-inch cranks, and had three paddle-blades abreast, each six inches square, in chambers, and connected by the shaft. The operation of approximately nine inches of water on these paddle-blades generated the amount of power specified above.

A larger machine, under a four-foot head, generated power enough to pump a column of water eighteen feet high, of sufficient volume to irrigate 1,100 acres of land. This machine is entirely automatic when installed, and is evidently destined to revolutionize the irrigation of land. One feature of the system is its economy of water. The amount of land which could be irrigated by it from a given amount of water would greatly exceed the area irrigated by gravity ditch. It will be readily perceived that the gravity system is an extravagant user of water, owing to the vast quantities that are lost by evaporation, seepage and leakage.

Take the case of any long ditch, and we have vast initial expense, waste of land and heavy maintenance charges. This waste is avoided to the extent to which a saving is effected in length of ditch.

The system referred to takes the weight and impetus of the water in a current or head, transforms it to power, using this to raise by a novel and exceedingly effective pump the necessary water in such volume as may be demanded at a point nearest to the land. The machine can be built for any condition or location specially. It is not a flimsy current motor, but a massive engine, capable of taking a high percentage of the power in the entire volume of a river, at succeeding points, to the full depth of rivers of large volume, and without expenditures of fuel, or any but casual supervision, using this to pump water by the valveless pump built on the same principle as the motor, and of almost indefinate capacity.

There is no doubt that, to some extent, especially in cases where tracts of fertile arid land lie along water courses of insufficient volume to furnish the area with water by gravity ditch, trouble will arise from the wastefulness of the latter system.

Another advantage possessed by this machinery is that standardized plants can be used by the individual rancher on his tract from ten acres up—indeed, it could accommodate the owner of an acre tract. In reference to this plant, an experienced hydraulic engineer, of Holyoke, Mass., used the expression, "It is a perfect machine—perfect in principle and in operation." Another gentleman stated that it was "the greatest invention of the twentieth century." These parties saw the machine in operation, raising under a four-foot head 3,000 gallons of water per minute, over eighteen feet high, under exceedingly disadvantageous circumstances. The machine which accomplished this work was only thirteen feet long by five feet wide. It may be surmised or calculated, therefore, from the data above what work would be accomplished by a motor having a paddle-blade exposure to the energy of the water of 2,700 square feet. The 3,000 gallons were raised by three blades, each four feet square, making forty-eight square feet; the larger machine should, therefore, raise 168,000 gallons of water per minute to the same height—eighteen feet—under the same conditions. The power thus generated could be duplicated again and again along the water course. The above remarks presuppose the utilizing of a stream of sufficient volume. The sum of the matter is that as much of the power of a river as can be possibly generated hydraulically can be so generated by this machinery, whether used under a head or in a current, and that this can be conducted at intervals along the entire course. From observation of the tests it was evident that it would efficiently supply power for large manufacturing concerns without the expenditure of an ounce of fuel. It so

impressed one witness that he stated that a manufacturing city along the Columbia could be supplied with all needed power by this system and all the power be generated from the current. The machine is absolutely efficient where the turbine would be entirely useless, and is much more effective under conditions guaranteeing turbine efficiency than the latter.

In the February issue of THE IRRIGATION AGE, on page 110, the paper by J. C. Stevens, on "Nebraska Water Supply," makes mention of the country adjacent to the Niobrara river as being uneven and not adapted to gravity irrigation. This method would solve the difficulty for such regions and conditions, as the placing of a plant sufficiently large to generate electric power for a number of pumps would permit the placing of pumps at such salient point as might best and most efficiently subserve the requirements of the situation. This feature would enable a combination of farmers to place a large hydraulic motor for community use to generate electric power and each have his own pump of the special design accompanying the motor, for exclusive use on his own ranch. Any individual who has had experience in irrigation will see the vast advantage accruing from this, as it makes him master of the situation so far as regards his own property.

Being deeply interested in the question of irrigation and knowing whereof I speak must be my apology for trespassing upon your valuable space. I may be pardoned for adding that in my estimation no owners of arid land having access to water should wait the advent of the gravity system so long as so efficient a method is open to them and subject to their own control. Respectfully yours,

W. H. BOOTHROYD.

CEDARBURG, WIS., March 21, 1903.

THE IRRIGATION AGE AND DRAINAGE JOURNAL:

I was somewhat surprised to find the answer to my letter of March 24th came from Chicago, as I sent it to Indianapolis, Ind. Well, I suppose Mr. Billingslea, the veteran editor of the Journal, has joined the great army; well, that's the lot of all of us. *You ask me to write something concerning the object of drainage in my part of Wisconsin. I must say that I am not a writer for the press—something I never did before, only on rare occasions, for I have had no schooling, my school days being spent among the Indian boys and girls—a poor place to learn to read and write, was it not? Nevertheless, I will give you a rough outline of what has been accomplished in this part of the state by tile draining since I commenced in 1885. Should I want to put the whole matter in a nutshell, I would say that the farmers in an early day hardly knew what tile looked like; now there are miles of them in the ground and giving good satisfaction, but this would hardly explain the situation here, therefore I will give you a rough outline of the land in Ozaukee and Washington counties. All this land is rolling, plenty of fall on most of the land, but low places are numerous; that is, a kind of slough running in width from twenty to eighty rods, some places whole sections of black ash and tamarack swamp. The subsoil on Lake Michigan as far as Sheboygan county varying from ten to twenty miles in width, has very heavy clay soil. This clay does not let the water down quickly enough in the spring; tile drainage makes it porous and loosens the surface, which allows early seeding; this it has accomplished in this part of the state and the farmers know it, and drain every year as much as time and money will permit. When I started, in 1885, people did not know anything about drainage. For three years I preached tile, tile drainage, distributed literature, showing how to lay out ditches (here the Harris level came handy, The DRAINAGE JOURNAL helped me a great deal in furnishing printed matter. The first tile were laid on my own farm, and when I got the Bowling Green traction ditcher, I thoroughly drained ten acres in ten days, ditches thirty feet apart. The next year twenty acres, having all the low land drained before the fall. I put in for two neighbors 1,400 rods; the next season I drained twenty acres for another neighbor; no paying crop had grown on this twenty acres for many years; it was drained at an expense of $130 and the first crop paid all the expense of draining. In 1895 I drained 100 acres at an expense of $450, and the man for whom the work was done said: "I have made double the cost on first crop," and another neighbor, who had lost his barley crop of 1,600 bushels, asked me what to do. I looked at the land and told him he must have a drain of eight-inch tile running through the whole length of the acres, or about 100 rods; it was put in at an expense of $100. Result, next year he thrashed 1,800 bushels of good barley from this land, where the year before he had very little. These are special cases selected to give you an idea of what has been done by tile draining here. Not one dissatisfied person who went at the work properly. Great stress must be laid on that word "properly." If I should write all my experiences during these years, it would fill a book of no small size. I am only sorry that the factory cannot be kept running, as the farmers now realize the importance of tile drainage, and in all probability will have more wet seasons than heretofore. One point more I wish to mention and then you can put this scribbling in the waste basket or pick out such as you think of value to the public.

THE IRRIGATION AGE AND DRAINAGE JOURNAL has advocated for years drain from three to four feet deep; notwithstanding this, my experience says "Don't;" on heavy clay soil a four-foot drain is simply useless. I followed the advice of the journal, and four years after I put one on top of the other as an experiment in a field of corn when the water stood two feet high for days; we dug down to the tile, opened them, when the water, of course, went away at once. But it was an eyesore for me, and, what was worse, a poor advertisement for tile drainage when my neighbors pointed to the water on top of the drains; so, you see, the old German saying, "Man wird Greisse aber nicht weise."**

HENRY MEYER.

1. Mr. Myer is in error. Mr. Billingslea, when we last heard from him, was, we are glad to say, well and prosperous.

2. "Man grows old but not wise."

POCATELLO, IDAHO, March 6, 1903.

EDITOR IRRIGATION AGE:

Dear Sir—Your favor of some time ago, advising me that you had been recently informed of my interest in irrigation in this section and asking me for the particulars of the reorganization of our company, received.

Will say that the old Idaho Canal Company was organized in 1889 and subsequently secured control of the Idaho Falls Canal Company, and constructed and has in operation about seventy-five miles of canals and laterals, and later made a contract with the United States goverment to furnish them with 15,000 miners' inches of water for irrigation purposes on the Fort Hall Indian reservation. The government paid the company $90,000 for a water right and 37½ cents per inch for the annual rental.

The construction properties were bonded for $300,000. I made an original purchase of $75,000 of the bonds and later purchased the balance of the $300,000, in order to protect the investment I had already made. I foreclosed the mortgage and took possession of the property January 10, 1903, and have deeded the same to the Idaho Canal & Improvement Company. This company now owns over 350 miles of canals and laterals, and before the season is over will be capable of having 80,000 inches of water.

The lands to be irrigated will be mostly around Idaho Falls, Idaho, where they are building a large sugar factory this season.

We charge nothing for a water right, and on the part of the canal, at present constructed, charge from 50 cents to $1.00 per inch for water, according to the distance it has to be carried.

There seems to have been an erroneous idea existing among the members of the last Congress of the United States that I was going to bring this water down to Pocatello, and that is the reason they marked the lands upon the settlement down to $10 per acre for the arid land. Of course, you know and I know that it was out of reason and caused me to abandon my plans for bringing the water to Pocatello. This is liable to work a great hardship on this city, for the reason that the present legislature passed a law that is going to restrain the building of canals, and in my judgment will practically prevent the building of canals in the upper Snake river valley.

I did not receive a copy of the paper that you said you sent me, but would be pleased if you would send me a copy and mark it "personal," as I am interested in this class of journalism. Very truly yours, J. H. BRADY.

CHICAGO, April 3, 1903.

EDITOR IRRIGATION AGE:

Dear Sir—Considerable dissatisfaction has been aroused among users of gasoline engines in the high mountains of the

west. The general rule as to the amount of gasoline to develop a horse power per hour is one pint.

This rule works very nicely in the lower altitudes, but when the engines are placed high in the mountains it is a well known fact that they will not develop the horse power which they will lower down.

The atmosphere at sea level has a pressure of about fifteen pounds per square inch. The higher the altitude, the less pressure, and, accordingly, less density. At 9,000 feet elevation it is about one-half as much.

If an engine which was developing 10 horse power at sea level would be placed at an elevation of 9,000 feet, it would probably develop not more than about 7 horse power. To genetrate 10 horse power at 9,000 feet altitude, an engine with the air ports one-half as large again and a cylinder as much larger would be required by local conditions. This is because the air is one-half as dense, and, accordingly, one-half more of it must be used in evaporating the same amount of gasoline. If the same amount of air were to be used as at sea level, it would be seen that the mixture would be so rich that powerful explosions could not result. The question naturally arises, if the mixture is so rich, why not use less gasoline? As the minimum amount of fuel per horse power is one pint per hour, to use less would be cutting down the power supply. Instead, one-half more air must be compressed to equal the same amount as it would at sea level. No general rule can be established to fix the size of the air ports in high altitudes. The method I use is to consult the United States Weather Bureau, finding the mercury column pressure and compute the density of the atmosphere on this report. We can give them a guarantee that an engine will develop the rated horse power and feel perfectly safe in doing so.

Yours truly, F. G. RICKER.
Agent Foos Gasoline Engine Co.

TOMAH, WIS., February 28, 1903.

D. H. ANDERSON, Chicago:

Dear Sir—Yours of February 19 received. My experience in drainage work is not very broad. I have eighty acres of swamp land and, during the dry seasons we had in 1895, 1896 and 1897, I cleared forty acres and seeded it to timothy hay, which did well until the wet seasons came, that we have had since. In 1898 I did some ditching and it helped me in drying out the land so I could cut the hay. My land lies at the head of our drainage district and next to the hilly country. The soil is a black muck and clay, which is true of quite a large portion of the entire district. There is one piece of a peat marsh that was cleared, ditched and tiled; it also lies at the head of one of our laterals; it has proved a success, as almost every kind of crop has been raised on it, particularly onions, which have done well. By the use of the ditch, which is a living stream, the owner can irrigate as well as drain his land. We now have our organization nearly completed. It is nearly two years since work was first begun by our organization. Yours Respectfully,

W. S. FRYER.

STANLEY, KY., March 17, 1903.

THE IRRIGATION AGE AND DRAINAGE JOURNAL:

Gentlemen—Enclosed find $1.00 for my subscription for your valuable paper, IRRIGATION AGE AND DRAINAGE JOURNAL. I have been ditching and tiling for the past eighteen years and would not be without your valuable paper for five times its cost. I saw an inquiry for ditching machines in your last number by Mr. Milton S. Dewey, Mazon, Ill. I have had some experience in this line. For tile ditching, I think the Buckeye, perhaps, the best. I have one ——— machine; it really does more than the firm claims, though it does not finish ditch to grade for tile; I would dispose of this one just for this reason and buy a Buckeye in its place. The ——— machine is built at ———.

P. S.—I will try and get you some subscribers for your paper. I know I can. Trusting this will be of value to some one and wishing success to THE IRRIGATION AGE AND DRAINAGE JOURNAL, I remain

Yours respectfully, E. H. KOERNER,
Civil Engineering, Ditching and Tiling Contractor.

WEBSTER CITY, IOWA, February 25, 1903.

Dear Sirs:

Surveys are now being made by Edward E. Fox, civil engineer, for the "Farley Ditch."

It starts at the Iowa river, near Alden, Iowa, runs through Hardin, Franklin and Wright counties, and heads at Blairsburg, in Hamilton county. Length, twenty-six miles.

EDWARD E. FOX, C. E.,
Webster City, Iowa.

Our Tacoma corrspondent, writing under date of April 1, has the following to say about the Twin Falls Land & Water Company:

The greatest irrigation project in the United States and the third largest in the world has been started in Idaho. It is under the management of a corporation originating in Salt Lake City. The plan contemplates an expenditure of almost $5,000,000 and reclamation of 271,000 acres of the best agricultural lands in the great Snake River Valley and southern Idaho. The principal shareholder in this enterprise is Frank H. Buhl, the multi-millionaire iron operator of Sharon, Pa., who is the president. He is associated with P. L. Kimberley, another wealthy man, and Walter G. Filer, a financier from the same city, who is the vice-president. They have three western men, familiar with irrigation and canal building, in the syndicate. These are Col. S. B. Milner and Frank Knox, bankers of Salt Lake City, and I. B. Perrine, a wealthy Blue Lake (Idaho) rancher. H. B. De Long, of Sharon, Pa., is the secretary and treasurer.

A tract of land as large as the state of Rhode Island is to be brought under ditch and made ready for farming and fruit raising. The lands were formerly set aside for a national park, because of the wonderful scenery. By an arrangement with the state officials, who are taking advantage of the Carey act of 1894, making a donation of 1,000,000 acres of arid lands to each state that will construct canals and have the lands reclaimed, the great part will become a garden of small farms and vineyards. The enterprise includes the construction of two irrigation canals and laterals that will have a combined length of over 1,000 miles. The main canal will be sixty-nine miles long and eighty feet wide at the bottom.

The Twin Falls Land & Water Company is the title of the new corporation. It is the purpose of the new company to harness the Shoshone Falls and develop power for operating an electric railway extending forty-five miles from the city of Shoshone, to cover the country to be brought under cultivation by means of two large canals. One canal will be taken from the north side of the river and the other from the south. The road will connect with the Oregon Short Line at Shoshone.

Under the provisions of the Carey act, only 160 acres of this land may be held by one man. The company plans to have smaller holdings than this, and many of the farms will be of the twenty-acre Utah class. The country is particularly adapted to fruit raising and general mixed farming, as practiced by the Mormons of that district. Alfalfa is the chief forage plant and grows to perfection. The country is also a choice spot for growing prunes, peaches and similar fruits.

The construction of these canals and laterals will probably require a period of five years' hard work. When completed, the system will be the most perfect in existence in the irrigated world. It is planned to have electric car lines reaching every farm and orchard, and, when the country is settled, to secure the rural mail system. Public telephones and all modern conveniences are to be added to the comforts of making homes. Many settlers are located on their lands, awaiting the coming of the water ditch.

Several carloads of graders' implements have been shipped from Tacoma to the point on the Snake river where construction will begin. Nelson Bennett, the Northwestern railroad builder, has secured the contract for constructing works to the value of over $2,000,000. Hundreds of men are to be engaged in the work, which will be pushed as fast as possible until every acre of the large tract has been placed in touch with the canal. Water rights are to be sold to actual users at reasonable rates.

Our correspondent at Ellensburg, Wash., states that there is a strong prospect that the Highland canal, which has been under consideration for some time, will be commenced this summer. The project is to be backed by eastern capital and will water from forty to fifty thousand acres and will require an outlay of something like half a million dollars. The people of Ellensburg and vicinity have looked forward to the consummation of this project with great interest, as all the land to be irrigated will be tributary to the city and will promote business in the city to the extent of thousands of dollars. The representative of eastern capital has been in Ellensburg for several months and met with the usual difficulties in securing the assistance of the various

interests involved, but now it appears that active work will be started this summer.

Our correspondent at Wenatchee, Wash., says: According to the federal census, Wenatchee, Chelan county, Wash., had a population of 451 in 1900. The present population of the town is about 2,000, and it is still growing rapidly. Its prosperity is a product of irrigation.

Wenatchee lies at the junction of the Great Northern railway and the Columbia river. Steamers ply between the town and up-river points. It is the natural trading center for an immense territory.

Good yields of grain are produced on the uplands without irrigation, but the pride of Wenatchee is its fruit, and especially its apples, and the orchards are irrigated. The fruit is handsome in appearance, firm in texture and has a tantalizingly, pleasing flavor. The yield is large and the growers have the advantage of a great and growing market. One and a half dollars per box is considered a low price.

Irrigation heretofore has been the result of individual effort and the systems are relatively small.

Several large irrigation enterprises have been contemplated and one important system is now in course of construction. The farmers in the vicinity are prosperous and enterprising. Nature smiles upon them and affluence claims them as her own. It is small wonder that they insist that theirs is the promised land.

NALGONDA, NAKRAKAL, INDIA, February 16, 1903.

D. H. ANDERSON, ESQ., EDITOR THE IRRIGATION AGE, Chicago:

Dear Sir—I am sending you by M. O. the sum of 6s 3d, being a year's subscription for 1903.

I had written to my agents at Bombay to discontinue sending me the journal for 1903, but when I received direct from you a copy, the No. 1, Vol. XVIII., of the journal, in its present improved state, I could not resist the temptation of continuing to subscribe.

I have brought the journal to the notice of our chief engineer for irrigation and a friend at Surriapett, and both of them would like to subscribe. Yours faithfully,

H. DINSHAW.

SHOULD ALKALI LAND BE IRRIGATED?

The above is a subject that has puzzled the best of farmers for many years here at Greeley, Colo., but as years roll on it is generally believed that seepage land, where alkali exists, necessarily has to be irrigated more thoroughly and more often than where it does not exist, because while this land is apparently moist enough to grow a crop, yet you will find the crop will come up and then begin to grow thinner all the time. It is the alkali burning off the young, tender plant, but if thoroughly irrigated before plowing, it will cool off the alkali until the crop gets up, and as soon as yellowness appears it should again be thoroughly irrigated. Although the ground be apparently wet, the irrigation will again offset the alkali until the crop matures. Two irrigations are generally sufficient to grow a crop here. We find the crops that do the best on alkali land are: First, sugar beets; second, barley; third, oats. Irrigation has no tendency to make the ground permanently wet.

JOHN G. HALL,
Greeley, Colo.

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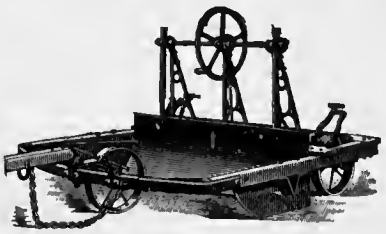

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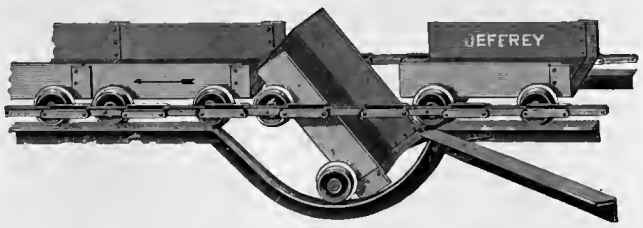

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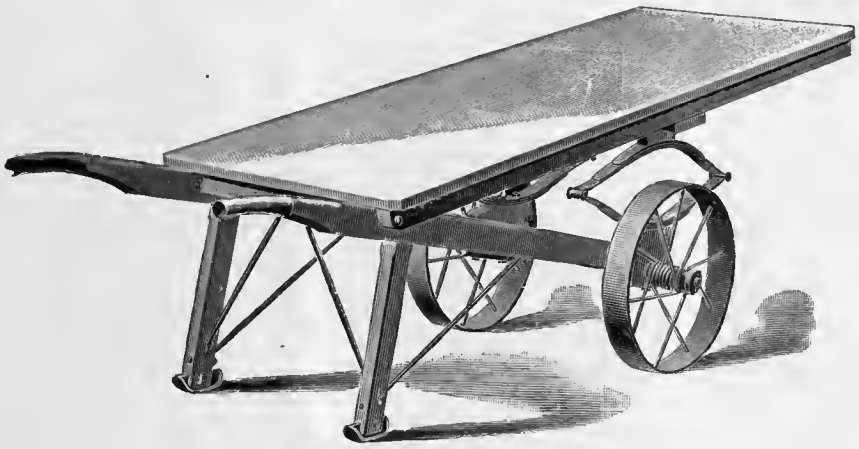

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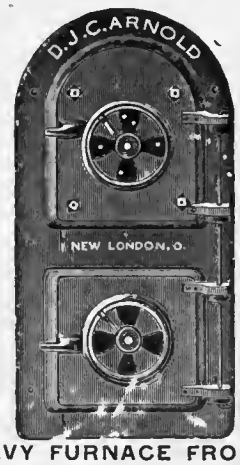

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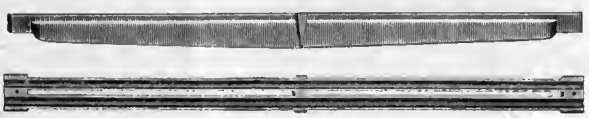

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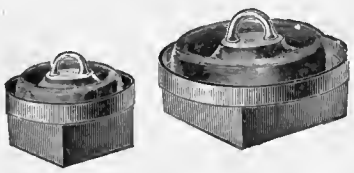

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THE IRRIGATION AGE

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THE IRRIGATION AGE

THE D. H. ANDERSON PUBLISHING CO.,
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D. H. ANDERSON, Editor.

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A monthly illustrated magazine recognized throughout the world as the exponent of Irrigation and its kindred industries. It is the pioneer journal of its kind in the world, and has no rival in half a continent. It advocates the mineral development and the industrial growth of the West.

EDITORIAL

Strange Reports. Strange reports come to us from Arizona about the way prominent Government officials are "playing in" with Maxwell. These reports are now being investigated and the facts will be given publicity as soon as the necessary information is in hand.

What is Your Opinion? We ask every candid reader to tell us whether it be possible to give any more useful, valuable and diverse information than that contained in this number of the AGE? If you think we are omitting anything drop us a postal and we will remedy the defect.

New Names. THE IRRIGATION AGE has secured during the past six months the names of over 70,000 people interested in irrigation, all of whom will receive sample copies of this journal with a view to securing them as regular subscribers. This list has been carefully prepared at a heavy expense and is so far as we know the only correct list of actual irrigators in existence. The above facts should be of direct interest to all advertisers. Please remember that THE AGE is the pioneer publication of its class in the world and an advertisement in its columns will produce satisfactory results.

Drainage by the Sea. We commend to our readers the article by Prof. C. G. Elliott, to be found on another page. The results attained by the drainage of what may be termed "Sea lands," are so unique, as well as surprising, that the interior agriculturist who has less difficulties to overcome may well take heart of hope.

Make No Mistake. The Primer of Irrigation, although treating of arid, semi-arid and irrigable lands specially, treats generally of soils, plants and general agriculture. The book will be equally as valuable in the East as in the West, and the man who lives in a swamp will find it as profitable as the man in the desert. It leaves very little unsaid about land and plants.

The Redemption of a Hundred Millions. We are indebted to "Opportunity" of St. Paul, Minn., for a copy of the special article on the above subject written by United States Senator H. C. Hansbrough, of North Dakota, the father of the irrigation law. In the article, Senator Hansbrough gives opinions and advice it were well worth heeding. One particular statement will appeal to the public generally: "The law is thoroughly safeguarded so as to prevent speculation." This seems too good to be true, and we shall wait with bated breath for that enforcement of the law which will bring on an anti-speculation millennium in homes for the great mass of the people.

Arkansas Valley Awakens. In this issue appears a full report of the proceedings of the Irrigation Convention, held at Garden City, Kansas, April 16-17. The question involved and discussed by practical men is somewhat novel—we refer to the "underflow" of the Arkansas River—and opens up an immense vista in the horizon of irrigation. The new Association purposes settling down to serious business without delay.

Huge Irrigation Projects. Our Washington correspondent tells about five irrigation projects to be undertaken by the government this summer. It is claimed that the "desert is to be made to blossom as the rose." We hope it will be, and we believe it will be unless——

An inkling of what comes after the "unless," may be gathered from the "Influences in the National Irrigation Program" on another page. It will be well not to gather the "desert roses" until some of the thorns are sliced off.

The Primer of Irrigation. We are plowing deep into every source of information, gleaning points from hundreds of personal experiences, and utilizing every plain, simple, scientific point to make "The Primer of Irrigation" something worth possessing by every farmer, as a ready counselor in everything pertaining to agriculture. The preliminary chapters are gradually working up to the irrigation point as our readers will perceive. Order a copy now with your subscription at reduced rates. The next chapter will be on Semi-Arid and Arid Lands, and contain facts not generally known.

In Regard to Salt River Valley. THE AGE is in possession of some strange, not to say "startling" information in relation to matters with which Mr. George H. Maxwell's connection with certain dealings and transactions that will not look pleasant when brought into the full light of an inquiry.

If those residents of Salt River Valley, Arizona, who are asking us to take this matter up and expose the methods of Mr. Maxwell and those practised by persons whom he appears to control, will have a little patience, THE AGE is certain they will be fully gratified with the results we have in expectation.

Indeed, we may say, that the evidence is fast accumulating, and it will not be long ere the whole case will be made up and placed before the readers of THE AGE, as well as laid before authorities who will take some more definite action than merely talking about it.

It must be apparent to even the casual reader that to eliminate only one disturbing element would still leave a strong leaven of others to continue operations. Wherefore THE AGE deems it best to provide for a clean sweep in the Irrigation Augean Stable, and our readers may rely upon it that no one will be spared, and that the pernicious influences combining against law, justice and common decency will be swept away to afflict loyal and true, hard working and energetic home seekers no more.

The National Irrigation Association. This number of THE AGE contains another installment of the editor's side lights on The National Irrigation Association. The reader will observe by a perusal of the article that Mr. George H. Maxwell, who, for some inscrutable reason, seems to have been permitted to absorb the entire Association, is building for George H. Maxwell, a very laudable enterprise generally, but rather "scaly" to say the least, in a matter of so much public interest as irrigation. It is using the skin of the animal for personal purposes and giving the public the tail. This it refuses to accept, or any other "leavings."

The editor asks why Maxwell has departed from his ardent admiration of state irrigation laws and the leasing system? The conundrum is answered by giving the "objects of the National Irrigation Association" as set forth in its Constitution, following with the "Publication and Work of the Association."

There seems to be considerable of a clash between Mr. Maxwell's views and the objects of the Association, but when these objects conflict with Maxwell's "plans," which are purely personal, why, the constitution and by-laws have to yield, sometimes even the government of the United States. This means that George H. Maxwell and the grandiosely styled, "The National Irrigation Association" are such close affinities that they cannot be pulled apart. Indeed, we are surprised that Maxwell did not include in his scheme the entire earth, and the canals of the planet Mars. He was probably prevented by the fact that they were beyond his reach.

The article starts out with the statement "Probably the greatest deception that has ever been worked on the Irrigation Congress has been through the agent of the so-called National Irrigation Association," and then goes on to demonstrate the proposition. What are we going to do about it? Well, it would not be good generalship to disclose plans in the presence of an enemy to the public welfare.

The public have, through sad experience, acquired the impression that an expenditure of public money means a "steal" of some kind. This betrays a lack of confidence which every honest official should make an exertion to restore. A grand opportunity is afforded him in the irrigation money. And not only the lost confidence of the public should be regained in money expenditures, but sought strenuously in executing the law for the public benefit—for legitimate homeseekers, and not for the private gain of certain "carpet baggers," who

have no more settled local habitation or domicile than carrion crows who follow the scent of their prey from afar off.

If this is refused, or neglected, then there is a way to call them to account, and give them short shrift. The condition of unrest that prevails everywhere, in spite of "an unexampled prosperity" portends an upheaval of the people, and so far as thwarting the spirit of the national irrigation laws is concerned, THE IRRIGATION AGE will be the first to fire the match to explode the volcano.

Talisman-ic Bugle Notes.

The "Talisman" authored by Mr. George H. Maxwell, of Chicago, and also numerous other localities where it is his peculiar policy to be, contains in its April number, some highly appropriate and valuable hints, the presence of which in the columns of the Maxwell organ, we cannot explain except by assuming that the executive chairman of the National Irrigation Association was busy censuring the Salt River Valley complaints.

Speaking of President Roosevelt's public land policy, and heaving a deep sigh because "me and Roosevelt can not make the laws and have the power to enforce them according to my sweet will," he says:

"Public sentiment is being awakened even in the West, and the shocking frauds which have been perpetrated upon the people in carving out of the public domain the immense number of great ranches now to be found everywhere in the West, have startled the people even in that region into a realization of the resulting evils of land monopoly."

How shocking! And to think that "even in the West," this has just been found out. Again the great purifying filter passes this great thought through its brain sand. It is the "Keynote," the harp of a thousand strings, struck by Mr. Roosevelt in his message to Congress:

"The one guiding purpose of the administration in dealing with forestry, with pasturage, with irrigation, with the land generally is to help and make easy the path of the home-builder, the small ranchman or tiller of the soil, and not to let the land be exploited and skinned by those who have no permanent interest therein, and who do not build homes, or remain actual residents."

These words should be hammered in the brazen columns of the "organ" until the noise of the pounding compels the editor to remember them in all his dealings with irrigation matters.

The "bugle blast" in the Senate Report also finds its way in the Talisman-ic instrument, inadvertently, perhaps, and what covers the other designs of its editor with plausibility as to purity of motives, is the fact that it is printed in black face letters like this:

"There should be but one act upon our statute books under which public lands can be acquired, and that one act should be a genuine homestead act which imposes a residence of five years and continuous cultivation of the soil—an act having no commutation provision attached to it."

There once lived a dramatic genius named William Shakespeare, who knew and understood human nature better than any man who ever lived, and his writings to this day are mirrors to modern humanity.

In his Merchant of Venice, Act I, Scene III, he makes one of his characters say:

"The devil can cite Scripture for his purpose.
An evil soul producing holy virtues
Is like a villain with a smiling cheek;
A goodly apple rotten at the heart:
O, what a goodly outside falsehood hath!"

Ordinary people in Shakespeare's time, ran against this sort of bluff, and did not know what to do about it; we, of modern times, call it.

THE IRRIGATION AGE.

We are much pleased with not only the improved appearance, but with the marked change for the better in the editorial and reading matter of *The Irrigation Age and Drainage Journal* since coming under the management of its present editor, Mr. D. H. Anderson. We are especially pleased to note that he is broad enough to champion the best interests of the people who have cast their lot and are now building for themselves homes in the coming arid West Empire.

We have watched and read *Irrigation Age* from its beginning, followed it through its trials and disappointments, and we now predict for it a brighter and more successful and useful future than ever before in its history.—*Modern Irrigation.*

NATIONAL IRRIGATION CONGRESS.

It is doubtful if at the coming meeting of the irrigation Congress, to be held at Ogden, Utah, this fall, the question of merging the congress with the Trans-Mississippi Congress will be brought before the congress at all. The fact is, the people of the arid West have been posting themselves and learning the true inwardness of the great desire exhibited by a few at Colorado Springs last year to merge. It has developed that it was a smooth deal, sprung without notice on the convention by Mr. Maxwell and his friends to place the Irrigation Congress fully in control of one Mr. Maxwell and his wealthy constituents—"yearly contributors"—repeating the expression, of Mr. D. H. Anderson. He says: "Maxwell's actions and seeming control of the congress last season led me to wonder whether this was a national irrigation association, controlled by the people, or a personal Maxwell association."—*Modern Irrigation.*

Hon. William Sturgis, in an article on "Colonization and the Arid West," in the *Wyoming Industrial Journal,* published at Cheyenne, makes this good point:

"The rainfall, beneficent as it is, brings to the soil pure moisture only, while with every gallon of water passing through our acequia comes its percentage of fertilizing silt, to irrigate the farm land and to replace its exhausted elements. An irrigated farm never wears out."

INFLUENCES IN THE NATIONAL IRRIGATION PROGRAM.

BY D. H. ANDERSON.

(Continued from April Number.)

THE NATIONAL IRRIGATION ASSOCIATION.

Probably the greatest deception that has ever been worked on the Irrigation Congress has been through the agent of the so-called National Irrigation Association. This organization was formed to attract those having an interest in national irrigation and to cover up the real purpose of the organizer when advocating policies which could not be openly indorsed by the interests giving him employment.

The readers of THE AGE already know where we stand relative to this organization. Any irrigation society which has a purpose that can be commended in any way we are ready and willing to indorse in so far as it serves some good purpose, but so far we have been unable to detect anything in the National Irrigation Association which warrants the support of those who desire to aid the irrigator. We have had some correspondence with members of the association, and wherever the organization has been unqualifiedly indorsed we have found that those indorsing it are in the employ of the same corporations that furnish the main support to the association. We know that wherever members have become fully acquainted with the purposes of the association and have not received a pecuniary inducement which leads them to favor it, they have withdrawn their support. We can refer those who wish to be satisfied as to the truth of this assertion to former members of the association, upon whom we have depended for much of the information set forth in this paper.

The prime mover in the association is a lawyer of the name of George H. Maxwell, a man who has commendable convictions to which he once gave utterance. His talents and even his personality, upon which latter he largely depends, might be of some service to the country in carrying out the program for the reclamation of the West, but he has voluntarily arrayed himself against the actual irrigator and homebuilder. Some three or four years ago, Mr. Maxwell submitted to the trans-continental railroads a plan for carrying on a campaign favoring national aid. His first recommendation was for the organization of the National Irrigation Association. He realized that he must have some kind of an association to work under, and hence he resolved to conceal the real object of his mission and at the same time secure support from those who were being deceived. It is surprising that the association has lived for three or four years. Those of its members who desire to simply further the extension of national aid through their influence and efforts deserve the commendation of the western people for their good intentions and for whatever wholesome influence they may have had in the management of the association. We do not wish to appear to criticise the trans-continental railroads in this connection, for we have repeatedly stated that they can be, and are, of great service in the development of the West. What we do say, and with understanding, is that their confidence has in this case been misplaced. We do not believe that it is to the interests of the railroads to secure the adoption of all of the policies advocated by Mr. Maxwell.

In the plan referred to, Mr. Maxwell set forth the objects of the National Irrigation Association. He has not adhered to these when he found it expedient to depart from them in carrying out his campaign. In the first section he recommends the construction of irrigation works under the plans submitted by Colonel H. M. Chittenden. He has gone far astray from the advice of Colonel Chittenden. Section 2 relates to public surveys. Section 3 recommends the leasing of the grazing lands and the expenditure of the funds thus collected in the construction of irrigation works. Mr. Maxwell states that although he once openly favored and worked for the leasing of the public grazing lands at a nominal rental in limited areas to settlers farming adjacent lands, he is now unequivocally opposed to any such plan. He explains the change in his attitude by saying that he never believed in leasing, but that he supported it only as a part of a general compromise measure. Is it not strange that he should commit himself as favoring a leasing system in setting forth the objects of an independent association of his own creation? Section 4 relates to the protection of the forests. Section 5 advocates the adoption of a harmonious system of irrigation laws throughout the West. Mr. Maxwell now believes that state irrigation laws are unnecessary, that a few court decisions will answer all purposes, and that state engineers are a menace to the irrigation interests of the West. We have noticed that he does not carry on an active campaign in those states where state engineer's offices have been established and where the irrigator is fully protected. A few years ago Mr. Maxwell was an ardent admirer of the Wyoming irrigation law. He advocated its adoption by other states. He was an equally strong adherent of the leasing system. Why has he departed from either?

OBJECTS OF THE NATIONAL IRRIGATION ASSOCIATION AS SET FORTH IN THE CONSTITUTION.

OBJECTS OF THE ASSOCIATION IN 1901.	OBJECTS OF THE ASSOCIATION IN 1903.
1. The establishment of a national policy for the construction of storage reservoirs as internal improvements by the Federal Government as recommended in the Report of Colonel Hiram Chittenden to the Chief of Engineers, U. S. A.	1. The adoption by the Federal Government of a permanent policy for the reclamation and settlement of the public domain, under which all the remaining public lands shall be held and administered as a trust for the benefit of the whole people of the United States, and no grants of the title to any of the public lands shall ever hereafter be made to any but actual settlers and homebuilders on the land.
2. The survey of the Federal Government of the irrigable public lands so that each tract of irrigable land susceptible of reclamation by irrigation from a common source and by the same system of works shall be segregated and platted as a whole and the water supply available and system of works necessary for its reclamation shown.	2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.
3. The reclamation of the irrigable lands and utilization of the grazing lands, leasing of the grazing lands, and the building of irrigation works with the revenues and the construction wherever necessary by the Federal	3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.

Government itself of the irrigation works for the reclamation of the irrigable public lands, the land reclaimed to be sold to actual settlers only in small tracts with a proportional interest in the water supply and irrigation system, the ownership of which shall be united to the land.	
4. The preservation of the forests as the sources of water supply, the conservation of existing supplies by improved methods of irrigation and distribution, and the development of the water resources of the arid region by the investigation of underground sources.	4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.
5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories, under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the measure of the right.	5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.
6. To hold an annual Congress, and to diffuse by public meetings and through the press, information regarding irrigation and the reclamation and settlement of the arid public domain, and the possibilities of better agriculture through intensive farming.	6. The holding of an annual Irrigation Congress, and the dissemination by public meetings and through the press of information regarding irrigation, and the reclamation and settlement of the arid public domain, and the possibilities of better agriculture through irrigation and intensive farming, and the need for agricultural education and training, and the creation of rural homes as national safeguards, and the encouragement of rural settlement as a remedy for the social and political evils threatened by the congestion of population in large cities.

PUBLICATIONS AND WORK OF THE ASSOCIATION.

Three or more periodicals have been published wholly or in part by the association during the past two or three years. The "National Advocate" has undergone numerous changes and it is now known by the catching title of "The Homemaker," published in Washington, D. C. "Maxwell's Talisman," another monthly, is published in Chicago and mailed from 1707 Fisher building. The third is a co-operative affair known as "Forestry and Irrigation," also published in Washington. It might be supposed that with all this printed matter distributed to men of influence, the program of the association would have but little opposition. The trouble with the publications has been that Mr. Maxwell has taken advantage of the liberty given him to air his personal grievances and criticise those who differed with him, rather than maintain such a position as would appeal to the judgment of the reader. He has also had some difficulty in explaining satisfactorily his reasons for changing his attitude upon several public questions and in accounting for the means whereby his propaganda is able to carry on such an expensive campaign. These questions would not have arisen if his work had been carried on in the open, as could have been done if Mr. Maxwell believed that those who furnished the funds for his campaign would indorse fully the policies of the association.

In addition to the publications, the association has carried on work in various fields. Converting eastern congressmen to the theories of the association has been one of the duties to which Mr. Maxwell has assiduously devoted himself. His methods for carrying on this campaign have been interesting to the looker-on and anything but pleasant from the standpoint of a dilatory congressman. Should a representative of the people fail to at once fall in with the plans of Mr. Maxwell, the Washington end of the fight is not considered and all efforts are directed towards securing an indorsement from constituents. Commercial and labor organizations of the various towns of the district receive notice that the chairman of the executive committee of the National Irrigation Association desires to speak before the bodies and arrangements are generally made for this purpose. Resolutions, always ready, are introduced, and, as a rule, indorsed. These are not slow in reaching the congressman, much to his dissatisfaction.

Labor organizations, which have been freely called upon for this service, have often adopted resolutions at Mr. Maxwell's solicitation when they are arrayed against the corporations which furnish the funds for his campaign.

Many letters have also been sent out from Washington and Chicago, having for their object the direction of sentiment in favor of the policies of the association. Newspapers have been looked after, and early in the campaign much of the material provided by the press bureau was published. Of recent years, however, as the purpose of the organization has become more widely known, this matter has been deposited in the waste-basket. The articles thus gratuitously furnished have varied greatly in character, but all have some "moral" of value to the association or those benefiting indirectly from its work. The papers of the east, where irrigation is not generally understood, and where the importance of the articles published has not been appreciated, have fallen comparatively easy victims to this press agency. None of the articles, as would be supposed, deal with the responsibility which Congress has imposed on the states by the acts already referred to. On the contrary, the states and territories have been cautioned not to enact comprehensive irrigation laws lest government construction might be interfered with. No stress has been laid on the duty the states owe the individual irrigator who is already on the ground.

MEMBERSHIP AND FUNDS.

THE AGE has already referred to the membership of the association. Mr. Maxwell refuses to furnish a list of the members, and as they are scattered over the country, it is difficult to obtain it in any other way. We have learned to our satisfaction that the membership approximated 2,000 in the balmy days of the association and each member contributed $5.00 per year to the treasury, over which Mr. Maxwell has been the watchdog. The president of the association has been a figurehead, all business having been transacted by the chairman of the executive committee, Mr. Maxwell. The funds have gone for various purposes, but chiefly to the publication of the organs through which the association has attempted to "educate the west" as to the proper national irrigation policy. It has cost something to

secure members for the association, and commissions have been given to persons who have been able and willing to do this kind of work. We have talked with men who have been so engaged and we believe that it would be almost impossible to add to the present list of members even if greater inducements were to be held out. We are confident that but few new members will ever be secured in the west.

Besides the funds derived from the membership, the transcontinental railroads have placed $30,000 per year at the disposal of Mr. Maxwell and his colleagues. This has gone largely to support the Washington press bureau and the publications sent out from that place. Mr. Maxwell's expenses and salary are probably paid from the same fund. We assume that an account of the expenditures under this voluntary contribution from the railroads is furnished them by Mr. Maxwell, but this has nothing to do with the funds brought in by the association. It has been impossible to learn what kind of financial arrangements have been made by the association, no statement as to receipts and expenditures having been published. The members of the association, as far as we have been able to discover, know as much regarding this as does the public at large. The Irrigation Congress and other organizations make all such matters public and we see no reason why, if the National Irrigation Association stands for anything that should receive the indorsement of the people interested in irrigation, it should not do the same.

The statement has been made, and in good faith, that the National Irrigation Association is connected with the Irrigation Congress, but we take the ground that no relation exists. There would have been no occasion for such a belief if the Congress had not accepted, through Mr. Maxwell's influence, the members of the association as accredited delegates. We believe that the time has arrived when the Congress should be composed of men other than those who may feel disposed to pay $5.00 per year towards the support of Mr. Maxwell. The members of the association, if they so desire, will have no trouble in securing other credentials and thus lessen the possibility of confusing the two organizations.

That Mr. Maxwell has used this large sum of money to further selfish schemes to the detriment of the irrigation interests of the country can not be doubted; that the transcontinental railways, have not, as yet, been reimbursed for their outlay is evident. As long as their present agent represents them we believe that neither they nor the western farmer will be able to receive any direct benefit.

During the summer of 1901 it seemed that something would be done in the next Congress looking toward the reclamation of the west. Those interested in the matter in the various states of the arid region naturally desired to see a plan drawn up at an early date which might be indorsed generally. A meeting was called therefore by the state engineers of a number of the states and all congressmen who found it convenient joined these officers at the time and place designated. The argument of the engineers was that the people of the states of the west were best informed as to the needs of those states and that if the funds received from the sale and rental of public lands could be devoted to the construction of canals and reservoirs the state engineers should be intrusted with the work. There are many strong reasons why this would have been a good policy and we are not prepared to say that the government can carry on construction work to as good advantage as can the states where wise and comprehensive irrigation laws have been provided. Water belongs to or is under control of the states. State engineers are acquainted with the needs of the various districts where irrigation is practiced and would therefore be able to locate works where the greatest good might be accomplished. These officers understand the water right complications of the state and have an interest in the welfare of their own commonwealth that cannot be equalled by an officer of the general government. The lands from which the funds arise are now located in the states to be benefited and their disposal depends somewhat upon the character of the administration of any reclamation service. Should the government require that the states must first organize offices to supervise the diversion and division of water before aid would be extended, much of the injustice now being done the irrigator would be ended and the state would be in a position to prosecute construction work immediately thereafter. Above all the policy of the reclamation service could not be dictated by one man as it is at present.

While the meeting of the state engineers and congressmen was in progress, Mr. Maxwell appeared and condemned the policy in vigorous terms. He saw that that if the work should be divided in this way his influence with those in charge would be diminished, if not altogether destroyed. The object of the meeting was primarily to enable those interested to exchange ideas, but when adjournment was taken it was agreed that western congressmen should be called for a conference before Congress convened in December, 1901. This conference was to be held in Washington. Mr. Maxwell also appeared there and had a part in framing the bill which was submitted to Congress. Because the bill did not suit him in some respects he instituted an active fight against its passage during the late winter and early spring months of the following year. He was finally called into line in a way that has not, as yet, been explained, and since the passage of the bill he has appeared to indorse it in every particular.

[To be continued.]

"DISILLUSIONED."

A poet came from 'way back East
Unto the glorious West,
Whose charms, he claimed, had ne'er by pen
In fitting garb been dressed.

He wrote of mountains, mesa, butte;
He sang of azure skies,
Whose blue he likened to the blue
Of the western girl's bright eyes.

His noblest effort, so he thought,
Was on a murmuring stream
That rippled 'tween alfalfa banks,
A sweet, soft-slumbering dream.

He took this to his western maid.
She laughed—the little witch—
And cried: "That stream? Ha! ha! Why, that's
Dad's irrigating ditch!"

—Florence Ansley Perkins in Sunset Magazine.

RECLAMATION OF ARID AMERICA.

Imperial Settlements.

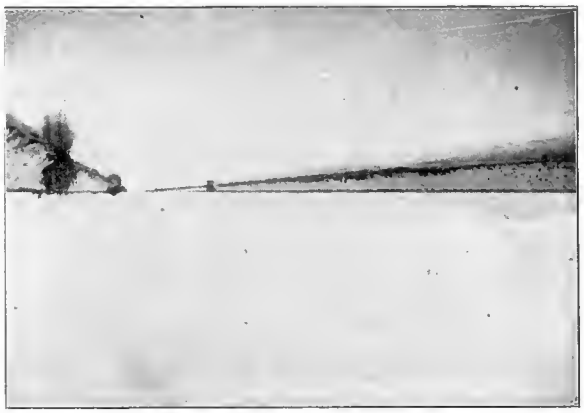
BY G. M. M'KINNEY,

GENERAL IMMIGRATION AGENT SOUTHERN PACIFIC RAILWAY.

During the month of September, 1902, I was called upon to make an examination of a piece of territory known as the Colorado Delta, lying some 80 miles from Yuma, Arizona, known as the Imperial Settlements, irrigated by the Imperial Canal. I had known this territory for years as a great desert, and the opinion of many who claimed to be experts along the lines of irrigation, regarded it as practically irreclaimable. This piece of territory consists of 500,000 acres of land in San Diego county, Cal., and 300,000 acres in Mexico, just south of the California line, or along the United States boundary line that divides the United States from the Republic of Mexico. Originally this piece of territory was the great settling basin of the Colorado river, and for many centuries has been constantly replenished by organic matter and silt from the annual overflows of this great river. For many years the scientific men of our country have disagreed as to what use could be best made of this great basin, which lies from sea level to 250 feet below it. Some advised the construction of a canal from the Colorado river thus allowing it to fill with fresh water for the benefit of commerce. Others thought it best to cut a canal from the Gulf of California to the Saltoun Basin, thus making an inland sea, 50 miles in width and some hundred miles in length. None of these ideas, however, materialized. It was my province during the year 1890 to become acquainted professionally with a gentleman who had long been identified with the reclamation of the arid lands of the West. The gentleman referred to is C. B. Rockwood, who in recent years has accomplished the most wonderful results through his thorough knowledge of irrigation, his foresight, good judgment and close application to business. The reclamation of arid lands being the business of his life. I had not heard from Mr. Rockwood for many years, except incidentally, as he had been employed by our Government in Porto Rico, and by individual corporations throughout various points in the West, as consulting engineer. I was agreeably surprised, however, to find Mr. Rockwood located in the Colorado Delta with headquarters at Calexico, a new town on the American side near the Mexican border some 70 miles Southwest of Yuma in full charge of the Imperial canal. Under him were several large corps of engineers, grading outfits and steam shovels and dredges, all fully equipped for the prosecution of their work in estimating, surveying, and constructing canals, laterals, and reservoirs for the reclamation of this vast territory from the Colorado river west to the Salton basin, a distance of 100 miles.

G. M. McKINNEY.

Mr. Rockwood conceived the idea of reclaiming this vast territory early in '92 and worked unceasingly, encountering untold difficulties and discouragements. An occasional capitalist would become interested soon to get discouraged and drop out of the proposition. Believing, however, that the reclamation of this territory would prove one of the greatest acquisitions to agriculture that had ever been developed in the known world, he continued to prosecute his work with that tenacity of purpose which has invariably crowned the efforts of enterprising men, and today Mr. Rockwood stands at the head of this great enterprise, the master workman reaping the benefit and rewards of this great effort through those years of discouragement.



VIEW OF THE MAIN CANAL.

I will say in this connection that A. H. Heber, president of the Imperial Canal Co., stood by Mr. Rockwood through all those years of discouragement, having implicit faith in his judgment, and I can without reservation say that these two gentlemen stand at the head of one of the greatest and most successful enter-

FIRST CATLE RANCH IN IMPERIAL.

prises that has ever been perfected in our country in all its history. The Imperial canal is the largeest of its kind in the known world. The headgate or intake of this canal is located in the west bank of the Colorado river, four miles west of Yuma. It is 125 feet on its base, ten feet below the lowest water mark of the Colorado river, with a solid stone foundation, all sub-

BARLEY CROP AT IMPERIAL.

stantially built of solid concrete. From the intake the canal runs in a southerly direction along the west bank of the Colorado river until it reaches what is known as the old bed of the Salton. From this point the canal takes a westerly direction to the Imperial Settlements. Today the present canal with its laterals, reservoirs and settling basins, is over 400 miles in length and completed at an expenditure of several millions of dollars. There is no question as to the successful future of the Imperial Settlements. In no place in the reclaimed districts of the West where lands have been brought under successful irrigation have I found such a variety of agricultural products maturing perfectly. Vegetable products of every character, wheat, barley, oats, rye, rice, cotton, alfalfa, sugar beets, corn, kaffir corn, broom corn, Egyptian corn, milo maze, millet, sorghum, tomatoes,

HEAD GATE OF CANAL NEAR YUMA.

melons, beans, okra, peppers, all reaching a perfect growth and maturity. I speak authoritatively from the fact that I went over the entire district and learned that by actual producers it was estimated that as much as 30 tons of sorghum, milo maze, and kaffir corn was grown to the acre, while alfalfa was cut as many as six times, yielding from a ton to a ton and one-half per acre. So it is a foregone conclusion that, as a forage producing territory, it will have no superior in the United States. Hogs and cattle are being shipped into the Imperial country from California and Arizona in large quantities. And it is a foregone conclusion that the Imperial country will in the very near future become one of the greatest feeding countries of the Southern Pacific coast.

The barley fields of the Imperial Settlements

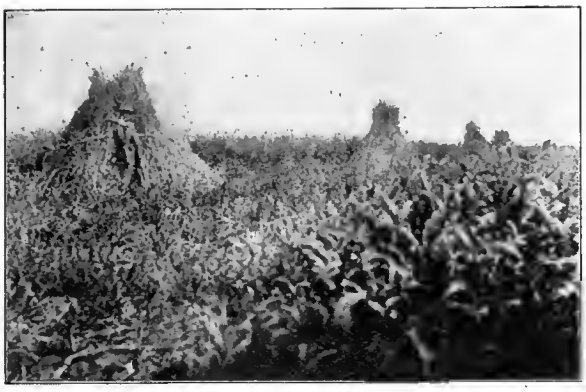
VIEW OF MAIN CANAL, IMPERIAL.

yielded from 50 to 75 bushels per acre. Early vegetables such as cantaloupes, melons, okra, peppers and tomatoes making marvelous yields, and melon growers at the present time can place their product on the market in large quantities earlier than any other part of the United States, and they can be shipped to any portion of our

ALFALFA FIELD, IN IMPERIAL.

country without difficulty. Near the headgate of the Imperial canal there are a number of date palm trees, and I had the pleasure of exhibiting the first bunch of ripe dates ever shown in this country in our Chicago office, and the date expert for the agricultural department of the United States is authority for the statement that this is the only place known in America where the most delicate varieties of the date palm "the Neglettnoor date," will perfect its fruit. This is a desert date and is imported to the United States only in small quantities and sells readily here at 50 cents

per pound. Same authority also states that a date orchard can be brought into bearing in six years' time, and at the end of that time will yield fruit that will pay interest on the investment of $2,000 per acre.



CUTTING SORGHUM CROP AT IMPERIAL.

Sugar beet has been thoroughly tried. I had in my office sugar beets grown in the Imperial Settlements that weighed as high as 13 pounds each, and never have I known sugar beets to thrive and mature as

BAILING HAY IN IMPERIAL.

they mature under the Imperial canal, and it is my opinion that it will become one of the best sugar beet sections in the United States. It has been estimated by experts that this country can support ten or more

MILLET CROP HARVESTED, WITH SORGHUM IN DISTANCE, IMPERIAL.

sugar beet factories equal to the one at Oxnard, Cal., and the seasons are much longer for the production of sugar beets in this territory than in any other part of our country. Settlers are coming into this country rapidly and the Imperial people have sold water for over 200,000 acres of this land up to the present writing.

The towns established along the new lines of railway and in various parts of the territory are already becoming business centers. Banks, stores, telephone systems, telegraph systems, newspapers, ice and refrigerating plants and power plants of various kinds, schools and churches, all have been established within the short space of two years. The Southern Pacific Railroad has completed a branch line from the town of Imperial to its main line, leaving the same at Old Beach Station, 70 miles west of Yuma.

To give the reader an idea of the business-like methods that the company has pursued that constructed this great canal. Recognizing the fact that it was de-

CUTTING BARLEY IN IMPERIAL SETTLEMENTS.

sirable that the owners of the land should own and control the irrigated systems and water rights, a system of mutual water companies was incorporated, under the laws of California, the stock of which company should

HOGS AT IMPERIAL.

be owned by the owners of the land to be irrigated on the basis of one share to every acre of land. These companies to obtain their supply of water from the Imperial canal at a fixed price, which price enabled the irrigators to get the best water in arid America, considering the fact that an abundance of water could be had every day in the year. These mutual water companies were incorporated to furnish water to their stockholders only, so that those who locate on these lands fully understand that to become a stockholder in these mutual companies, it is absolutely necessary that they become absolute owners of the water. These mutual water companies were incorporated to furnish water to

their stockholders only, so that those who locate on thes lands fully understand that to become a stockholder in these mutual companies it is absolutely necessary that they become absolute owners of the water. These mutual companies were also put on an equal footing as regards cost of stock and cost of water, so that there was no cents per acre foot, which is equal to about 2 cents per inch for 24 hours' flow. The owner of the land is entitled to receive four acre feet for every acre of land for which he owns water stock should he need the same, but he is required to take at least one acre foot of water per annum for each acre every year. Each mutual water company owns its own distributing sys-

FLOODING THE LAND AT IMPERIAL.

tems of water and manages that system for distributing the water under its own control among its stockholders.

As these lands are all held by the Government and subject to delivery under the Desert Land Law of the United States, the individual can locate 40, 80, 160, or 320 acres, as the case may be, by paying the United States Government $1.25 per acre for the land, and can purchase a perpetual water right for the same from

A FIELD IN MILO MAIZE.

the mutual water companies in the district that these lands may be located in at $15.00 per acre on easy payments; $2.50 a share at the time of purchase and $2.50 per share on the first day of January of each year until possibility arising as to priority to right, as there is more than water enough for all. Up to date there has been six water companies incorporated, covering 360,000 acres of land. Each of these companies has a contract with the Imperial Canal Company whereby it is to receive perpetually from the main Imperial canal water for as many acres of land each season as it has outstanding sales of stock at the uniform price of 50 paid, with 5 per cent interest on the deferred payments. There is no question as regards the water supply, as

SORGHUM FIELD NEAR IMPERIAL

the Colorado river is a navigable stream, and after this canal diverts water enough from the river to irrigate 800,000 acres of land the stream will still be navigable. By actual analysis an acre foot of water taken from this canal carries a value as a commercial fertilizer worth $3.42 per acre. Consequently lands irrigated by these waters must continue to be fertilized indefinitely.

The climatic conditions in this territory are much like that of the Salt River Valley in Arizona or the Sacramento Valley in California. The summers are

CANE GROWN NEAR CALEXICO.

hot and dry, the winters cool and pleasant, and for nine months in the year no more enjoyable climate can be found anywhere in the world. This fact alone will eventually make it one of the most popular resorts on the Pacific coast.

In conclusion I will say that it was the marvel of the age and it only proves what I have long believed —that in the near future the arid regions of the West will become the most prosperous and most thickly populated districts in the United States, as the wealth producing power of the average irrigated lands where the water supply is ample, is equal to that of any portion of the Mississippi valley multiplied by five, where natural moisture is relied upon.

WESTERN KANSAS IRRIGATION ASSOCIATION.

REPORT OF PROCEEDINGS OF IRRIGATION CONVENTION, GARDEN CITY, KANSAS.

This is a new association organized "for the promotion of practical irrigation." A convention of representative farmers and business men of the Arkansas valley met at Garden City, Kansas, April 16 and 17, and the above organization was the result.

There was nothing "political" in the convention, and its labors from beginning to end were actuated by public-spirited motives, and the public welfare. I. L. Diesem was chairman and the convention was addressed by numerous practical men. The Republican and Democratic candidates for congress addressed the convention and other noted persons also spoke, among them Senator Dumont Smith, Professor C. T. Johnson from Wyoming, Captain Hall of Syracuse, W. R. Hopkins of Garden City, Victor Murdock of Wichita, Thomas Lloyd of Rocky Ford, Colo., General Booth-Tucker, and Captain Holland. Vandergriff Turner of Wichita, by means of a chart illustrated his plan of using the underflow, by means of a large well and pipes for two or three miles, carrying water to the surface, to be distributed over the lands. The persons in attendance are very enthusiastic in their ideas of the possibility of the underflow, and seem to be almost unanimous in believing it is the only successful plan for permanent irrigation, and it only remains to develop some plan to bring it to the surface, at a reasonable cost. One of the objects of the convention is to assist in devising some plan to accomplish this purpose, also to get the government interested in reservoirs where there is no underflow.

General Booth-Tucker and Captain Holland were not on the programme, but their addresses were of particular interest on account of the relation to their irrigation and colonization experiment. General Booth-Tucker, before he took up Salvation Army work, was lieutenant-governor of a British province in India, and there became familiar with the crude methods and success of irrigation in that country. He said if the same industry and perseverance should be employed in the Arkansas valley with the modern machinery obtainable here one million persons might be settled in the Arkansas valley between Garden City and Rocky Ford. This region, he declared, with proper energy and small farming, ought to sustain a family on every acre. What is needed are men and money, live people and more cash to settle these people. Colonization is the handmaid of irrigation. Four hundred persons have settled at Amity since the colony was established five years ago. They are good families and getting on well.

TWENTY-ACRE FARMS.

Every family, the general said, has twenty acres and a home, and the head of every family possesses from $4,000 to $5,000. All this was accomplished within five years. The Salvation Army has spent $150,000 to establish this colony, but it will all come back. It costs about $500 to settle a family in the colony, and the colonists do the rest. One-half the colonists are children and they are useful in weeding sugar beets. The colony maintains an orphanage. If the army had the money it could easily settle 50,000 persons in the valley. The army bought 2,000 acres and divided it into small farms.

General Booth-Tucker believes in small farms and intense cultivation. The army sells the land at $40 an acre. Town lots are put up at $300 to $700. This is high, but the scheme is to keep the people on the farms

Captain Holland spoke of the methods of the colony in detail and said the principal products are sugar beets, cantaloupes and cucumber seeds.

OFFICERS OF THE ASSOCIATION.

Following are the officers of the association until the first annual meeting: President, I. L. Diesem, Garden City; vice president, J. C. Starr, Scott City; secretary, C. A. Loucks, Lakin; treasurer, John Hall, Syracuse; executive committee, R. M. Lawrence, Garden City; W. O. Bourne, Scott City; E. R. Thorp, Lakin; J. T. Hastings, Cimarron; I. H. Churchill, Dodge City; Paul Rich, Coolidge; A. A. Barlow, Santa Fe.

RESOLUTIONS ADOPTED.

The convention adopted the following resolutions:

In view of the fact that the Dodge City land district, of which Southwestern Kansas is a part, has confund segregated and set apart by the Federal Governfund segregated and set apart by the federal government for irrigation purposes, we urge our senators and members in Congress to use their united influence to secure at an early date the appropriation of a part of this fund for use in this territory for the building of storage reservoirs or otherwise as may be determined to the best interests of irrigation in this vicinity.

We call attention to the splendid results that have so early been achieved in the Arkansas valley with sugar beets as a result of the bounty generously granted by the two preceding legislatures of the state and hereby express our gratitude to the members of those two bodies who supported and voted for these appropriations. We call attention to the fact that the foundation for a great and growing industry has so cheaply been laid, diversifying and extending our resources, enabling us to support a larger population and to add to the wealth of the state.

Believing that in the economical utilization of the great Arkansas river underflow lie the greatest future results to this valley, and realizing that it is impossible to enlist private capital in any untried experiments looking to that end; and believing that with the expenditure of a limited sum it would be possible to demonstrate the practicability of a plan to bring this underflow to the surface by gravity or otherwise, thus insuring a water supply for the whole valley, we urge the next legislature to make an appropriation for that purpose to be expended under the direction of competent engineers.

THE KANSAS-COLORADO WATER CASE.

Senator Frederick Dumont Smith explained to the convention the purpose of the suit of the state of Kansas against the sate of Colorado over the right to use the waters of the Arkansas river. The convention feared that the suit might affect the farmers living in the valley east of the state line, but Senator Smith relieved them of this apprehension. He said:

"The suit of the state of Kansas against the state of Colorado is a bill in equity for a permanent injunction against Colorado, restraining that state from granting any more charters or other rights to take water out of the Arkansas river. The suit will not affect any ditch now existing, appropriation of water now effected or water rights now vested. It will not affect the rights of any riparian owner. It is to prevent the taking of water from now on, not for riparian lands, but for lands back on the upland, wholly non-riparian in char-

acter, and many miles from the river, depriving true riparian owners in Kansas of the water to which they are entitled for the benefit of non-riparian owners in Colorado. This is the whole gist of the suit."

The convention was attended by delegates representing a large number of counties, and the subject of irrigation before it attracted a great audience of persons interested in the matter personally.

The association's annual meeting will be in Garden City in October, and all irrigation companies, cities, commercial clubs and counties will be entitled to representation.

WYOMING LANDS WITHDRAWN.

On April 25 the commissioner of the General Land Office has issued orders temporarily withdrawing from entry in connection with proposed irrigation enterprises about 368,000 acres of public land located in the Buffalo and Lander land office districts of Wyoming.

DECISION IN SALT RIVER VALLEY RESERVOIR CASE.

The Secretary of the Interior, on April 24th, decided the various points in the controversy among land owners in the Salt river valley in Arizona, over the terms on which thry may secure water from the big reservoir the Government is to build above Phoenix. The Government having decided that when the reservoir shall be built, present owners shall have the preference to water, a dispute arose among those affected as to whether the Government should deal with them as individuals or as a community. The Secretary has decided in favor of the community idea. He also holds that there shall be no preference on account of the age of accrued water rights, but directs that all land holders shall stand on the same basis in securing water from the reservoir. Expenses of maintaining the work will be distributed in proportion to acreage, and mortgages must be given to secure the repayment to the Government of the funds expended in the construction of the works.

The ruling in this case establishes important precedents. The proposed reservoir is expected to irrigate 200,000 acres of land available for growing citrus fruits.

We shall have something to say about this decision in a future issue.—Ed.

ACCLIMATIZING WHEAT.

Plants, like animals, may become accustomed to certain peculiar environments and thrive fairly well. Mr. Fred Bond, State Engineer of Wyoming, in his last official report describes some experiments made in Colorado and Wyoming to grow wheat without irrigation.

In 1886 Mr. Robert Gauss advanced the theory that wheat could be acclimatized and made to thrive under the arid conditions of Colorado, and some years later began conducting experiments to test his theory. In 1896 he planted some improved Fife wheat, but secured at harvesting time but little more than seed enough for the following year. This seed was planted and the experiment continued each year with better and better results. In the spring of 1902 Mr. Bond obtained a pint of this seed and planted one-half near Cheyenne at an altitude of 6,050 feet above sea level, and the remainder near Buffalo, Johnson county, at an altitude of 4,700 feet. From the harvest of the first lot Mr. Bond obtained 9½ pints, a yield of nineteen fold, and from the second lot 21½ pints, or about forty-three fold, although there had been no irrigation of either lot. The effective precipitation at Cheyenne had been 6.38 inches and at Buffalo 4.90 inches.—*Wyoming Industrial Journal.*

CAPTAIN PORTER'S SUB-IRRIGATION SCHEME.

A SAN DIEGO COUNTY, CAL., EXPERIMENT.

"I have always cussed the gopher," remarked Captain Porter, while eating his lunch in Balcom's grocery, "but I don't do it any more; the gopher is my friend, and I am in hopes of training him to do systematic work in a way I have discovered him to be useful. He beats the band.

"That the gopher is a most indefatigable pest I have had reason to know, for what that rat left undone to my young fig and orange trees, likewise to my pet beet patch, was not worth mentioning.

"There was one particular one that multiplied himself into a regiment of sappers and miners, so it seemed to me, and every morning an investigation disclosed a fine tree lying over on its side, or a choice beet pulled down to the top of its leaves

"I studied the habits of the rascal, and finally hit upon a plan to utilize his extensive underground operations. I saw him several times, but as he could easily dodge a bullet or a load of shot, I could not exterminate him by the weapons of war. Hence the idea that occurred to me as the only way to get rid of him. By running a ramrod into the ground here and there, I found that there was not a spot of ground two feet square that was not crossed by a branch of the net work of tunnels my gentleman had constructed for the purpose of reaching succulent roots. 'So,' said I to myself, 'if I can find and stop up the outlets I will have him sure.' They were found and hermetically sealed with broken cobbles and earth. Then I turned the hose into the upper end and emptied a three thousand-gallon tank of water into the runways.

"I persevered for several days, to the great benefit of the young trees and beets by a novel method of subirrigation Mr. Gopher emigrated to a dry climate, I presume; at least I have never had any more complaints to make against him, but I hope he will come back and do some more tunneling. This might not work on a large scale, nor in a prairie dog village, for there are some runways that would exhaust the Mississippi river and a few of its branches before any appreciable diminution of rats would be noticed. However, the waste energies of nature are being utilized to so great an extent, that I expect soon to hear of 'trained gophers' for tunnel work in sub-irrigation schemes."

THE PRIMER OF IRRIGATION.

BY D. H. ANDERSON.

CHAPTER II.

PARTICULAR SOILS, AND THEIR ADAPTATION TO VARIETIES OF PLANTS.

Although this book is intended to apply exclusively to irrigation, that is, the artificial application of water to lands deprived of a sufficient rain fall to raise a crop, such as the arid and semi-arid lands, which constitute so vast a portion of our western country, yet, as all arable or fertile soils in whatever part of the world they may be, must contain certain elements necessary to plant life, an inquiry into the specific nature of soils will supply whatever information may be needed to till irrigable lands, as successfully as those where a rain fall may be depended upon to raise a crop. It is even possible that such information may be of greater practical value, because the elements in the soil and the crop itself, are under better control and management when the necessary water is in an irrigating ditch, than when it is in a cloud beyond control.

As a matter of fact, there is very little difference in soils as such, wherever they may exist. All of them are capable of producing some variety of plant life, unless absolutely barren on account of the absence of plant food, as the Desert of Sahara, for instance, or by reason of an excess of the elements essential to plant life, as our so-called "alkali lands." But, when it comes to the comparative quantities of organic and inorganic elements to be found in all soils, there is a vast difference, particularly when crops of a certain kind are to be successfully raised.

It was stated in the last chapter that soil consists of inorganic and organic elements. The inorganic material being decomposed rocks and minerals; to be more precise, such as were never endowed with life, and the organic material consisting of decomposed vegetable matter, which once possessed some form of life, both of which elements are absolutely necessary to grow any kind of plant.

A little experiment, which any one can perform, will make this clear to the reader. When any vegetable substance is heated to redness in the open air, no matter whether it be a peach or a potato, a strawberry or a squash, a handful of straw or a beautiful rose, the whole of the so-called organic elements, which are carbon, hydrogen, oxygen, and nitrogen, are burned away and disappear, but there remains behind an "ash" composed of potash, soda, lime, magnesia, iron, etc., which does not burn, and which, in most cases, does not undergo any diminution when exposed to a much greater heat. It is this "ash" which constitutes the inorganic portion of plants.

The predominance of certain of these substances, which, it was stated in the last chapter, are absorbed from the soil by the operation of plant life, is what enables agriculturists to give certain names to various kinds of soils, which names, however, are of very little practical importance, except to enable a farmer to specify which of them are best adapted to the varieties of plants he desires to raise.

So far as these inorganic substances are concerned, they must exist in the soil in such quantities as easily to yield to the plant, so much of each one as the kind of plant specifically requires. If they be rare, the plant sickens and dies just the same as does an animal when deprived of its necessary food. The same thing will happen if the organic food supplied the plant by the vegetable matter in the soil be wholly withdrawn. It should be noted, however, that a plant will sometimes substitute one inorganic element for another, if it does not find exactly what it requires, as soda for potash, the tendency of every plant being to grow to perfection if it possibly can do so. This matter will be treated at length in the chapter on "Plant Foods."

The following table of the essential inorganic elements found in soils will prove useful and well worth study. The first column gives the scientific, technical name of the elementary bodies; the second column the elements or substances they combine with, and the third column contains the result of the combinations, that is, the various substances ready to form salts which enter into the life of the plant.

ELEMENTARY BODY	COMBINES WITH	FORMING
Chlorine.	Metals	Chlorides.
Iodine	Metals	Iodides.
Sulphur	Metals	Sulphurets.
Sulphur	Hydrogen	Sulphuretted Hydrogen.
Sulphur	Oxygen	Sulphuric Acid.
Phosphorus	Oxygen	Phosphoric Acid.
Potassium	Oxygen	Potash.
Potassium	Chlorine	Chloride of Potassium.
Sodium	Oxygen	Soda.
Sodium	Chlorine	Chloride of Sodium, or Common salt.
Calcium	Chlorine	Chloride of Calcium.
Calcium	Oxygen	Lime.
Magnesium	Oxygen	Magnesia.
Aluminum	Oxygen	Alumina.
Silicon	Oxygen	Silica.
Iron and Manganese	Oxygen	Oxides.
Iron and Manganese	Sulphur	Sulphurets.

All the above elementary substances, except sulphur, exist only in a state of combination with other substances, principally oxygen, and are found only in the soil, in no combination are they generally diffused through the atmosphere, so as to be capable of entering into the life of the plant through the leaves, or those portions above the ground. Hence, they must be taken up by the roots of plants, for which reason they are said to be the necessary constituents of a soil in which plants are expected to grow.

The enormous quantity of inorganic matter in soil may be estimated by a simple calculation. Out of five hundred samples of soil gathered from different parts of the world, the average weight of a cubic foot, wet, has been found to be 126.6 pounds. Now, let us ascertain how many pounds of mineral, or metallic salts exist in an acre of soil, say eight inches deep, the usual tilled depth, or surface soil; of the subsoil, we shall speak later on. We shall give the chemical analysis of an ordinary alluvial, or river bottom soil, such as is common in the western lands. The first column gives the name of the mineral, and the figures in the second column the parts of the mineral in an agreed one hundred parts, and the third column the weight of each substance in the surface soil eight inches deep:

Elementary bodies and their combinations	Percentage	Weight in pound
Silica and fine sand	87.143	3,203,781+
Alumina	5.666	208,308+
Oxides of Iron	2.220	81,617+
Oxide of Magnesia	0.360	13,235+
Lime	0.564	20,735+
Magnesia	0.312	11,470+

Potash combined with Silica.....	0.120	4,411+
Soda combined with Silica	0.025	919+
Phosphoric Acid combined with Lime and Oxide of Iron.....	0.060	2,205+
Sulphuric Acid in Gypsum	0.027	992+
Chlorine in common Salt	0.036	1,323+
Carbonic Acid united to the Lime....	0.080	2,941+
Humic Acid	1.304	47,941+
Insoluble Humus	1.072	39,411+
Organic substances containing Nitrogen	1.011	37,169+
Total Inorganic and Organic substances ....100.		3,676,464

It should be remembered that these immense quantities are contained in only eight inches of top soil, and that twelve inches, or one foot of soil, which is about the depth before reaching the subsoil, would contain a total of inorganic and organic matter equal to 5,514,696 pounds, or 2,757 and one-third tons.

The calculation is made by multiplying 43,560, the number of square feet in an acre, by 126.6. pounds, the estimated average weight of one cubic foot of wet soil, which gives the weight of one acre twelve inches deep. Then dividing by twelve, we get the weight of an acre one inch deep. To ascertain the weight of eight inches, we have only to multiply by eight inches, and again multiply by the number of parts of any organic or inorganic matter to ascertain the exact weight of that particular matter in the acre, thus:

43,560x126.6=5,514,696 pounds per acre one foot deep.
5,514,696÷12=459,558 pounds per acre one inch deep.
459,558x0.120=551.46960 pounds of Potash in one inch acre.
551.46960x8=4,411 pounds of Potash in acre eight inches deep.

Five right hand figures must be cut off, three for the decimal places and two more because the calculation is based on a percentage of one hundred parts.

The average weight of a cubic foot of dry soil, according to the foregoing estimate, based upon the tests taken in the cases of five hundred soils collected from various places on the globe, is 94.58 pounds, which will make the dry soil acre eight inches deep weigh 2,715,792 pounds, a difference in weight between wet and dry soils of 960,672 pounds per acre eight inches deep, which, of course, represents the weight of water.

This information will prove of value in considering the question of applying water to the soil. As a rule, the proportions of inorganic and organic matter remain about the same, except that the application of water by irrigation adds to the quantity in soluble matter carried to the soil, which is greater in the case of irrigation than when rain is depended upon, humus and salts in solution being carried in the ditch water.

ORGANIC MATTER IN THE SOIL.

By referring back to the test table of a specimen soil, it will be noticed that the first twelve substances are "inorganic," and the three last "organic." It will also be noticed that the proportion of inorganic matter is vastly greater than that of the organic. It is necessary that this should be so, for the organic matter is the "active" principle, the dynamic force, and the inorganic matter the "passive" principle. If the proportions were reversed, the inorganic matter would react upon and destroy itself, and as it could not be replaced very well, there would soon be an end to the growth of plants. Hence, nature provides a store-house of raw material, so to speak, to be utilized in the manufacture of plant food, and it is practically inexhaustible, the subsoil, for an unlimited depth, containing all the ingredients necessary to restore the top soil should it become jaded and unresponsive to the demands of cultivation and fertility, if the farmer will take the trouble to dig down after them and bring them to the surface.

Moreover, the inorganic elements in the soil are permanent. They are insoluble except when acted upon by the acids formed through the chemical action of the organic matter, and the vital force exercised by the growing plant.

In the table of specimen soil, given on another page, the percentage of inorganic matter passes 95 per centum, while the organic matter is about three and one-half per cent. Yet that particular soil is a fertile one, in which it is possible to produce a good crop of any kind of plant. It is only an analysis, it is true, and a chemical analysis is not always to be depended upon, because there are so many unknown and mysterious applications of the laws of nature, but there are many things to be said in favor of ascertaining what ingredients the soil does contain, approximately, if not with rigorous exactitude. It gives the practical farmer valuable information in the form of suggestions for the improvement of the soil. It enables him to remedy the defects in his land by the application of substances it needs, and, what is equally of value, it enables him to avoid adding to the soil what he knows it already contains, and will put him upon the search for substances it does need. Moreover, an analysis will indicate to the farmer whether a certain soil is capable or not of producing a good, profitable crop of certain plants, and save him from losing his time, labor, and money by planting a crop which can not grow to perfection because of some defect in plant food necessary to plant life. In other words, the farmer will know what to do with his land without guessing, or trying expensive experiments. This is not "Book farming," it is common sense.

The reader has already discovered that the inorganic elements consist of decomposed rocks and minerals, which have assumed a variety of forms by combining with one another, and now he has reached a point which is the foundation of plant life, being that other essential in all soils, the organic elements, which must exist in a greater or less proportion. This organic matter consists of decayed animal and vegetable substances, sometimes in brown or black fibrous particles, many of which, on close examination, show something of the original structure of the objects from which they have been derived; sometimes forming only a brown powder intermixed with the mineral matters of the soil, sometimes entirely void of color and soluble in water. In soils which appear to consist of pure sand, clay, or chalk, organic matter in this latter form may often be detected in considerable quantities.

In the table already given, the percentage of Humic acid, Insoluble Humus, and organic substances containing Nitrogen, is given as 3.387 per centum, a very small quantity apparently, but really amounting to 124,521 pounds or 62¼ tons, in a top layer of soil eight inches deep, covering one acre of land. A quantity sufficient to supply crops with essential matter for plant food during many years without manuring.

This vegetable matter is the result of vegetable decomposition, a decay which means fermentation ending in putrefaction, a purely chemical process. Whence it is said: Growth is a living process; death, or decay, a

chemical process. Putrefaction is the silent and onward march of decay, its goal being humic acid, which in its turn produces life. The saying of that great physician of the past centuries, Paracelsus, may be aptly quoted here: "Putrefaction is the first step to life." Everything travels in a circle in the vegetable as well as in the animal kingdom: The egg, or germ must first putrefy to produce an animal, and the seed, or plant germ, must first putrefy before there can be any living plant.

It has been said that various names have been given soils, according to the predominating mineral of which they are composed, but in reality, there are only three great varieties of soil: sand, clay and loam, the latter being a mixture of granite sand and clay. The great distinctions in the scale of soils, may be said to be sand and clay, all other varieties proceeding from mixtures of these with each other. Now, the sand may be siliceous, or calcareous, that is, composed of silicates or lime. By clay is meant the common clay abounding everywhere, and composed of about thirty-six parts of Alumina, 68 parts of Silica, Oxide of Iron, and Salts of Lime, and Alkalies, 6 parts. A sandy clay soil is clay and sand, equal parts; clay loam is three fourths clay and one fourth sand; peat soil is nearly all humus, which we have seen is vegetable matter decomposed, decayed or putrefied; garden, or vegetable mold is eight per cent humus, the rest being silica, and the other mineral substances; arable land is three per cent humus. There are, in addition to these varieties of soil, several special varieties which are fortunately not general, and therefore, need not be more than referred to. They are those peculiar conditions found in the "black waxy," "bad lands," "hard pan," upon which, nothing short of dynamite will make any impression so far as discovered, and the "tules," which are common to California, but are extraordinarily fertile when reclaimed, being similar to peat bogs without the disadvantages of the latter, and that are known as "swamp" or "marsh lands." When it comes to "desert lands" in the sense of the Acts of Congress, they lack only water to make them as fertile as any lands in the world. They will be treated in the chapter on Arid and Semi-Arid Lands.

Aside from the chemical composition of soils, what equally concerns the farmer is their physical characteristics. These may be enumerated under the terms cold, hot, wet and dry land. And these are dependent upon weight, color, consistency, and power to retain water. The relation of the soil to consistency makes it light or heavy; its relation to heat and moisture makes it hot or cold, dry or wet.

Taking the varieties already specified, sand is always the heaviest part of soil, whether dry or wet; clay is among the lightest parts, though humus has the least absolute weight. To calculate more closely: a cubic foot of sand weighs, in a common damp state, 141 pounds; clay weighs 115 pounds, and humus, 81 pounds, and garden or vegetable mould and arable soil weigh from 102 to 119 pounds. The more humus compound soil contains, the lighter it is.

The power of a soil to retain heat is nearly in proportion to the absolute weight. The greater the mass in a given bulk, the greater is this power. Hence, sand retains heat longest, three times longer than humus, and half as long again as clay. This is the reason for the dryness and heat of sandy plains. Sand, clay and peat are to each other as 1, 2, 3 in their power of retaining heat.

But while the capacity of soil to retain heat depends on the absolute weight, the power to be warmed, which is a very important physical characteristic, depends upon four circumstances: color, dampness, materials, and fourth the angle at which the sun's rays fall upon it.

The blacker the color, the easier warmed. In this respect, white sand and gray differ almost fifty per cent in the degree of heat acquired in a given time. As peat and humus are of a black, or dark brown color, they easily become warm soils when dry, for secondly, dampness modifies the influence of color, so that a dry, light-colored soil will become hotter sooner than a dark wet one. As long as evaporation goes on, a difference of ten or twelve degrees will be found between a dry and a wet soil of the same color. Thirdly, the different materials of which soils are composed exert but very little influence on their power of being heated by the sun's rays. Indeed, if sand, clay, peat, garden mould, all equally dry, are sprinkled with chalk, making their surfaces all of a color, and then exposed to the sun's rays, the difference in their temperature will be found to be inconsiderable.

Fourthly, the angle at which the sun's rays fall on the land, has much to do with its heat. The more perpendicular the rays, the greater the heat. The effect is less in proportion as these rays, by falling more slanting, spread their light out over a greater surface. This point is so well understood that it is not necessary to dwell any longer upon it, further than to add, that there are localities where every degree of heat diminishes the prospect of a good crop, particularly in hot regions, and the circumstance should be taken advantage of to obviate the danger of loss. A northern exposure or an eastern exposure, or a crop on a slope may sometimes realize more benefit than if this knowledge were disregarded.

The relation of soil to moisture and gas, particularly moisture, is of great importance in the case of irrigation. All soil, except pure siliceous sand, absorbs moisture, but in different degrees. Humus possesses the greatest powers of absorption, and no variety of humus equals in its absorptive power, that from animal manure, except those heavily charged arid and semi-arid lands, in which fibrous roots and vegetable matter form a large part of the elements they contain. The others rank in the following order: Garden mould, clay, loam, sandy clay, arable soil. They all become saturated with moisture by a few days' exposure.

It is a very interesting question: Does soil give up this absorbed water speedily and equally? Is its power of retaining water equal? There is no more important question to the irrigator. As a general fact, it may be stated, that the soil which absorbs fastest and most, evaporates slowest and least. Humus evaporates least in a given time. The power of evaporation is modified by the consistency of the soil; by a different degree of looseness and compactness of soil. Garden mould, for instance, dries faster than clay. As it has already been shown, that the power of being warmed is much modified by moisture, so the power of a soil to retain water makes the distinction of a hot or cold, wet or dry soil.

Connected with this power of absorbing moisture, is the very important relation of soil to gas. All soils absorb oxygen gas when damp, never when dry. Humus has this power in the highest degree, however, whether it be wet or dry. Clay comes next, frozen earths not at all. A moderate temperature increases

the absorption. Here are the consequences of this absorptive power.

When earths absorb oxygen, they give it up unchanged. But when humus absorbs oxygen, one portion of that combines with its carbon, producing carbonic acid, which decomposes silicates, and a second portion of the oxygen combines with the hydrogen of the humus and produces water. Hence, in a dry season well manured soils, or those abounding in humus, suffer very little.

The evaporation from an acre of fresh-ploughed land is equal to 950 pounds per hour; this is the greatest for the first and second days, ceases about the fifth day, and begins again by hoeing, while, at the same time, the unbroken ground affords no trace of moisture. This evaporation is equal to that which follows after copious rains. These are highly practical facts, and teach the necessity of frequent stirring of the soil in the dry season. Where manure or humus is lying in the soil, the evaporation from an acre equals 5,000 pounds per hour. At 2,000 pounds of water per hour, the evaporation would amount in 92 days, that is, a growing season, to 2,208,000 pounds, an enormous quantity of water, too much to be permitted, however beneficial that evaporation may be. It is true that this evaporation is charged with carbonic acid, and acts on the silicates, eliminates alkalies, waters and feeds plants, but where irrigation is practiced, the evaporation is carried on with as good an effect beneath a mulch of finely pulverized soil through which it penetrates, if the land is properly prepared for and tilled after the application of water. This is a subject which demands careful study, so that the laws of nature may be as rigorously enforced when man takes them under his control, otherwise, there will always be failure. How to enforce those laws without doing violence to the principles which underlie them, is matter which will be fully treated in future chapters.

In concluding this chapter, it is deemed proper to call the attention of the reader to this maxim which should never be forgotten: It is not the plants grown in a soil that exhaust it, but those removed from it. It is an undeniable fact, that the growth of plants in any soil is beneficial, inasmuch as it brings into play the forces of nature which are in constant motion toward increase through fertility. For ages, the great prairies of the West, and also the so-called "arid, and semi-arid" lands have been storing up humus which now needs but the application of water to convert them into lands that will laugh with rich harvests. Plant life has, for centuries, sprung into existence, reached maturity, and decayed, going back into the soil, with no hand to remove it. The consequence is, all these lands are rich in salts and humus, and it is left for the man with the ditch to add moisture, open the soil and admit oxygen to the seeds he plants, so that they shall be fed up to perfection and enable him to reap a glorious harvest.

The laws of nature are the same in this regard as to the man who looks to the heavens for his inconstant rainfall. There is for him to consider in the lands under ditch, that all soil has four important functions to perform, which are:

First.—It upholds the plant, affording it a sure and safe anchorage.

Second.—It absorbs water, air and heat to promote its growth. These are the mechanical and physical functions of the soil.

Third.—It contains and supplies to the plant both organic and inorganic food as its wants require; and

Fourth.—It is a workshop in which, by the aid of air and moisture, chemical changes are continually going on; by which changes these several kinds of foods are prepared for admission into the living roots.

These are its chemical functions. They all are the law and the gospel of agriculture, and all the operations of the farmer are intended to aid the soil in the performance of one or the other of these functions.

THE REDEMPTION OF A HUNDRED MILLIONS.

BY U. S. SENATOR H. C. HANSBROUGH, OF NORTH DAKOTA, THE FATHER OF THE IRRIGATION LAW.

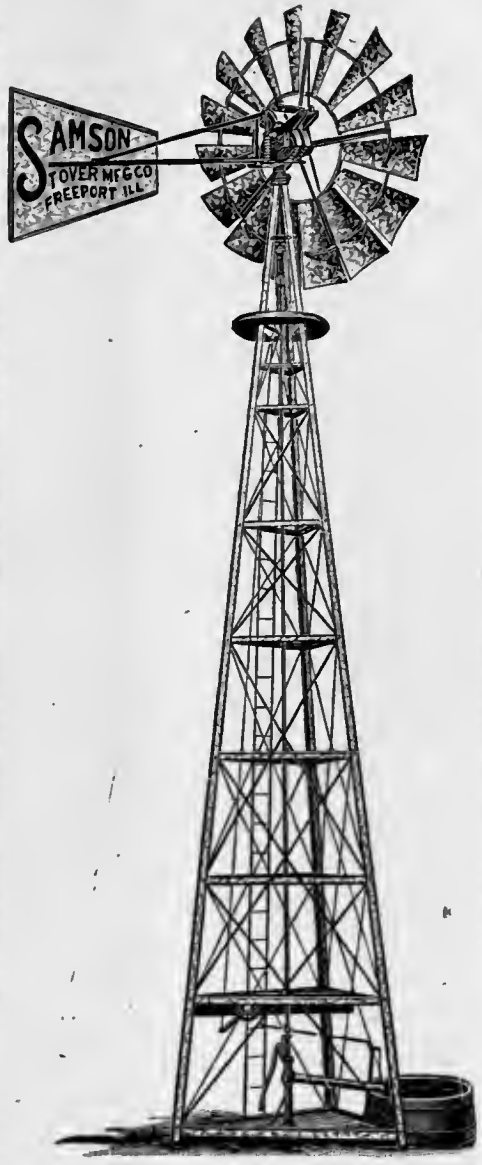
H. C. HANSBROUGH.
U. S. Senator.

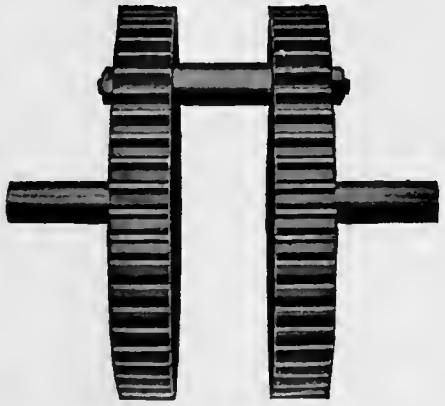
Irrigation will play a great part in settling the West, and will bring much of its waste lands and all of its waste water into use.

Under the national irrigation law, enacted justa year ago, I believe that fully 60,000,000 acres, or about ten per cent of the present public domain area, will be reclaimed; but it will require at least forty years' time in which to do it. This means homes for about two millions of people on the farms, and half as many more in the cities, villages and hamlets. During the same time private enterprise will reclaim 40,000,000 acres, which would afford homes and employment for an additional two millions of people; or 100,000,000 acres of reclamation and five millions of population in something less than half a century.

It is difficult to estimate the value of this new real property, with its personalty, but it cannot be an exaggeration to say that it would amount to at least $5,000,000,000. The work thus far under the new law has been wholly of a preliminary nature. It is expected that the Secretary of the Interior will soon announce the location and character of the first enterprises to be entered upon. This announcement will be in the nature of a proclamation withdrawing from entry the lands to be irrigated, that is, withdrawing them from entry under any of the land laws except the irrigation act. Under this act the entryman must have all the qualifications of a homesteader, and among other things must contract to pay, in not less than ten installments, his pro rata share of the cost of the works by which he is to be supplied with water He must also live upon and cultivate the land. The law is thoroughly safeguarded so as to prevent speculation.

In framing their constitutions nearly all the Western States inserted the most stringent provisions as respects the control of streams, and nobody expects the Secretary of the Interior to have an easy time of it adjusting disputes that must necessarily arise. Undoubtedly the federal Supreme Court must pass upon many of the controversies before orderly progress is assured. No doubt if some of the states were to amend their organic laws they would be much more liberal. Under the law all irrigation works are in time to be turned over to the people. Thus will wealth be added to the state, and the newly-created property pass eventually under the complete control of the state.





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617 River Street FREEPORT, ILL.

The Drainage Journal Department

DRAINAGE BY THE SEA.

A DRAINAGE SYSTEM WHICH PROTECTS LAND FROM INJURY BY TIDE WATER.

BY C. G. ELLIOTT.

So much interest is centered about the reclamation of lands of the interior states and the settling up and improvement of the newer parts of the country that progress along this line in the older and especially the coast states has passed unnoticed. The attention of the writer has been recently called to the interest which South Carolinians have manifested in the building up of their agricultural interests. No state has such a checkered history or one fraught with such distressing vicissitudes of political life and industrial conditions as the state of South Carolina. The people of no state can boast of more brilliant statesmen. The spirit of higher European social distinctions which took root at the time of its first settlement still bears fruit under modified and continually changing conditions. The attention of the people of this state, in common with those of other states of the South, is now turning to the necessity of developing the agricultural possibilities of the soil. The attainment of this object is a work attended with perplexing difficulties. The urgent demand for highly intelligent management of lands can not be met by the negroes who constitute so large a part of the cultivators of the soil, by reason of their lack of information, previous training, and working capital. Enterprising white farmers must carry the burden of this work alone and at the same time furnish example and precept for less favored tillers of the soil.

COAST ENTRANCE TO FARM OF W. G. HINSON.

Enterprising farmers at the North who are public-spirited enough to work in a disinterested way for the promulgation of improved methods of agriculture would be doubly discouraged by the obstacles which continually loom up before the Southern agriculturist.

This is a digression from the object of this article, which is a description of some drainage work on James Island, opposite the city of Charleston. The appearance of this island from the main shore is a fringe of green rising above the sandy shore line beyond which is the outline of farm buildings, suggesting to one just from the center of the rustling city a restful quiet with agreeable surroundings. The buildings which first meet the view are those of Mr. W. G. Hinson, one of the most progressive agriculturists of the State and who is the pioneer in tile drainage in that part of the South. His roomy residence and ample grounds bear marks of taste and thrift in rural affairs, while the large range of books found in the library indicate culture of a literary character rarely found in farm homes of the North. The original part of this residence was built by Mr.

RESIDENCE OF W. G. HINSON.

Hinson's ancestors in 1745. As an evidence of the historic interest attached to the location it might be mentioned that it is one of the three houses on the island which was not destroyed during the Civil War. In fact, the remains of coast battery defenses are still in view at the rear of the premises. It may be added that pottery ware with the British coat of arms which was in use at the time of George II. has been unearthed on the grounds, left there by the king's subjects when this fertile island was a part of the province of Carolina.

The islands off the coast of South Carolina have long been noted for the production of Sea Island cotton, the most valuable and highly prized species of the cotton plant. The soil is a dark, sandy loam, containing peculiar elements by reason of its formation as an island in the sea, having this characteristic, however, that the north coast line, with its numerous deep indentations, is bordered by a ridge of red sandy clay, fine in its texture and quite retentive of water. Mr. Hinson, in his interesting account of the condition of his land before he attempted tile drainage, which, by the way, was fully twenty years ago, says that his cultivated fields were divided by various depressions which were neglected by reason of their wet condition, and by swales or low land into which tide water backed from the arms of the sea or small bays, and submerged them, thereby depriving him of the use of much otherwise

fertile land. The first attempts in underdrainage were made for the purpose of reclaiming the low places or natural depressions, and, though successful in every way, demonstrated that in the loose soil of that island tiles of small size should be used with great caution. When a level field of considerable size was thoroughly drained, laterals of 4-inch tile were used, but ponds and swales were drained by single lines of such size as former experience might dictate.

There are some features of this drainage which are of peculiar interest to those unfamiliar with outlets which discharge into tide water. By the rise of the tide, which is between five and six feet, all the low land at the upper end of the creeks was daily submerged and could be drained only during low tide. To reclaim such land the tide water must be shut off and provision made to drain away the excess of rainfall. A bank is thrown across the upper end of the creek and the low land above filled and the main drain laid, from which laterals reach out into all accessible depressions. At the outlet is placed an automatic gate which closes during the rise of the tide and opens as the water recedes and permits the accumulated drainage and soil water of the land to flow out. The gate consists of an iron pipe six feet long, having the outlet end cut sloping at an angle of about 60 degrees with the bottom line of the pipe. The flap or swinging gate hinged on the upper outside diameter of the pipe hangs suspended against the end. There are several outlets on Mr. Hinson's drainage works, and he has adopted a wooden gate which is made of plank 1.5 inches thick, which, being lighter than iron, permits the outward flow of drainage water more readily as the tide recedes. To make the gate fit closely a groove is cut around the periphery at the end of the pipe and a rubber washer inserted. The wooden gate shuts against the rubber and effectually excludes the sea water, and has been found to be the most satisfactory gate thus far tried.

Another peculiarity met with here is the surface inlet, which may be found at every point of distinctive

SEA-ISLAND COTTON FIELD OF LAST YEAR WITH GARDEN PEAS GROWING IN THE ROWS.

surface depression. This is a square box extending from one foot above the surface of the ground to the drain, screened at the top, or in some cases, at the side. The utility of these inlets arises from the fact that the tile drains can discharge at their full capacity only during low tide. Heavy showers frequently occur which fill the depressions very rapidly, and at times when the discharge of the drains is obstructed by tide water. When they are in condition to discharge the water coming to them, they must do so with the greatest possible rapidity; and this is accomplished by the aid of the open surface inlet. It has also been found well to take a further precaution for this purpose by laying lateral drains 25 or 30 feet apart through the basins which gather surface water most rapidly. While the soil seems friable, there are localities which retain water with great tenacity. Mr. Hinson has observed that his drains operate more freely and effectually three or more years after they have been laid.

The grade upon which he usually lays his drains is five inches to 100 feet. The lines are leveled with an instrument in a preliminary way and the grades from point to point computed, but the bottom of the ditch is tested by the use of a board and spirt level. A board ten feet long has a cleat one-half inch thick across the end which is kept at the downstream end and the surface of the board maintained in a level position as determined by a common spirit level. When constructed in this way the ditch has a grade of five inches per 100 feet. For inexperienced workmen he has found this method of preparing the bottom of a ditch the most practical one. It should be added that it has been found usually necessary to lay the tile upon boards on account of the unstable condition of the ground which is often encountered.

A drive over the fields with Mr. Hinson is pleasant and profitable to any one interested in advanced soil culture. A glance into the surface inlets, which in some instances consist of sewer pipe placed vertically, is rewarded by a sight of clear soil water coursing through the underdrains on its way to the sea outlet. The fields are well cared for. Mr. Hinson has 500 acres which he has drained with greater or less thoroughness. His first tile were shipped from New Jersey at large expense. Later a tile factory was built in South Carolina which has supplied him in recent years, and today is the only one in the State. He estimates that he has fully doubled his production by drainage, and no more earnest advocate of underdrainage can be found than this southern gentleman. He does not see how any agriculturist can afford to neglect so important an improvement if his lands suffer from oversaturation from any cause. Concerning the method of best promoting this practice among farmers, he said: "If I can persuade one man in a neighborhood to drain one acre I have presented the most forcible and effectual argument upon the value of drainage." What the South needs is a larger number of object lessons of this kind.

Of the methods of culture and management of these lands much might be said, but at present it must be given only a passing notice. The maintenance of the fertility of the land is one of the leading problems in this State. This expense may be regarded almost as a fixed charge. The purchase of commercial fertilizers, the rotation of crops, and the use of green crops which may be plowed under are an annual expense which must be charged against each field. Mr. Hinson has a field of 50 acres in asparagus which he has planted and cared for at great expense until now, the third year, he expects to obtain his first cutting. One field of garden peas attracted the writer's attention by the novel plan of bushing employed. The peas are planted in the rows of last year's cotton field, which furnish strong, widely-spreading bushes which the vines will later completely envelop.

This description should not omit a reference to one of the most salutary effects of the drainage of these lands and one which the cultivators of the low lands of the South will be quick to appreciate. From earliest times it has been the custom of the planters who cultivate low lands or those closely bordering them, to own and keep up a winter and a summer residence. The first was located on the land operated as a plantation and occupied from September until May, while the latter was located on some sandy ridge surrounded by the long-leaf pine, which always indicated a more healthful climate. While the blacks do not appear to be seriously troubled with malaria during the summer months, white people can not endure the nights near the overflowed lands. The custom still prevails and the land owner or manager must make his daily trip of from two to eight miles to attend to his farming. This was the condition of things on Mr. Hinson's farm on the island when he began the practice of underdrainage. After he had added to his drainage improvements annually for about seven years it began to be noticed that there were fewer cases of malaria and other forms of sickness and that white men could remain on the island much later in the summer than formerly. For the last twelve years no attempt has been made to vacate the farm during the summer months because of its unhealthfulness. While this result of drainage is not new to those who have watched its effect in other localities, it should not be lost sight of in estimating the benefits which may be derived from this kind of improvement in malarial climates.

On the whole, so many unique features are found about this farm by the sea that the writer could have spent many more hours upon it with pleasure and profit to himself. No outer fence but the water-swept beach, strewn with driftwood and dotted with boats for crossing the bay; no public roads by means of which the produce of the farm is conveyed to the city market. It illustrates the varied conditions under which our field products are grown and placed in the hands of the consumer. Through all of these vicissitudes the producer, though often commercially wronged, lives "near to Nature's heart," and enjoys her gifts at first hand. Every movement in the interest of healthful living, bountiful production, and the amenities incident to a happy and contented life may appropriately originate with the intelligent agriculturist of modern times.

A correspondent at Fort Dodge, Ia., writing under date of April 13, says the Jackson township ditch, which has been awaiting the decision of the county board of supervisors for some months past, will be constructed. Early in April the board, after a careful discussion of the pros and cons of the matter, granted the petition and established the ditch.

The board did not take action until after a careful investigation. At its last meeting it took up the matter, and heard both the advocates of the ditch and those who were opposed to it. In order to get still more exact information in the matter the board went to Jackson township and went over the ground to be covered by the proposed ditch. The action establishing the ditch followed.

The ditch in question is approximately five miles in length and its constructcion will cost in the neighborhood of $10,000. It starts in section 6, Jackson township and runs south by southeast to the south line of section 21 draining considerable swampy land.

CORRESPONDENCE

North Yakima, Wash., April 16, 1903.

The Irrigation Age, Chicago, Ill.:

Dear Sir: I am very much interested in irrigation and will ask you to kindly send me a copy of your paper. I would send a year's subscription, but am not sure that it will reach you. I understand there are concerns in your city that make irrigating pumps a specialty and have several in operation. I will take it as a great kindness if you can send me their address. Yours very truly,

C. A. Bryant.

We take pleasure in noting Mr. Bryant's letter and in forwarding him copy of Age as requested. There are certainly concerns in Chicago making a specialty of irrigating pumps that are in great use. A glance at our advertising columns will remove all doubt on that head.—Ed.

North Yakima, Wash., May 2, 1903.

The Irrigation Age, Chicago, Ill.:

Gentlemen: Many thanks for the copy of your paper, also for your kindness in being instrumental in my receiving so many pump catalogues. Enclosed you will find $1.50, for which please send me The Irrigation Age for one year; also "The Primer of Irrigation," which please send at your earliest convenience. Yours respectfully,

C. A. Bryant,
North Yakima, Wash.

P. S.—Can you give me any information about submerged water wheels? C. A. B.

A correspondent at Santa Fe, N. M., states that the ranchers of the Mesilla valley are aroused to the subject of securing a reservoir at or near the Elephant Butte, on the Rio Grande. They have received information that the irrigation authorities in Washington are favorably impressed with the condition along the Rio Grande for the construction of a reservoir on the river, and that all the people have to do to get an appropriation is to go after it.

They have seen with mortification that Arizona has already received over $2,500,000 from the national irrigation fund for the purpose of constructing irrigation canals, and that not a cent of it has been appropriated for the territory of New Mexico. When inquiry as to the cause of this has been made, the people have learned that the principal reason has been that the citizens of the territory have entirely failed to lay before the irrigation authorities at Washington the necessary data to pass upon the merits of any proposition which they desire the government to take hold of.

They are going to supply that data. A large and enthusiastic meeting was held at the court house at Las Cruces not long ago and a committee of five appointed for the purpose of effecting the end desired, and protesting against the land board leasing more of the irrigation grant to cattlemen. The committee will collect funds and send the best men they can to Washington with all data from the land office and the facts and figures of the Elephant Butte country.

It is confidently believed here that the territory can get a good appropriation for irrigation. It is also learned that the government is to change its form of attack on the old English company and endeavor to secure a decree annulling the rights of the company on the ground that it has forfeited its rights by the failure to construct its reservoir within the time limit fixed by the statutes.

Our correspondent at Delta, Colo., writes under date of April 11th that at 1 o'clock on that morning the dam of the Garnet reservoir burst and an immense flood of water rushed down the valley at tremendous speed, flooding the low lands. A hasty telephone message was sent to this city, reporting the state of affairs, and riders were sent out in haste to warn the farmers in the path of the waters.

All of them were told in time, and as a result no lives were lost as far as is known. But growing crops are washed out and stock of all kinds has been drowned. It is known that several hundred head of cattle have been carried away.

The Rio Grande tracks were washed out for about a quarter of a mile. Workmen have been sent out and it is

believed that traffic can be resumed tomorrow. The house at the reservoir was almost entirely destroyed. The people were aroused by the crash and hastily made their way to the hills, wading through a foot of water and carrying the children on their shoulders. They got out in their night clothing, not having time to dress.

The dam was built a year ago and finished just a year ago today. It was supposed to be remarkably firm. An investigation this morning shows that the entire dam is not gone, only a narrow section in the center having given way before the weight of water.

It was stated by the managers and owners of the reservoir that the break could be repaired in a short time and that the freshet in June would fill it so that the Garnet mesa could be irrigated from it this summer, as usual, and no loss need be experienced from that source. The dam is located fifteen miles from this city.

It is almost impossible to estimate the loss already, as few reports have been made in this city. However, one of the men, who has been over the ground, said it would run close to $100,000. The flood reached its maximum at 2 o'clock, and continued until 7, when it began to subside. At 10 o'clock it had gone down considerably.

ABOUT SOUTH DAKOTA.

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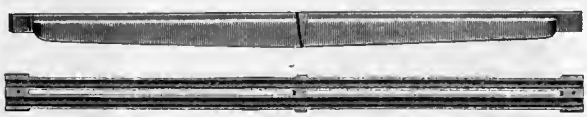

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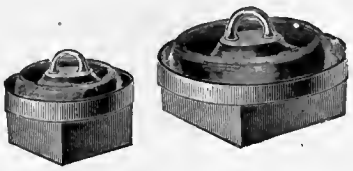

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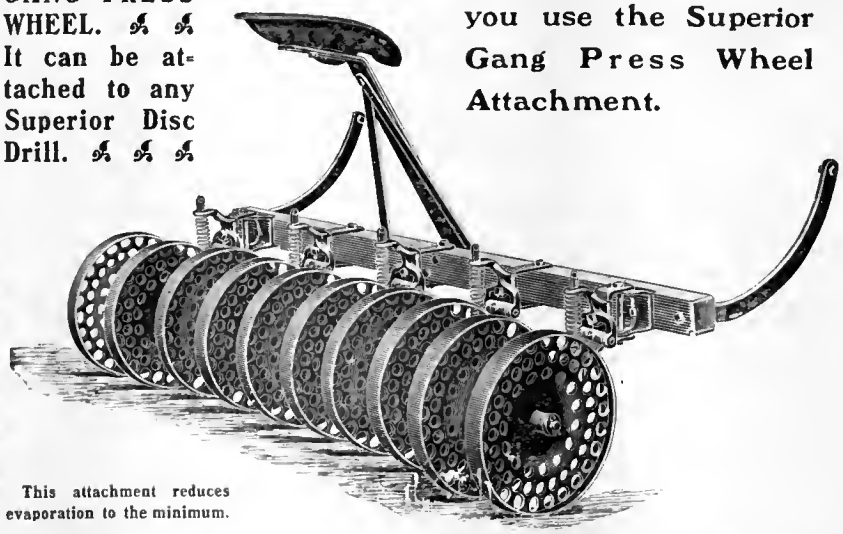

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THE IRRIGATION AGE

VOL. XVIII. CHICAGO, JUNE, 1903. NO. 8.

THE IRRIGATION AGE

THE D. H. ANDERSON PUBLISHING CO.,
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EDITORIAL

"George."

We wonder if President Roosevelt is still addressing Maxwell as "George." If so, what will he call him when he is fully posted on all his methods, aspirations, connections, governmental and otherwise?

How about this, "George?"

The position of Executive Chairman of The National Irrigation Association must be a good paying one when George H. Maxwell [who fills it by the grace of his friends in the Geological Survey and Interior Department] can pay eight to twelve thousand dollars for a winter home in Arizona.

Elwood Mead's Book on Irrigation.

Elwood Mead, E. E., M. S., holds the important place of chief of irrigation investigations of the Department of Agriculture in Washington; is also the professor of institutions and of the practice of irrigation in the University of California, and special lecturer in Harvard on irrigation engineering, so if any one can speak with authority on this important and interesting problem it is certainly Professor Mead. He has had twenty years' experience in irrigated agriculture in the far West. He was assistant state engineer in Wyoming and the state engineer in Colorado. All phases of the question of hydraulic engineering have passed under his practical administration.

With this experience to justify him, Mr. Mead has published a book on Irrigation which is a clear cut resumé of everything pertaining to the subject. The author is a strong advocate of the importance of irrigation, and the early unification of the diverse laws upon the subject so as to create a uniform system. He believes that far reaching changes in the irrigation systems of the West must occur in the near future. These will involve new methods of social organization and new forms of co-operation.

The Destruction of Forests.

It is a pity that this subject was not gone into scientifically when it might have been of some public utility. But it was easier and less troublesome to cut down the forests, and denude the land that solve the problem. Now, that men's lives are not worth a baubee, and tens of millions of dollars worth of property destroyed, crops ruined, and lands washed out by sudden, unparalleled floods, the question again becomes burning.

The old forests will not return by the whistling of them back, so what is there to be done about it? Some say plant new forests, and the magazines are full of illustrations of how beautiful barren lands will look, ten, twenty, thirty and fifty years hence if everybody begins planting forest trees now.

It is a good but dilatory scheme, for the country cannot sit down and wait half a century for trees to

grow, which would be cut down by government timber thieves then as they have been in the past. Other plans must be laid to protect our watersheds.

The ancients ditched and otherwise manipulated their treeless watersheds, and when spring came with its melting snows and mountain rains, the water did not come down with a rush as it does with us, and disappear after a few days' destruction, but the streams ran full and free all the season.

Suggestions have been made to create a glacier system which will appear in another column of this issue. We refer to it as a suggestion, at a time when the very air is full of suggestions, and an additional one can do no harm.

View of Congressman Mondell.

In an interview with Congressman Frank W. Mondell, of Wyoming, the future of the arid region was fully discussed. Speaking of proposed land legislation before Congress, Mr. Mondell said:

"Some of the legislation will meet with determined opposition. In the Congress just ended there was considerable agitation to have repealed the commutation clause of the homestead act and also the desert land clause and the timber and stone clause. By the commutation clause a settler may, after fourteen months of residence on his 160 acres, obtain a full right and title by paying $1.25 an acre; by the desert land act the settler buys the land and reclaims it; by the timber and stone act he obtains the land for $2.25 an acre. If those clauses were repealed there would be no legislation to replace them and there would be no way to obtain government land except under the general provisions of the homestead act, requiring a residence of five years. The people of Wyoming are opposed to the repeal of these clauses for what they believe to be excellent reasons. At the present time five-eighths of the revenue obtained from the sale of public land is obtained under these clauses, and, as under the recent irrigation act, this money is to be used for the reclamation of arid lands, it is a matter of much importance to Wyoming; for if this source of revenue disappears there will be little money with which to pursue the work of irrigation.

"Moreover, we believe in encouraging the settlement of the land. It is the opinion of many that the agitation for the repeal of these clauses comes from the land grant railways, who have millions of acres to sell. It is clear that if government land should be difficult to obtain these companies would be able to dispose of much of their land."

President Roosevelt Talks Well, But—

At Boise City, in his recent trip West, Mr. Roosevelt gave utterance to some sound talk, which, if it could be followed up by some strenuous action on his part, would create the impression that he means more than talk.

"The forests and the grasses are not to be treated as we properly treat mining—that is, as material to be used up and nothing left behind. We must recognize the fact that we have passed the stage when we can afford to tolerate the man whose object is simply to skin the land and get out. That man is not an equitable citizen. We do not want the big proprietor. It is not for him that we wish to develop irrigation. It is not for him that we must shape the grazing lands or handle our forests. We must handle the water, the wood, the grasses, so that we will hand them on to our children and children's children in better and not worse shape than we got them.

"Inasmuch as I myself passed a large portion of my life in the mountains and on the plains of this great western country, I feel a peculiar pride that it was given to me to sign and thereby make into law the act of the National Government, to my mind one of the most important acts ever made into law by the national legislature, the national irrigation act of a year ago. The Government, in my judgment, not only should, but must, co-operate with the State Governments and with individual enterprises in seeing that we utilize to the fullest advantage the waters of the Rocky Mountain States by canals and great reservoirs which shall conserve the waters that go to waste at one season so that they can be used at other seasons."

If President Roosevelt will see to it—he has the power—that this glorious vista is not obscured by George H. Maxwell and land grabbing syndicates, he will indeed be President of the United States.

The Western Floods.

No man can read without a shudder the awful calamities that have fallen upon the people of Kansas, Missouri and other sections, through the masses of flood water that came down upon them without warning from the upper country.

We know that the Government is aiming to put a curb upon the Missouri and other streams that rage like lions at certain periods, and are as peaceful as lambs at other times. The people of the arid and semi-arid West know what cloudbursts are, but they cannot conceive such a succession of them as will sweep villages, towns, and even cities, out of existence.

How does it happen that this enormous mass of water accumulates in sufficient proportions to become the twin brother of the salt water tidal wave which nothing can resist? There must be a reason somewhere—no, we will not say a fault—a lamentable degree of recklessness in going on year after year with this sword of Damocles hanging by a slender thread over the heads of its victims. It is not ignorance, for even the most ignorant do not take death into their category of risks.

The trouble is higher up than the submissive, innocent, confiding people who throng the banks of these treacherous streams. They know that something is doing to protect them and they fancy that the protection

is fully adequate. By and by they are swept into eternity and then Providence is made the scapegoat of the gross negligence, or dilatory action on the part of others.

The only cure for all these monstrous calamitous floods is in providing outlets for sudden accumulations. They did things better in ancient Babylon, over four thousand years ago. They cut blind streams, ditches, laterals, reservoirs, and when old father Euphrates raged his worst he couldn't drown a fly.

It would cost a few million dollars to amend present conditions and at the rate of human destruction already accomplished, the aggregate value of human lives on an insurable basis has reached a much larger sum than their salvation and protection would have cost.

Maxwell Place, Phoenix, Arizona

THE AGE gives elsewhere an excellent photograph of the Maxwell Place, one and one-half miles northeast of Phoenix, Arizona, which will be of interest to those in the neighborhood of the government improvements, and in the shadow of the Tonto scheme.

THE AGE has reason to believe that the great majority of the citizens and "actual" residents of the Salt River Valley, are not the hail fellows well met when he calls around and slaps them on the back, as he supposes.

The fact is, the attempt to "muzzle the monkey" has had the effect upon the fellow who tried the experiment as it did upon the individual who monkeyed with the buzz saw. The people down Salt River way are persuaded that there are land grabbing syndicates in their district, as there are all over the arid west, and that these same syndicates are attempting to obtain control of the entire arid public domain.

It may be a good business proposition to work such a scheme, as business schemes now go, but it is not clearly understood why the government employes should go into it, or join hands with private parties to deprive actual settlers of the benefit of the irrigation act, and turn it to the profit of the members of the syndicates.

Mr. George H. Maxwell is making himself altogether too conspicuous in this irrigation matter not to have caused wonder why he, a private person, should presume to dictate, or even direct, officers selected by the Government to do the work. It is not believed that Maxwell is the originator, author, and creator of the national irrigation law, and even if he were, it is not clear why he should take upon himself the management of its execution and operation. He is too close to the land grabbing syndicates for the comfort of the plain, ordinary settler, and his efforts to annul the operation of the irrigation law sub rosa for the personal benefit of himself and his associates is a curious desertion by a parent of his offspring.

The AGE has Mr. Maxwell's gigantic scheme down pat, and understands all its details and ramifications, and when we allude to his organization of a so-called "Water Users' Association," to put the majority of 25,000 acres of land in the hands of a syndicate, we feel sure that the time has come for an investigation and an exposure of the same methods which have deprived the Government of timber, grazing, and farming lands of the Northwest without compensation and to the great profit of the schemers.

The Milk in the Cocoanut.

The article on "Influences in the National Irrigation Program," in the last issue of THE AGE made the following statement alluding to Mr. George H. Maxwell: "Because the bill (before Congress) did not suit HIM in some respects he instituted an active fight against its passage during the late winter and early spring months of the following year. *He was finally called into line in a way that has not, as yet, been explained, and since the passage of the bill he has 'appeared' to indorse it in every particular.*"

The italics are intended to emphasize the fact that the writer has since obtained some light on the subject of Mr. Maxwell's sudden conversion.

The bill as finally approved by the committee in charge of it was not satisfactory to Mr. Maxwell, nor to several members of the committee who reflected his ideas, and after the bill was reported, it was attacked most viciously by Mr. Maxwell, both in speeches before various commercial bodies in Nebraska, Colorado, and elsewhere through the medium of his "Homedestroyer"—beg pardon—"Homemaker." His opposition to the bill was constant, unfair and abusive. During all the time it was being considered by the House committee his vials of wrath were being poured forth with particular vehemence against the bill, and against those whom he assumed to be responsible for its provisions. Finding, however, that he was not making much headway in the West in creating feeling against the measure, he transferred his field of personal operations to Washington, where, during his absence in the West, his henchmen had been publishing his tirades against the measure. Arriving in Washington Maxwell put forth every effort to stampede members of Congress in opposition to the bill, which at that time had already passed the Senate, and following his usual tactics his opposition was always under the cloak of righteousness and a burning desire to serve the dear people and the "actual settler."

Mr. Maxwell's efforts, however, were not particularly effective, largely by reason of their abusive character, which was resented by many members of Congress, and he concluded as a final desperate resort to endeavor to secure the President's opposition to the bill. With this object in view he worked upon a member of the House Committee on Irrigation, who, while well meaning, had but little knowledge of irrigation, practical or theoretical, and, through some friends of

his connected with Government bureaus, on several members of Congress not members of the Irrigation Committee, and through these people and his friends in the Government bureaus before mentioned, he finally succeeded in reaching the President's ear, with the result that strangely enough the newspapers came out stating that some Western Congressmen and others had been before the President and had reported to him that the national irrigation bill was a very villainous measure, and that the President had expressed himself as in opposition to certain provisions of the bill. This was Mr. Maxwell's trump card, and was expected to be very effective, as in fact it seemed for a time that it would be.

To block this nefarious opposition and attempt to hoodwink the President himself, Mr. Roosevelt was called upon by a committee who suggested a conference. This was called, and the President being a man of good hard sense, it did not take him long to discover the real motives for the animus displayed by the opposition. He found that the opposing element and the whole opposing force was—Maxwell—just Maxwell—a mountain in labor that brought forth a mouse. At the end of the conference the President expressed himself as being satisfied that the bill had been carefully drawn.

With one or two slight changes in the phraseology of the bill, one relative to state control which strengthens the bill, and another with regard to the power of the Secretary of the Interior to withdraw lands, Mr. Maxwell had either to acknowledge himself for what he really was, an enemy of the entire proposition for government aid, or else come into camp and support the bill. He came into line, but not out of respect to the President, the Congress of the United States, or for common justice, but a little bird says that certain railroads that were putting up for him had their eyes slightly opened and ordered him to right-about-face. When the bill was up for consideration it was found that those most violently opposed to it were using Mr. Maxwell's arguments against it.

In the face of this Mr. George H. Maxwell is moving barrels of printers' ink, and the jackscrew of "you-scratch-my-back-and-I'll-scratch-yours," to make the people believe that he was the most important factor in securing the passage of the national irrigation bill!

Can duplicity reach any further, or is it possible to believe that there are any persons honestly abject enough to believe him? He would have killed it if he had been able, and the Lord knows he tried hard enough.

He formerly strenuously advocated state control over the distribution of water used in irrigation, and he attempted to disguise his real objects under the cloak of philanthropy and a disinterested desire to do a public service. In his present attempt to secure the repeal of certain provisions of the land laws he is following his old tactics, using the name of the Irrigation Association and showing the indorsement of the National Business League of Chicago, and other well meaning but entirely uninformed and deluded persons and associations.

It is time to make an effort to throw overboard such a man, who for some inscrutable reason, is permitted to meddle with national and private matters, to such an extent that some people who cannot see a pike staff ten feet distant, think he is I T.

Were Grover Cleveland politically alive and in the proper position to make his words of national import, he would say, "Who the h—l is George H. Maxwell?" And nobody but Maxwell could answer.

INFLUENCE IN THE NATIONAL IRRIGATION PROGRAM.

(Continued from May number.)

BY D. H. ANDERSON.

CO-OPERATION WITH GOVERNMENT OFFICIALS.

Before the plan submitted to the railroads by Mr. Maxwell was accepted he had the campaign fairly well outlined in his mind. He saw that it would be necessary for him to become intimate with Government officials who could bring him into contact with Congressmen, members of the cabinet, and even the President. He had already become acquainted with those who had ambitions to direct the irrigation policy of the country, and through them he met heads of bureaus in Washington who hoped, through his co-operation, to broaden the sphere of their influence and work. We do not wish to bring these men into disrepute and do not say that their ambitions are either to be commended or condemned. We do say that their methods are open to criticism. That they have been working with Mr. Maxwell for the past two or three years is an established fact. The readers of "Forestry and Irrigation" can easily inform themselves as to the bureaus which are working with Mr. Maxwell to maintain that publication. Those who were at the Irrigation Congress held in Chicago in 1900 have no doubt as to who the gentlemen are, and they fully appreciate the support which the National Irrigation Association has since received. The arrangement made with Mr. Maxwell by these officers is not known, but since 1900 the National Irrigation Association has advertised these men and their work in return for substantial support of another kind. Mr. Maxwell has, through one of these men, been able to confer with the President upon more than one occasion. Through the favors extended by another he has met Congressmen who have been particularly active in the movement for national aid, and has thus been brought into contact with the Secretary of the Interior. He has had their support in meetings of the Irrigation Congress or wherever their services have been needed. He has been introduced into clubs at Washington, and has appeared before engineering and scientific societies. Only a short time since both Mr. Maxwell and one of his Government assistants appeared before an economic society in Washington to promote their mutual policies. Through the publications controlled by Mr. Maxwell he has been able to repay his debt to these gentlemen. Besides, he has flooded the country with material sent to the daily newspapers, advertising those who have been of service to him. He has realized that should the Government embark on a

plan whereby the West is to be reclaimed, it would be to his advantage to have his friends maintained in places where they would be valuable in carrying out the policies of the National Irrigation Association. We have a bale of newspaper clippings sent out by this bureau relating to the thorough training and wide experiences of the men with whom Mr. Maxwell has found it advisable to work.

Mr. Maxwell has always been active in working for specific appropriations for the construction of projects which he has already selected. These projects need not be mentioned here, as they are enumerated in the report of the Secretary of the Interior for the year 1901 published eight months prior to the passage of the irrigation bill. No reliable preliminary surveys had been made to determine the feasibility of these projects up to that time and this work has not yet been completed. Why should the Secretary of the Interior place himself on record as favoring one or all of these projects unless his subordinates had so recommended? Through whose influence were the subordinates induced to advocate Government construction of these projects? It is not our place to guess or surmise as to how the Secretary of the Interior was thus led to commit himself. We feel, however, that an explanation should be made as to why, if the Secretary of the Interior should advise the construction of these projects two years ago, the reclamation service has found it necessary to spend much time since then making surveys as to their feasibility?

Mr. Maxwell has led the way in planning the work of the Government during the past year. He goes here and there promising what the reclamation service will do for this or that community and formulating regulations under which the Act of June 17th can be carried out without delay. He has been especially active along the Salt River Valley in Arizona, where conditions are rather unusual. Mr. Maxwell was hailed first as a prophet, but his domineering tactics have robbed him of much of his power and influence. Men with whom he first co-operated have turned against him, and it is extremely doubtful if any of the measures he has advocated will be indorsed by a majority of the people of the valley. In a number of states those chosen by him to act as vice-presidents of his associations are now using their influence to make known the character of the organization and the man who dominates its policies.

The question as to who has given Mr. Maxwell permission to represent the Government in irrigation matters is often asked. If you should ask him, he would probably answer that he is acting as the chairman of the executive committee of the National Irrigation Association. Those who have read what has gone before know what this means. He does not get his position from the association, however, but from Government officials who are willing that he should represent them. That this places the national irrigation program in the hands of those who furnish the financial support to the propaganda is plain.

To show how Mr. Maxwell attempts to control the reclamation service through his association a copy of a letter sent out recently to the members of the organization is given. Attention is called to his demand for the construction of "specific projects" and his reference to his "own work."

CHICAGO, ILL., Feb. 14, 1903.

DEAR SIR:

The National Irrigation Association is working for *results*. We want to see the irrigation works *built*, and the increased population and trade actually *created*.

When completed the Tonto, or Salt River, reservoir in Arizona, costing $2,700,000, with a capacity of 1,500,000 acre-feet will rival the Nile dam as a great engineering work. It will more than double the *productiveness*, population and trade of the Salt River Valley.

To make the influence of the National Irrigation Association effective it must be *concentrated* on specific projects which will demonstrate the benefits of national irrigation to the entire country, and this Salt River reservoir is such a project.

The Homemaker for January contains in both the illustrated section and the editorial section, articles giving in detail an account of this great project, and my own work in connection with it. *Read it carefully.*

The enemies of the national irrigation movement, our erstwhile opponents who wanted the states to control the great work of reclamation, though scotched are still active and *venomous*. They are leaving no stone unturned to undo the great work we have accomplished.

"By their fruits ye shall know them," is the rule by which the friends of the national irrigation movement who comprise the National Irrigation Association must be measured. So far it is a record of *things done*.

Yours faithfully,

GEORGE H. MAXWELL.

To the Members of the National Irrigation Association.

CAMPAIGN AGAINST REFORM IN STATE IRRIGATION LAWS.

Mr. Maxwell has not only deemed it to be his place to see to the enactment of a bill providing for the extension of national aid in irrigation and to carry its provisions into effect, but he has also assumed the role of the champion of the theory that "No state irrigation laws are preferable to those that are comprehensive." He has fought reform irrigation legislation in nearly every western state. From favoring the Wyoming law a few years ago, he has now gone to the other extreme and advocates what he is pleased to call "home rule." His objection to state control as expressed in his argument setting forth the advantages of the "home rule" policy is that the states can not settle interstate complications. We do not believe that this contention is to be sustained in practice, but even if it should be, would there not be far more difficulty in settling rights with each district independent of those adjoining? We believe that when the time comes for the settlement of rights on the great interstate streams no special difficulty will be encountered. The work of making a complete adjudication will certainly be much reduced should the states adopt a "harmonious system of irrigation laws" providing for the settlement of rights.

Mr. Maxwell is peculiarly apt in the choice of his phrases. He pleads for "home rule" in irrigation, yet he is fully aware that, practically, the fullest measure of home rule comes with some system of public supervision, which is the only possible way, as demonstrated in this and foreign countries, of preventing appropriators near the head waters of a stream from absorbing the entire water supply without any regard whatever for the rights of the appropriators farther down. The nearest approach to home rule in irrigation that has ever been attained was under the famous Wright district law of California, by which irrigators and property owners within a section capable of irrigation from a common source can unite to own and control the irrigation resources of the section. Mr. Maxwell began his career as an irrigation "reformer" by attempting to have that law declared void by the courts, with the avowed purpose of entirely freeing his clients—landowners and taxpayers within several of the districts organized under

the law—from the burden of the bonds they themselves had sold and then dishonestly sought to repudiate. He did not succeed in having the district law annulled by the courts, but he did succeed in so discrediting all district securities that successful organization under the law was for a time impossible. He is even now appealing to his former employers in one of the discredited districts, promising in return that their land shall now be irrigated by the National Government. This is no secret, for it is fully known from Mr. Maxwell's own letters sent to hundreds of farmers in the district. There is not a single irrigation authority in California who will say that had there been more of public supervision of the affairs of the various district organizations, there would never have followed the calamitous results that are a blot on the industrial history of the state.

It would seem that Mr. Maxwell either has an idea that the Government is to ultimately control the water of the streams or that he desires to leave the matter undisturbed until he has the leisure to dictate the irrigation policies of those states which have not yet provided a legal method whereby claims to water may be equitably and definitely settled. He visited New Orleans last fall and in talking to the Chamber of Commerce of that city congratulated the people that there were no good laws governing the diversion and use of water in the State of Louisiana. He goes to Montana and advocates his system of "home rule" as against a measure which has been prepared by an able student of irrigation, a man who has some interest in the welfare of the state. To bring his ideas before the public, he writes an open letter to Senator Paris Gibson, which is sent broadcast to the papers of the state. This letter cautions the people of Montana against the enactment of any law which would be revolutionary in the practice of the state. He speaks as though there were no one within the borders of the state who could intelligently frame a law suitable to the conditions prevailing there. Lying between the Dominion of Canada and Wyoming, it would seem that a compromise measure incorporating a portion of the laws of both might not go far astray. Behind all of the cautions urged by Mr. Maxwell can be seen his desire to prevent the enactment of any laws which might later interfere with the prospects of a certain irrigation project lying within the borders of Montana for the construction of which he has failed to secure "specific appropriations" from Congress.

In the same letter to Senator Gibson he referred to a bill which he says would be presented to the California legislature. He prophesied that it would meet the same fate as did a bill in the Arizona legislature two years ago. Mr. Maxwell's influence killed the latter measure and he takes pride in pointing to its failure. The bill before the California legislature also failed of passage, largely through the influences represented by Mr. Maxwell. It was framed by some of the best lawyers, irrigationists and judges of California. The poorer class of irrigators can not afford to be continually in court in defense of their water titles. The more wealthy are able to control the available water supply by threatened law suits. How long this condition is to prevail in California depends upon how soon the people are aroused concerning the purpose of those who are furnishing paid lobbyists in the California legislature.

Let us briefly consider the agencies which operated to defeat the bill. At a meeting held at Riverside, on the 29th day of last December to "consider" the merits of the bill it was found that the program had been fully arranged before the delegates appeared. But one friend of the measure was present and he was not on the program. Charges had been made by those opposing the bill that it had been framed for the benefit of the large corporations. That there was no truth in this assertion is demonstrated by the character of the delegates at this convention. It was composed almost wholly of agents of the great water companies of Southern California, who have the irrigator in their power and who, for this reason, do not favor state restrictions to their influence, or any provisions which might bring relief to the actual user of water. The call for the meeting was signed as follows:

S. Armour, a director and officer of the Anaheim Water Company, and others.

John G. North, attorney for the Riverside Water Company.

F. C. Finkle, chief engineer of the Edison Electric Company.

E. W. Freeman, attorney for the Temescal Water Company.

George E. Otis, attorney for the Arrowhead Reservoir Company and others.

H. Clay Kellogg, chief engineer of the Santa Ana Valley Water Company.

E. E. Keech, attorney for the same company.

W. E. Smythe, representing other companies.

Does this look as though the irrigator or the water company opposed the bill? In this fight did Mr. Maxwell defend the interests of the irrigator, or did he array himself with the corporations? The following quotation from a statement made by one of the defenders of the bill makes clear his position:

"And then comes George H. Maxwell, another reformer, who protests, in an article just published in the Los Angeles *Times*, that the bill is bad because it makes that very provision, preserving to the state the control of the waters of its own streams. And why? Because it will interfere with national irrigation."

In a letter written from Chicago by Mr. Maxwell on February 11, 1903, he says: "It is true that a bill embodying the theories of state property in the control of water has been introduced in the California legislature, *but the actual irrigators who compose the co-operative canal companies of the southern part of the state* are up in arms against it, and are making a vigorous and determined effort to prevent such a law from being inflicted upon the State of California." Mr. Maxwell knows that the *actual irrigators* were not represented at Riverside on December 29th of last year.

Does Mr. Maxwell go to Nebraska, Colorado or Wyoming legislatures and advocate his doctrines? Does he seek to outline the policies of those states relating to irrigation or does he predict the outcome of any reform legislation there introduced? We have heard of nothing of the kind. The irrigator is well represented among the law makers of those states.

Mr. Maxwell refers to the State of Washington as having model irrigation laws. Those who have given the matter study know that the rights of the irrigators have never been established on a single stream in the state, and where a few irrigators have gone to court and obtained a decree fixing their relative rights, the state assumes no responsibility in protecting them from later diversions. Does this indicate that Mr. Maxwell is working in the interest of the irrigator? Will a few court decisions with no state administrative machinery to carry decrees into effect ever lead to a just settlement of rights? Government by injunction, at

the best, is not popular in the United States, and if the irrigation laws of the land are to be enforced in this manner the farmer has anything but a bright prospect for the future.

ATTITUDE TOWARD THE REPEAL OF LAND LAWS.

While the National Irrigation Association apparently indorses the Act of June 17, 1902, and its organs have repeatedly made the statement that a great fund will accumulate from the sale of public lands, to be loaned by the Government in the construction of irrigation works without interest, yet during the past year or two the same organization has advocated the repeal of the desert land act, the timber and stone acts and the commutation clause of the homestead act. From whence will come the funds for the construction of irrigation works after these laws have been repealed? We can not believe that it is the intention of the parent of the National Irrigation Association to bring about the downfall of national irrigation at this time by cutting off the source of revenue now provided. It does not seem reasonable that the gentlemen should have any other motive than that which would tend to advance national irrigation under the "compromise bill" as he called it a year ago. There must be some reason, therefore, which makes it advisable for him to advocate the repeal of the land laws. It has been suggested that he desires to cut off the revenue in order that "specific appropriations" may again be asked for. His arguments favoring the repeal of the land laws is that the Government is being robbed by land sharks and he charges the people of the West of being "land grabbers" and "land pirates." We believe that any land law can be so administered that steals may be possible under its operation. We do not believe that more land has been illegally obtained under the timber and stone acts than under the homestead act, even before the commutation clause was added. We doubt whether more land has been stolen under the desert land act than under the homestead act. We are confident that fraud is not as common as he seems to believe and that such defects as exist can largely be corrected by a better administration and perhaps some amendments. If the homestead act were to be repealed the recent act of Congress would be null and void as far as its practical application is concerned. If other land laws were to be repealed no funds would revert to the treasury for carrying on construction. Either course, therefore, would lead to a termination of the reclamation work now in progress.

As before stated, Mr. Maxwell and his association, as controlled by him, do not stand for the people of the West, but for the corporations that have interested themselves in national irrigation. Should the above enumerated land laws be repealed the large area belonging to these companies would have a ready sale at advanced prices. Of the 30,000,000 acres or less of public land yet remaining, fully 85 per cent will always be unsuited to irrigation farming. With the land laws repealed this large area must remain an open range. The government rightly prohibits fencing of the public domain. A sentiment with which Mr. Maxwell sympathizes at the present time, antagonizes any leasing system that can be devised. What is to be done with this land? It can not be reclaimed and disposed of under the homestead act, it can not be controlled by small or large ranchmen because it can not be fenced, and under existing laws it can not be leased.

We do not know how far Mr. Maxwell proposes to have the repeal of the land laws extend. If the laws of 1866 and 1891 which give the states authority over the water of the streams within their boundaries are to be included in his program, we can see that he is working to secure the same control of water that he now has of construction under the act of last June. If this should take place, the National Irrigation Association would then be able to deal with a few men at Washington to control the water of western streams. He can not affect the irrigation administration of many of the western states at the present time, but should the land laws which contain one of the provisions which clothe the states with the responsibility of dividing water among the claimants be repealed, his influence would be greatly widened.

It may be that the land laws of the country should be modified. If this is true THE AGE wishes to indorse the movement. If they are so obviously defective that all or nearly all should be repealed, we favor that; but we do not believe that the statutes under which the West has thus far been developed can be wholly condemned. When repeal measures are advocated by Mr. Maxwell we deem it necessary that the West take an active interest in detecting his real motives and the logical results of such measures, and also that Congressmen from the arid region be fully prepared to meet the issue. The matter has already been called to the attention of the land committees of both the Senate and the House by the legislatures of a number of the western states. The resolutions of one of these states reads as follows:

REPEAL OF THE UNITED STATES LAND LAWS.

Senate Joint Resolution No. —.

A resolution relating to the public land laws:

Be it Resolved, by the Senate, the House of Representatives concurring, that a campaign is now being carried on in the eastern and southern states favoring the repeal of all land laws except the homestead act, which, if successful, will interfere with, and greatly retard the development of the West; and

Whereas, This campaign is being conducted by the National Irrigation Association so-called, for the purpose of excluding from the market all lands which now compete with the sale of railroad lands; and

Whereas, It is believed that where the land laws now on our statutes have been carried out in good faith, they have operated successfully; therefore be it

Resolved, That it is believed that the land laws under which the settlement of the West has thus far been made possible are suited to the conditions that prevail here and that no changes should be made therein unless a most thorough and exhaustive investigation shall demonstrate that such are advisable; and be it further

Resolved, That a certified copy of these resolutions be forwarded to each delegate in Congress from this State and to Hon. H. C. Hansbrough, chairman of the Committee on Public Lands in the United States Senate, and to Hon. John F. Lacey, chairman of the Committee on Public Lands in the House of Representatives.

The question naturally arises, why does Mr. Maxwell secure his indorsements from the East and South rather than from the West? If fraud under these land laws is common the people of the West should be aware of it and we believe that there are enough people in that section of the country besides the "land sharks" who have convictions of right and wrong sufficiently

strong that the defects in these acts will be reported and a remedy found.

We do not believe that the West is indebted to Mr. Maxwell in any way. He has been well paid for his time and he has abused the privileges of his position. We regard the irrigation bill as a measure over which one should not become insanely enthusiastic. It represents a departure in the policy of the Government. It is the first measure which has extended aid in any manner towards the construction of irrigation works, and it marks the first time in the history of the country that public works have been provided for by a loan from the treasury. If the law is not carried out by an independent and fearless administration but little will be accomplished under its provisions. Funds must be provided, and those in charge of the reclamation service must be capable of carrying on the construction of meritorious projects without regard to the theories or advice of such men as the leader of the National Irrigation Association.

While we have admitted that the recent act of Congress will bring about no revolution in the reclamation of the arid region, yet we believe that, such as it is, it merits the support of all who desire to see the West ultimately become the great agricultural country that nature intended it should be. We stand for the irrigator who has had the courage and stability to bring about the existing extensive development. It

W. W. WOOLDRIDGE.
Industrial Agent Great Northern Ry., Hinsdale, Mont.

seems to us that he is the man who should be first aided through Government construction of irrigation works. He has labored for years to receive some such recognition and he can not permit the work to be conducted indirectly by a man who has advocated great issues "as a part of a general compromise measure"; who has created an association and secured members therefor by deceitful tactics in order that his real purposes might be hidden; who has changed the "objects" of this association, regardless of his own convictions of right, whenever the necessities of intrigue have demanded; who has sought the courts to repeal laws whereby valid bonds might be repudiated; who, failing in this, has promised his clients that the Government would build their irrigation works providing certain support was advanced.

We simply ask, is Mr. Maxwell a safe man to be intrusted with the responsibility he has sought and so easily found?

THE AGE believes that it has performed its duty; that any publication which remains silent when an honest, truthful and fair statement of fact may result in reform does not deserve the support or patronage of the people; that with the support of the "actual irrigator" we will keep abreast of the movement to reclaim the West and continue to champion that which aims to better his condition and to condemn that which tends to steal from him his independence.

THE CRITICAL KANGAROO.

'Twas a growly, spotted Leopard,
On the plains of Timbuctoo,
Who met one Sunday morning
With a happy Kangaroo.
"Your suit is really startling,"
Said the latter, with a smile,
"For polka-dots no longer
Are the proper style;
And though no criticism
On your tailor I would cast,
I have a strong suspicion that
The color isn't fast.
For—" But here an interruption
Most sudden did occur,
Which filled the air around them
With what resembled fur;
And the Leopard some time later,
Much larger round the waist,
Mused long in pensive manner
On that Kangaroo's "good taste."

—St. Nicholas.

MAXWELL PLACE, PHOENIX, ARIZ.

OWED TO MAXWELL.

A pin feather poet begged us to accept some of his brain work, and as he needed the money, we paid him in advance, expecting him to furnish something worth while Instead, he handed in the following ode, or "owed" as he had it, and, however, diffident we felt about printing it, since we had paid for it we were obliged to use it. Everybody who has bought a pig in a poke will understand that it would have been criminal waste to throw it away.—ED.

Oh, Maxwell, Maxwell, Well! Well! Well!
Salt River Valley says you're swell,
While others say you're a d—d sell;
That's how they put it, what they tell.
'Tis whispered in the shady dell,
Brought to our ears by "passing bell;"
The waters rushing down pell mell,
Through ditches, streams, beneath your spell,
Strange stories gurgle, some so fell
That those who hear them give a yell,
And shout out, "Maxwell, you'll catch h—l."
(Orchestra crash to cover confusion.)
Oh, Maxwell, Maxwell, Well! Well! Well!

IRRIGATION INVESTIGATIONS FOR 1902.

BY ELWOOD MEAD.

The essential features of the Review of Irrigation Investigations for 1902, from the annual report of the United States Department of Agriculture, Elwood Mead, irrigation expert, in charge, present matters of so great interest to our readers that it has been deemed advisable to utilize it in this issue at the risk of crowding out other matter of importance, but not so immediate as this. The report is down to June 30, 1902, but is just published by the government and therefore new.

The report in its introduction points significantly to the rise in value of irrigated land and water rights, in many sections the price of farming lands having doubled and nearly trebled. This is due principally to rise in value elsewhere, changes in the methods of conducting the range live stock business, growing trade with Alaska and the Orient, and the passage of the national irrigation act, which is a most potent factor in enhancing the price of land and water, and increasing the area of cultivation.

Drainage is regarded as an important means of increasing this cultivated area, standing next to reservoirs for storing water, strange as it may seem. The cause, as explained, is due largely to seepage, large areas having been rendered unfit for cultivation by an excess of water on that account. All these lands will be restored to productiveness by proper drainage. The report says that the aggregate area is surprisingly large and is being rapidly extended, a fact which raises the drainage problem from a local to a general nature, involving, as it is liable to do in time, all the older irrigated sections of the west, and the valleys now being brought under cultivation.

The government is now engaged in making surveys to prepare for the emergency of drainage, actively so in California and Colorado, where drainage is most needed, the object being to provide for a reclamation of these "drowned" lands, and the protection of others from the threatened effects of seepage by simple methods of drainage.

In many parts of the west the growing scarcity and greater value of water is leading to the use of sources of supply which were at first neglected. The rise of soil water under many irrigation canals has led to a large increase in the number of wells and pumping plants in the districts watered. In other sections vigorous search is being made for subterranean sources. In the Santa Clara valley in California over 1,500 pumps are now supplying water to irrigators, and along many western rivers there are now more pumps than ditches. Figure 1 will show one of the pumping methods, and the supply of water obtained.

The water-right problems of the arid region continues to be a burning one. That there must be an adequate settlement of this question is not denied, nay, it is demanded. The statutes which govern the filing of

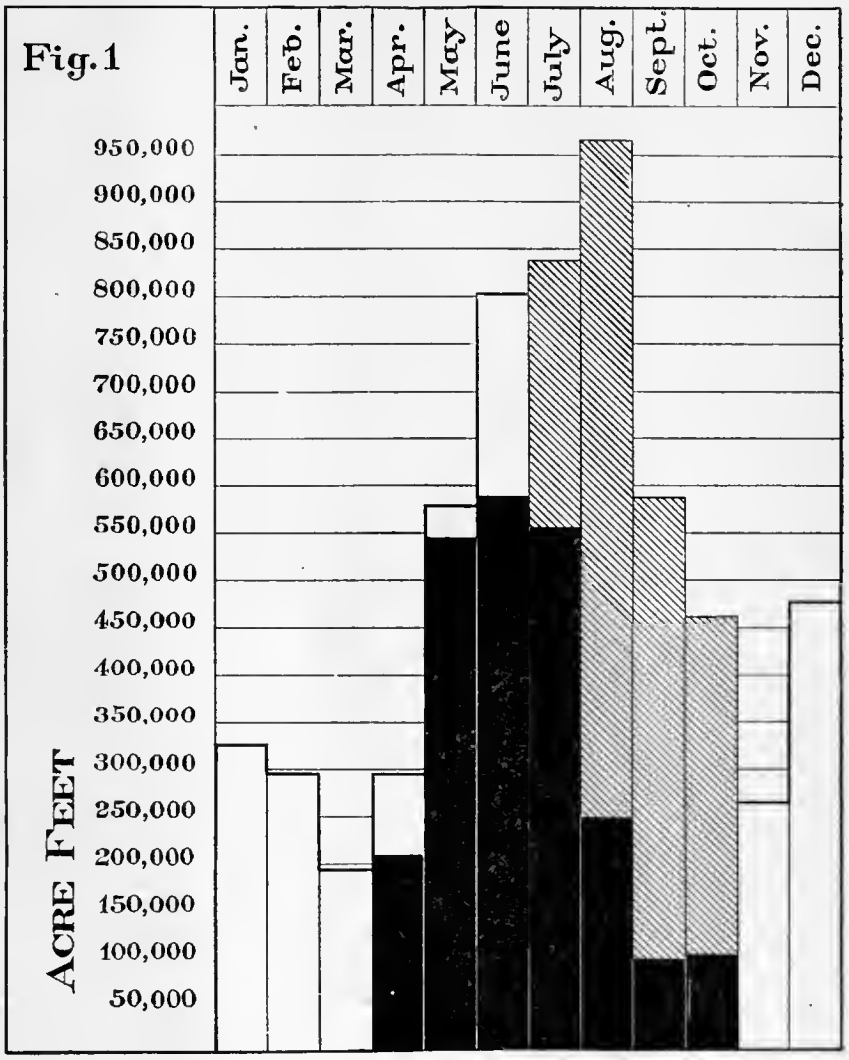


Fig. 2

ANNUAL DISCHARGE OF STREAM 4,202,013. ACRE FEET

ACRE FEET AVAILABLE FOR IRRIGATION BY DIRECT DIVERSION 2,637,094. 55 PERCENT OF ANNUAL FLOW

ACRE FEET WHICH MUST BE STORED 1,564,919. 45 PERCENT OF ANNUAL FLOW

Courtesy U. S. Dept. Agriculture. (*Mead.*)

IRRIGATION INVESTIGATIONS—DIAGRAM SHOWING FLOW OF YAKIMA RIVER, WASHINGTON, AND STORAGE REQUIRED FOR ITS COMPLETE USE IN IRRIGATION.

White areas represent amount of flow during nonirrigation period and unused flow during April, May and June. Black areas represent amount of flow which could be used by direct diversion. Hatched areas represent the volume which must be stored and the time of its use.

claims to water in most of the arid states are so loosely drawn that appropriations of excessive amounts have been the rule rather than the exception.

The uncertainty lies in the failure to unify riparian rights and those arising out of appropriations. In the establishment of rights to water, each state has been a law unto itself, and the only way in which the Federal government can interfere, as matters now stand, is in controlling interstate streams, many of which rise where the riparian doctrine has been abrogated and flow into states where the riparian rights are closely and rigidly guarded. The report deems it of first importance to decide what a water right is, and then determine the amount of that right which an individual may possess for his land. Because the appropriators of water could not agree upon this simple question, Nebraska, Wyoming and Colorado declared for state control of all the water.

Although, as says the report, "the appropriation for the irrigation investigations of the Department of Agriculture, makes the study of laws affecting irrigation and riparian proprietors and institutions relating to irrigation the leading feature of its work, its duties are wholly educational, the responsibility for legislation rests ultimately with the people themselves. The facts, so far, have succeeded in arousing public sentiment to the need of reform. What is suggested is the passage of laws which should include:

"1. A determination of the priority and amount of all existing rights.

"2. The division of states into districts based on drainage lines and the creation of an authentic record of the priorities and amounts of appropriations of water in each of these districts.

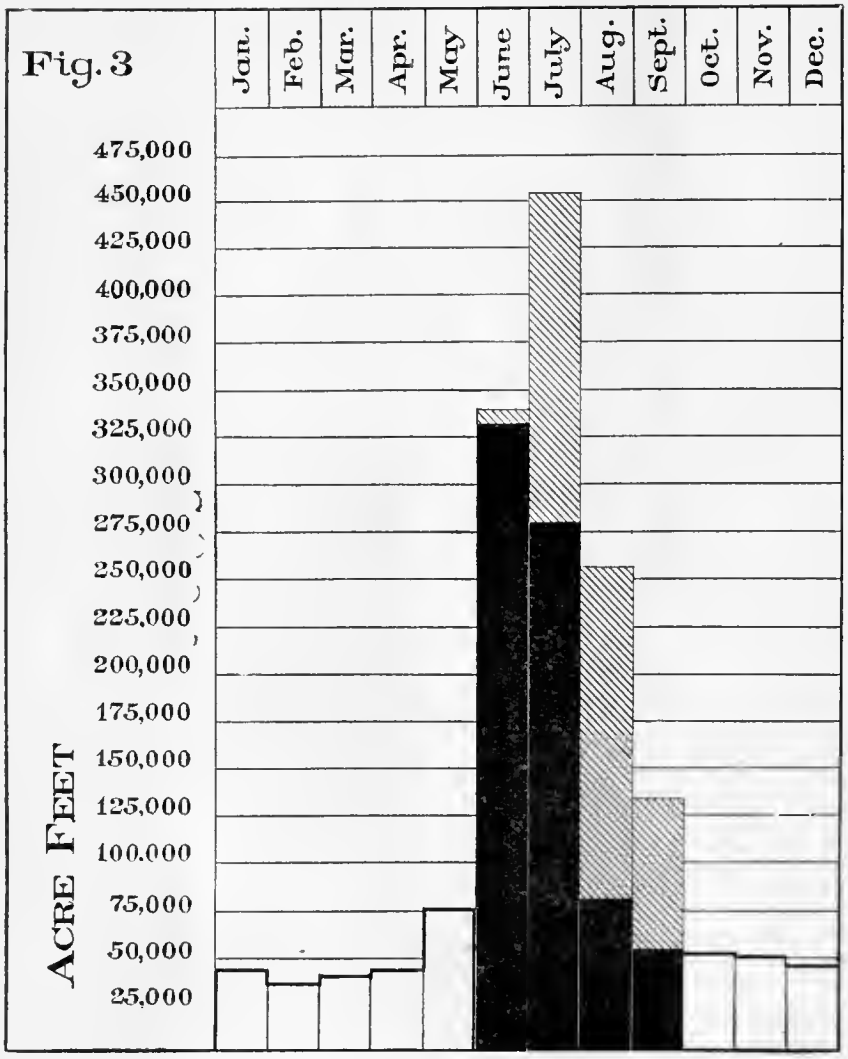
"3. The protection of rights to water in times of scarcity by the division of streams among appropriators by some public official.

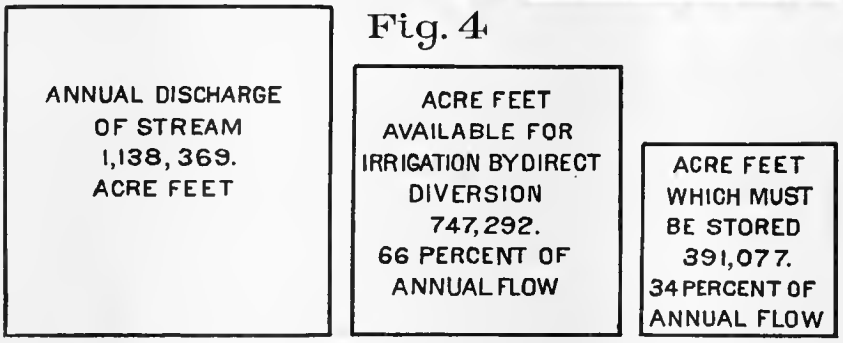
"4. Limitation of all rights to use and the attachment of rights for irrigation to the land irrigated.

"5. The establishment of some systematic and orderly procedure for the record of all future appropriations, and the prompt establishment of priorities and amounts of rights acquired through beneficial use."

As to irrigation in the humid sections of the United States, the report is of the opinion that it is not yet determined whether it will pay, but the question is of sufficient importance to justify a thorough investigation. In New Jersey it has been determined that an irrigation plant will pay in connection with trucking and fruit growing, and that it will be of service every year for one or more crops. In Wisconsin irrigation has proved practically successful, notwithstanding a total rainfall of 19.49 inches for five months. In leachy soils where the rainfall is not retained, irrigation gave an increased yield. In Missouri it is settled that irrigation will pay in the case of vines, nursery stock, orchard and small fruits.

The report contains a highly interesting letter from Hamilton Yancey, of Rome, Georgia, on the subject of irrigation in the south, which will appear in full in the columns of the AGE.





Courtesy U. S. Dept. Agriculture. (*Mead.*)

IRRIGATION INVESTIGATIONS—DIAGRAM SHOWING FLOW OF GALLATIN RIVER, MONTANA, AND STORAGE FOR ITS COMPLETE USE IN IRRIGATION.

White areas represent amount of flow during nonirrigation period. Black areas represent amount of flow which could be used by direct diversion. Hatched areas represent the volume which must be stored and the time of its use.

Rice irrigation forms an important portion of the report, which says that the remarkable increase of the production of that grain along the Gulf coast has made it desirable that the irrigation problems of that section be systematically studied, many farmers knowing nothing of the methods of applying water to crops. Many unsolved questions confront the manufacturers of pumping machinery and those who buy and operate it. There is need to know how much water is required, how it can be distributed with the least loss, and used to the best advantage.

Irrgation in our insular possessions is also treated, and altogether, the report is as complete as possible.

Accompanying the report are three diagrams showing the flow of three rivers largely used for irrigation purposes, which merit attention and study. Also illustrations of irrigating investigations in various parts of the irrigated districts, all of which are given in this number of the AGE.

ARTIFICIAL GLACIERS NEXT.

A CALIFORNIA SCHEME COINCIDENT WITH A SIMILAR SUGGESTION FOR COLORADO.

Dr. Woolridge proposes to render the arid lands of Southern California fertile by changing the climate by means of artificial glaciers in the San Bernardino mountains.

J. L. Herwick, of Glenwood Springs, writes that irrigation in Colorado may be vastly augmented by artificial glaciers, or "icebergs," created in the winters in the mountains.

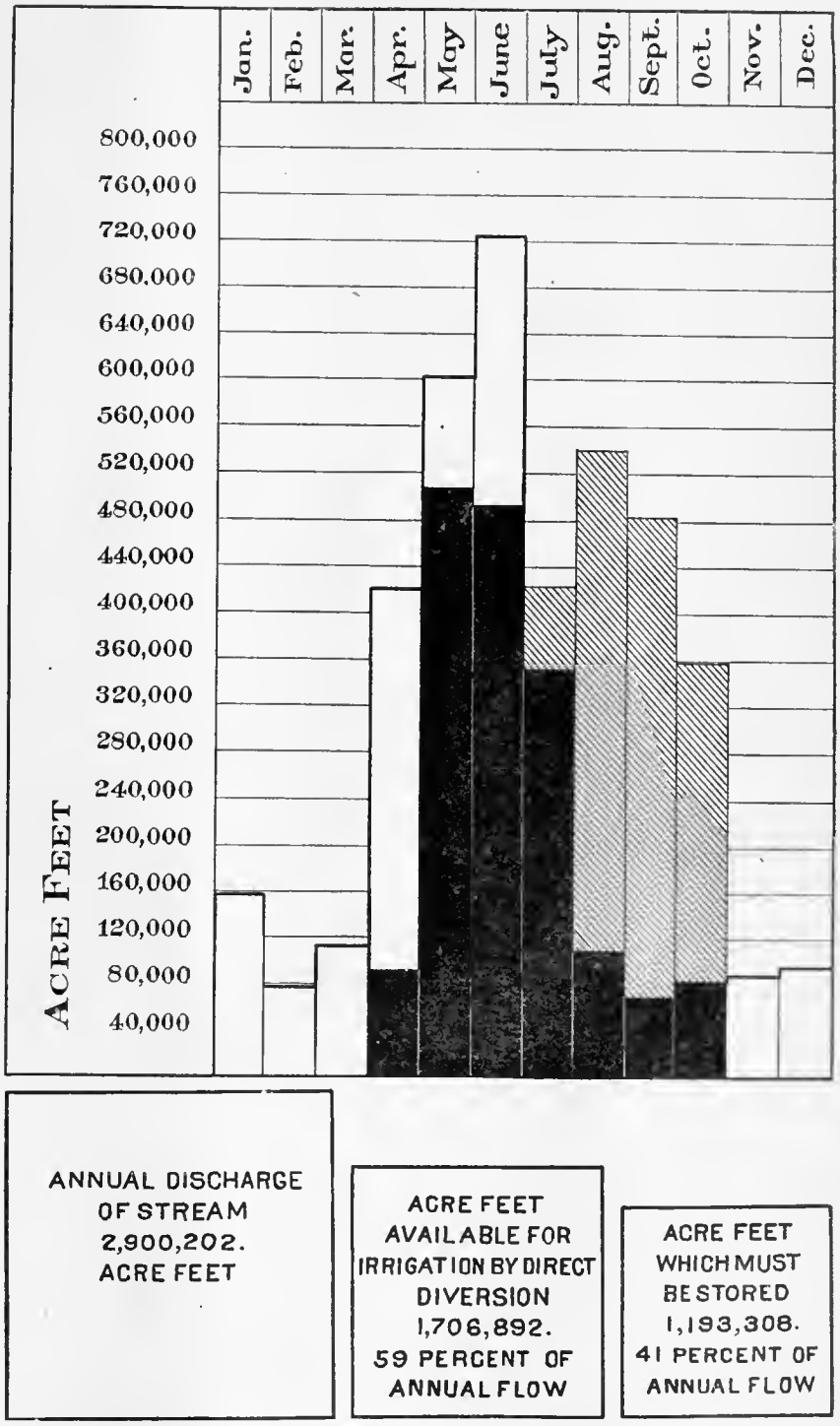
For many years vast sections of the arid lands of Southern California have been so much waste territory to the country from the standpoint of farming. They have baffled every proposed plan of irrigation. Systems used with great success in other states have failed here.

A scheme for irrigating this section of the country, startling in its magnitude and originality, but possibly plausible at the foundation, has just been advanced by Dr. C. W. Woolridge, of Cleveland, O. It is to create by scientific means an artificial glacier at the top of the San Bernardino mountains in California.

The first thing which the plan for making this artificial glacier calls for is an immense chimney on the Pacific coast, miles in width at the base and of an enormous height, so that the ocean air could be carried to the top of the San Bernardino mountains.

This scheme is not so impracticable as it appears on the simple stating of the plan. It must be remembered that the most wonderful modern engineering feats have been accomplished in America, and when some of these are considered, the building of a huge chimney by means of which land may be irrigated seems no longer an impossibility.

The chimney, once constructed upon the plan suggested by Dr. Woolridge, the tremendous current of ocean air passing through it to the great height of its topmost point, by rarefaction, would be reduced to an extremely low temperature, thus forming, according to the inventor's theory, an immense glacier.



Courtesy U. S. Dept. Agriculture. (*Mead.*)

IRRIGATION INVESTIGATIONS—DIAGRAM SHOWING FLOW OF BOISE RIVER, IDAHO, AND STORAGE REQUIRED FOR ITS COMPLETE USE IN IRRIGATION.

White areas represent amount of flow during nonirrigation period. Black areas represent amount of flow which could be used by direct diversion. Hatched areas represent the volume which must be stored and the time of its use.

The presence of this glacier would cause rainfalls throughout the year in that section of the country, which is now discouragingly arid on account of the upper strata of atmosphere being too hot to permit of a sufficient fall of rain to water the lands.

Dr. Woolridge explains his theory very clearly and points out its usefulness and practicability.

"My theory of creating a glacier has only grown from a close observation of the laws of nature," he said during a recent interview. "When warm air from the ocean's surface is carried in large volumes to great heights, clouds are formed and after an interval of time, because of pressure, rain falls. This has been known since the dawning intelligence of man first began to note and understand the operations of nature. If, however, as has long since been discovered, the air from the ocean's surface rises slowly and is diffused and warmed as it rises the precipitation does not occur.

Courtesy U. S. Dept. Agriculture. (*Mead.*)

IRRIGATION INVESTIGATIONS—IRRIGATED ORCHARDS IN THE SAN JOAQUIN VALLEY, CALIFORNIA.

"This is exactly what happens in the lands I propose to irrigate by means of the glacier. And to wage a successful war against this law of nature, it will be necessary to devise some scientific means of carrying the air which is now diffused straight up to a great height in a vast volume.

"Within the range of temperature and pressure to which life is limited the volume of the air varies, it being guided by the pressure. For instance, one cubic foot of air at the sea level with the barometer at thirty inches, will, at such a height that the barometric pressure is only fifteen inches, occupy two cubic feet.

"At the same time without any heat being added to or taken from this air, its temperature is being reduced as its volume increases, or decreases as its volume is diminished by pressure, varying inversely, directly the pressure changes. This is practically illustrated every day in the operation of the ammonia manufacturing apparatus.

"If then, with the temperature at 80 degrees in the shade and the barometer at 30 inches, a great volume of air were carried directly from the ocean's surface off Southern California to the height of 10,000 feet, where the barometric pressure is about 20 inches, its temperature would register two-thirds of what it was at the sea level, and the moisture it contained would be precipitated either on the mountain tops or before reaching that height.

"But the true zero temperature for air is the vaporizing point, or point of no pressure, which the experiments with liquid air have proved to be at 312 degrees below zero. Hence the true and scientific statement of the temperature at the sea level which we call 80 in the shade is 80 plus 312, or 392 degrees, as registered by the liquid air system.

"The apparent loss of temperature that would occur by carrying this air to the height proposed would be one-third of the temperature, or 130 2-3 degrees, which subtracted from its original temperature of 80 would leave 50 2-3 degrees below zero, as the temperature of this air at the height of 10,000 feet is changed from 80 degrees at the sea level by expansion only. This is a degree of cold much greater than is usually found on mountain heights under twenty inches barometric pressure corresponding to 80 in the shade at the sea level with 30 inches pressure.

"This demonstrates that the commonly accepted teaching that the effect of the sun on the upper strata of the atmosphere is slight and that its heating power is mostly exerted close to the earth's surface is a mistake. The sun's rays act on the ocean of atmosphere exactly as they do on the ocean of water. In proportion

Courtesy U. S. Dept. Agriculture. (*Mead.*)
IRRIGATION INVESTIGATIONS—HEADGATES AND WATERWAY, SKALKAHO CREEK, BITTER ROOT VALLEY, MONTANA.

to their mass the upper layers are heated most and the air lying nearest the ocean's surface is the coolest.

"The application proposed by the foregoing scientific truth is that a great flue will be built. The plan is that the entrance to the flue over the ocean's border should be twenty-one miles long, and under the deck or roof of this flue, which is supported like a suspension bridge, the height is 250 feet. This gives a trifle more than a square mile of area of cross-section at the entrance of the flue. The same area of cross-section is maintained throughout, the height increasing as the width of the flue diminishes, until where the constant width of the five miles is reached the height is one-fifth of a mile or 1,056 feet plus the necessary allowance for the slack of suspension cables.

"This is relatively but little higher than the Eiffel tower, and the supporting towers within the structure may be trussed columns braced in all directions by steel cables, rather than towers. This structure should be carried to the height of 10,000 feet on the San Bernardino range. As I have planned it it should be enclosed in glass set in steel sash; a large part of which is arranged to act as gravity valves to yield to storm pressure.

"Such a structure once built would take in the sea breeze throughout the whole breadth of its entrance. A larger volume of moist sea air than in the course of nature is often concentrated on any mountain tract of equal area to the San Bernardino heights, even where the heaviest precipitations on earth occur.

"When the air once starts to blow through such a flue, as it must as soon as enclosed, there is nothing in nature that could reverse the current; it would flow on forever as long as the flue remained. The cold produced by expansion would cause the moisture contained to be precipitated, not as rain, but in the form of powdery snow to be distributed over the heights, while the cold blast accompanying this snow would maintain it there unmelted until a great glacier would be formed.

"The water which the melting of this glacier would supply," says Dr. Woolridge in the *Los Angeles Herald*, "could be collected by a canal encircling the mountain group near the level of 3,000 feet, and in reservoirs occupying the valleys above the line of that canal. This water would be amply sufficient to make a garden of all the desert lands adjacent, including the great Mojave desert, while the chill imparted to the upper atmosphere at this governing point would, I doubt not, greatly modify the climate and increase the precipitation throughout the whole arid region from Mexico to Montana."

PROPOSED COLORADO GLACIER.

Having been requested by W. L. Grubb, president of the Colorado Cattle and Horse Growers' association, and Senator Tomkins, of Chaffe county, to write an article giving my views on the part the timber plays in conserving the snow that falls during the winter, I take pleasure in doing so, believing that it will be interesting to the public.

The general accepted theory is that the cutting away of the timber tends to lessen the flow of water in the latter part of the irrigating season, while the exact opposite is the case.

Having had twenty years' actual experience and residence in the high altitudes of the mountains, I know whereof I speak when I say that if every vestige of tim-

Courtesy U. S. Dept. Agriculture. (*Mead.*)
IRRIGATION INVESTIGATIONS—ORCHARD IRRIGATION IN SANTA CLARA VALLEY, CALIFORNIA. SUPPLY DERIVED FROM PUMPING.

Courtesy U. S. Dept. Agriculture. (*Mead.*)
IRRIGATION INVESTIGATIONS—REPAIRING BRUSH AND ROCK DAM, YELLOWSTONE RIVER, MONTANA.

ber was removed from the mountains we would then have more water in July and August than we do now. This is the season of the year to test the truth of what I am saying. Go into the timber in the high altitudes, take the measurements and you will find that the snow is from one to two feet deeper in the dead timber than it is in the green timber.

The reason for this is that when the snow falls it lodges on the boughs of the green timber and is held in this position until the wind and the dry air carry it away by evaporation, while in the dry timber the snow falls to the ground and is not subject to the above action of the elements. Again, if there were no timber on the high timbered hills and plateaus the winds of winter would drift the snow from those hills and plateaus and pile it up in deep gorges and behind the brows of hills in drifts so deep that the suns of summer would not be able to melt them away until late in August or September, as is the case above timber line.

I have seen, and many of you have seen, huge drifts of snow lying under the brow of some hill far down on the mountain side long after the snow has all disappeared out of the green timber; and, again, you will find it is true that long before the streams get low the snow has all disappeared in the green timber.

It is the big drifts at and above timber line that make the water for late irrigation.

I do not want any one to think that I want to see the timber destroyed for the sake of water to irrigate the land, for I do not; there are other ways of procuring water and the people need the timber for mining and building purposes and should be permitted to use it, so long as they do not waste and destroy it.

There should be some way of regulating the cutting of timber so that the people may get what they need and at the same time protect the young and growing trees. Some people advocate buying the timber from the government, and say that the mill men should pay for the timber they cut. I am not opposed to this plan if it is deemed to be the best. It would only result in the consumer having to pay the additional price, and I am inclined to believe that it would be the wisest plan.

I am opposed to the large and uncalled for timber reservations all over the state for the above reasons.

Speaking of water supply, I was favorably impressed with an idea advanced by Senator Tomkins at the last meeting of the Cattle and Horse Growers' Association, in regard to building what he termed icebergs. The plan was to take out water through pipes at the heads of mountain streams and conduct it to suitable places and there spray it during the winter in such a way that it would form a huge mountain of ice.

In this way very small streams of water could be made to yield a vast amount of water and thereby increase the annual yield many times in crop tonnage.

This system of reservoirs can be built at a trifling expense and in localities where other reservoirs could not be built at all. I believe that this theory is deserving of a practical test.

Courtesy U. S. Dept. Agriculture. (*Mead.*)
IRRIGATION INVESTIGATIONS—PUMPING FOR IRRIGATION IN A SANTA CLARA VALLEY ORCHARD, CALIFORNIA.

THE PRIMER OF IRRIGATION.

BY D. H. ANDERSON.

Chapter III.

SEMI-ARID AND ARID LANDS—THEIR ORIGIN AND PECULIARITIES.

From a general chemical point of view there is very little difference between the soils elsewhere on the surface of the globe, and those in the vast empire in the United States west of the 100th meridian. The soil possesses the identical organic elements already specified in the table given in the second chapter; the same organic substances abound; the processes of plant life are similar, and the same plant foods are essential to the welfare of crops. Still, there is a difference apparent to every man who thrusts a spade into the ground, plants a seed, and attempts to coax the soil to produce a harvest.

A bird's eye view of the entire region impresses the observer with the appalling sense of a vast, barren desert, a few oases, here and there, where widely separated streams and springs exist, but in the main it is an illimitable ocean, a desolate plain, with occasional straggling clumps of scant coarse grass, sage brush, artemisia, chemisal, greasewood, scrub oak, cactus and other sparse vegetation, kept alive by the scant snows of winter followed by dreary, hot, rainless summers, or by inadequate winter rains succeeded by a tropical dry season. This is the general aspect of the semi-arid lands.

Beyond them, except in the North, there is no winter, no seasons, nothing but a pitiless cloudless sky, tropical heat, unmitigated by moisture, with an atmosphere so dry and desiccating that animal matter exposed to its oxygen dries, or oxidizes and becomes reduced to an odorless powder, the toughest substance soon presenting the appearance of a moth-eaten garment. This is the aspect of the arid lands. Some say there are a hundred millions of acres of both kinds of land west of the 100th degree of longitude, others claim a hundred and fifty millions of acres, but the author suspects a still greater measurement.

Notwithstanding all these discouraging features, there is no land in the world that possesses greater fertility, greater capacity for plant growth, and that will so amply and so richly repay the labor of him who puts his hand to the plow and blinds his eyes to the hideous scenic features, until he has created an oasis of his own, in the midst of which he may sit in peace, plenty and content, beneath his own vine and fig tree, in a cooling breeze, sipping the pure cold water from his own olla hanging in the shade, while over, beyond him, sizzling in the hot sands of the so-called desert, eggs may poach in the intense heat, and not even an insect find energy enough to emit a single buzz.

By and by, a neighbor comes, sees the oasis and the near by sands, wonders if he can accomplish as much, tries it, and is surprised to find how easily it is done. Then comes another neighbor, and another, and still more, who push the desert farther off, until there is no desert as far as the eye can reach, nothing visible but rich harvests, fat kine, and plenty. The very atmosphere has changed; the rainfall is slightly increased, where rain and moisture had been strangers from a time far beyond the memory of man, the dews of heaven begin to fall and restore to the parched soil a portion of the moisture stolen from it by the greedy sun. It is a desert reclaimed, semi-arid and arid lands wrenched from the grasp of ages of barrenness and in the struggle forced to perspire plenty, comfort, and wealth. Is the picture overdrawn? The reader has but to look around to perceive the truth of it; it is a moving picture constantly before the eyes of him who turns them in the right direction.

There are men still living who remember when all that vast domain was considered as a desert, and indicated on the maps of long ago, as "The Great American Desert," even the Government regarding it as a desert not worth offering the public, or so poor and worthless as not to be worthy of protecting against marauders.

It has been said that from a general chemical standpoint, there is no difference in the soil which offers so mournful and dreary a prospect as our semi-arid and arid lands, and that found anywhere else on the globe. In their physical characteristics, however, a vast difference is presented to the eye, but that difference is not to the disadvantage of the desert, for when we come to investigate, even carelessly, we discover a greater richness of inorganic and organic matter than in any other region on the earth. For ages the land has been exposed to the lixiviating action of rain water, in greater or less quantities—for it must be taken as true that at some period in the misty past all these lands were exposed to the wash of rains—without losing their fertility. As year after year and age after age rolled away, greater or less vegetation grew to maturity, and, unharvested, returned back into the soil to further enrich it, and hence it became richer and richer, for it must be remembered, that the fertility of the ground is not diminished by plants growing therein; it is not until they are removed from the ground that the soil gradually loses its fertility. Neither was there any impairment by their utilization as pasture grounds for countless herds of wild and domesticated animals, for those, during ages of pasturage, returned to the soil the elements most suitable for plant life.

GENERAL CHARACTERISTICS.

Inasmuch as this book is devoted to irrigation, it will be understood in all cases, that the lands and soils referred to in it belong to that class known as "arid," or "semi-arid," or, as they are commonly called, "desert lands," as contradistinguished from those soils which produce crops through the instrumentality of rain. This is often said to be raising crops by "natural means," but it by no means follows that growing crops by irrigation implies "unnatural" means, the latter method being equally as natural as the former, the forces of nature being equally at the command and disposal of the farmer. Nature works along lines laid down by general laws, and man makes a special application of them for his own uses and purposes. He drains the land when the rain fall is too abundant, and when it is insufficient, or fails altogether, he irrigates it. He follows the laws of nature in both cases, wthout altering, straining, or violating them, indeed, he could not if he would.

Comparing the entire vast area of arable desert lands of the great West with the lands within the rain belt, the soil relations between the various localities are substantially the same. There are good and there are bad lands, lands that are fertile and others that are sterile; here we find soils which will grow luxuriant crops, there we see soils that are not worth even an experiment.

To realize this properly the reader must divest his mind of the idea of immensity that amazes, and

often disheartens him; this idea eliminated, the only thought that should dominate his mind, if he contemplates practical success, is, how to abolish the actual differences and arrive at practical uniformity in agricultural results. He thinks of the pioneers who went into the forests with their axes and laboriously felled trees and extracted stumps with infinite labor, to prepare a clearing, in the soil of which he might plant his sparse crops, and wait years before establishing any sort of home. Perhaps he remembers how a bog or marsh had to be drained, and the years it required to "sweeten" the soil before it could be utilized. He does not fully realize that in the desert his land is ready for his muscles, for his seed, and for his crop; he does not dream that he does not have to grow old before carving out a comfortable home as he had to do in the old days, back in what he is pleased to call "God's country," and that out in the desert he may have a home and plenty while still young enough to enjoy them.

The climatic differences are too much in favor of the desert to desire alteration, but the diametrically opposite methods of controlling the soil are difficult to be appreciated, though they are never baffling. They are no greater than elsewhere, but they are opposed by preconceived opinions, perhaps, rooted prejudices, and are, therefore, apparently more serious. There are illimitable treeless regions, covered or patched with stunted vegetation, that receive little or no moisture at all from the clouds, and a soil parched, even burned by the hot sun. Yet the scientists have discovered and classified 197 different species of plants that love the desert soil and flourish in it. Many of them suitable for animal food, all of them indicating some quality in or under the soil as plainly as if they were labeled.

Thus, greasewood, or "creosote bush," indicates less than 0.4 per cent of alkali in the soil; salt grass and foxtail mean that there is plenty of moisture at the surface of the ground and consequently, the presence of free ground water not far below the surface; shad scale indicates dry land with less than 0.4 per cent of salt; rabbit bush flourishes on sandy soil comparatively free from salts, and will seldom grow under any other conditions; sweet clover and foxtail indicate wet land and less than four per cent of salts, though sweet clover will grow in six per cent alkali soil and produce a fairly good crop for forage if harvested very early.

So it is with the color of the soil. Indications are ever present of the dominant characteristics of the ground. Red soils always indicate iron in the form of an oxide; black soils mean carbonate of soda, an alkali ruinous to vegetation; white soils or gray mean soda in sulphate salt form, also deleterious to plants when more than one or two per cent; gray or brown and black cracked or checked soil with vegetation, signifies adobe, while barren, dark or light colored soil so hard that dynamite is more suitable for its tillage than a plow, is "hardpan," the former indicating a soil retentive of moisture, the latter indicating that moisture is somewhere beneath.

Another peculiarity of desert land soils is the frequent occurrence in the soil when plowed or dug up, of innumerable small roots or rooty fibers. They are, indeed, vegetable remains, but through lack of moisture, they have not fermented into humus, though it may be said that they have practically "oxydized" without losing any of their nitrogenous elements. It is well for the desert soil where this organic matter exists, that these rooty fibers have not fermented, for the inorganic matter, the alkalies and other mineral and metallic salts would have speedily devoured the product and left nothing for plants to feed upon. The reader has already been informed that both organic and inorganic elements are essential to plant life, and that the inorganic elements—the substances given in the table in the second chapter and their combinations into salts, are largely in excess of the organic elements. The same principle holds good in the case of desert soils—it is not a theory but a practical fact—that organic matter added to the inorganic means life; their separation, death. Hence, it is clear, that the addition or presence of organic matter and nitrogen, added to the mass of inorganic substances in the soil, tempers the latter and lessens its natural tendency to do harm. In the case of an alkali soil, vegetable matter and nitrogenous substances lessen the deleterious effects of the alkali, although it may not reduce the percentage of the salts. Whence, also, the presence of masses of coarse or fine vegetable fibers in the soil is evidence of either the absence of an excess of alkali, or that it is under control and inocuous to vegetation. Perhaps the reader may see in this a way to get rid of the alkali in soils and render them fertile. If he does, he will not be far wrong in his idea, as we shall see presently.

LACK OF WATER.

There are two conditions which are the bane of all desert lands, whether arid or semi-arid: Lack of water and the presence, in excess, of alkalis. We shall devote space here to some general remarks on both conditions, leaving it to subsequent chapters to enter more into details. The chapters on "Alkali Soils," "The Relations of Water to the Soil," and that on "Cultivation," will give more particulars, though at this point it may be necessary to include matter which will be repeated elsewhere, or presented from a different viewpoint. This, however, should not be deprecated as a fault, but extolled as a benefit, for the subject is of so much vital importance that it can not be repeated too often, lest it be forgotten.

There must be a water table at some point below every soil, at a less or greater depth. This may be accepted as a fact without going into geology to prove it. Such subsoil water originates in a variety of sources, through percolations from above, underground streams coming from great distances, from springs that have their original sources in some nearby hill or mountain land, by seepage from rivers, brooks, or streams, from an irrigating ditch, or pond, and from the artificial surface application, or through sub-irrigation. Although the action of the earth's gravity pulls or draws water downward as it does every other object heavier than the atmosphere, the constant natural tendency of the water beneath the surface is to rise to the surface and evaporate.

It is this rise of the water table to the surface that causes more alarm than any other process of nature in the arid and semi-arid regions, particularly in the arid regions where all water must be applied artificially. The reason is obvious. The subsoil water contains in solution whatever soluble salts it may come in contact with, and reaching the surface, evaporates, leaving behind a deposit of the salts as crystals. Constant deep cultivation also has a tendency to bring up the water table with alkaline solutions, for we have already seen that the subsoil contains in reserve as much mineral matter and salts as the surface soil. And this is so whether the land is in the arid regions or in the rain belt, the disadvantage of the desert land being that the

proportion of organic matter is not high enough to maintain an equilibrium of plant food consumption. Still, this is not an incurable disadvantage, for when the labor and expense of draining, mixing, tempering, and reducing soils in the rain belt is compared with the trifling care and attention devoted to desert land soils to render them continuously fertile, the wonder is that they produce any crops at all, so slight is the effort to make them yield.

It is not uncommon to fill the subsoil with water from irrigating ditches, by putting into it all the supply obtainable during the flood season, thus bringing the water table sufficiently near the surface to supply the crops by capillary action. This brings the ground water within three or four feet of the surface, which is well enough for alfalfa and gross feeding plants, but is bad for trees, vines, and more delicate plants. In arid regions where irrigation is the only means of bringing moisture to the soil the water table may be a hundred or more feet below the surface and can not rise on account of impenetrable strata of rock or hardpan. But in that case the irrigation water creates a new water table, the excess of the irrigating water sinking down until it meets an impervious stratum of rock or hardpan, and there it accumulates, becomes stationary, dissolves out the earth salts and when the surface soil dries out or is deeply cultivated begins coming to the surface by capillary action, every subsequent additional saturation of the soil from the irrigating ditch increasing the area and zone of the artificial water table. When that happens, and it does happen in desert lands sooner than it takes to clear the ground of trees and stumps in the rain belt, drainage becomes of vital importance, second to irrigation itself.

In semi-arid regions, where there is some rain fall, though inadequate, the amount of rainfall, whatever it may be, has washed the alkali out of the surface soil down into the water table, and the surface soil is freer from the deleterious material, which in the arid soils even prevents the seeds from germinating and obtaining a foothold strong enough to resist it, for when a plant has outgrown its infancy, and developed its first true leaves, it will require a most extraordinary quantity of deleterious material to destroy it. It refuses to absorb what it does not need and does not require, and unless wholly overpowered by the solutions in the water that surrounds it, it will grow up to be something more or less perfect.

It is said that six or eight inches of rain will mature a crop in the semi-arid region with proper cultivation. It matters little whether it be wheat or barley if the grain be sown very thin to allow more room for stooling. Six inches will grow it to fodder and eight inches will cause it to head out fairly well. An instance has been called to the attention of the author, where ten inches produced two crops without irrigation.

A fair crop of potatoes was grown in and removed from the fibrous, red clayey soil in April. The land lay on a side hill, about in the center, the summit of which had been roughly plowed to gather as much rain as possible so as to utilize the seepage for the potatoes. Immediately after the removal of the potatoes the land was plowed deep, and moisture still showing, it was carefully cultivated. Corn, of the variety known as "white Mexican," was then dibbled in and left to its fate. From the time of its planting, until harvested, not a drop of water was put on the land by way of irrigation, and only about an inch of rain in "Scotch mists" fell upon the surface. The corn came up in four days and grew strong and vigorous. The soil was plowed deep about every ten days, fully turned over and followed with the cultivator and harrow, until it became so soft and powdery that it was difficult to walk in it. It was also hoed frequently, not a weed being permitted to appear, and the soil stirred deep and drawn well up over the roots. The land measured about an acre. The corn grew to full maturity without a single set back, or twisting of a leaf. The stalks measured an average of nine feet and each bore from two to four perfect ears of plump kernels, and made good roasting ears, and when harvested in the middle of June, the ground still showed some moisture.

Instances of this particular kind are abundant in every locality in the arid and semi-arid regions. They are nothing but experiments, or rather accidents, and prove nothing that can be of general utility. They show, however, what may be done by careful cultivation with a small amount of water husbanded to the last drop. There was not a particle of alkali in the soil above referred to, and it was very retentive of moisture. It emphasizes what the author contends, and what scientific investigation places beyond the pale of denial, that cultivation and moisture are what may be considered essentials, and not water in its liquid form. To borrow a word from another profession: we are dealing with the homœopathy of agriculture, and advocating water triturations provided they accomplish the purpose of growing a profitable crop, where drastic doses will ruin.

In every case, however, the supply of water diminished by evaporation must be restored either by irrigation or by rain fall, and the requisite amount must be continuous and not intermittent; that is, the plant must be kept growing.

If it were not for the fact that water is a solvent of the salts necessary to plant life, and as a medium for conveying them in a state of solution to the plants, there would be no necessity for water, and plants could grow in an absolutely dry and rainless region without irrigation.

It should be borne in mind that it is not so much "wetness" that plants require, as a medium for dissolving the earthy salts and vegetable acids, so that the two may find their affinities and form the various chemical combinations which are necessary to make the plant. When that has been accomplished all the rest is surplus, waste, useless expenditure of the forces of nature, deleterious to plants by over feeding them, and injurious to the soil by washing its reserve elements out altogether, or driving them down into the subsoil beyond the reach of the plant roots, or forcing them to combine in excessive quantities which leach out, or crystallize on the surface and accumulate in masses that prevent the germination of seeds.

More will be said upon this important subject in the chapter on "The Relations of Water to the Soil," the second bane of desert land, "alkali," being next in order.

The Collins Plow Co., of Quincy, Ill., recently shipped to Europe one of their Jumbo Eli Haypresses, the largest machine of its kind made in the world. This press has a capacity of ten tons per hour. This is the second press shipped to the same purchaser. Another press of this kind is being shipped to California, where machines of large capacity are in demand. These presses each weigh over five tons, which will give some idea of their massiveness.

The Drainage Journal Department

DRAINAGE FOR ALKALI.

RESULTS AT NEW MEXICO EXPERIMENT STATION.

A detailed study of the water and alkali conditions has been made by this station with the results hereinafter stated. The experiment was made on twenty acres of land east of Roswell, N. M., the preparations for the experiment having been completed by May 1st, 1900. Now comes the sequel, as related in the *Portales* (N. M.) *Herald:*

In the summer and autumn of 1900 the alkali flat was given a number of heavy irrigations. It was intended to break up the land adjacent to the drains in the spring of 1901 and plant it in narrow plats, running north and south, to various crops, continue the flooding and study the effects of the varying depths of water table and the alkali on the growth of these crops. It was also desired at the same time to study the necessary depths, distances apart and cost of the drains, and they were arranged with this end in view. The land selected for this experiment is a part of the Hondo bottom. It extends from the Hondo river southward to the foot of the slope which forms the south boundary of the river bottom. The surface of the land rises from the bottoms rather abruptly at first for about 300 feet, and then more gradually off toward the south and southwest.

The line for the central drain was selected at the narrowest part of the bottom land, the width here being about one foot in the first 100 feet from the river and of about half a foot in the remaining 500 feet. There is also a slight fall toward the east. In addition to the general slope to the south and east there are a few well marked depressions in the surface. The Pierce, Cunningham and Ballard irrigating canal is situated about midway on the abrupt portion of the slope, at this point about 150 feet from the end of the central drain. The soil of this slope contains a large amount of gypsum, is somewhat gravelly, and allows water to pass through it quite readily, so that the seepage from the canal is large.

About a quarter of a mile to the south, and on higher ground, there is another canal, running from west to east, through the adjacent 40 acres. The soil through which this canal runs is loam, underlaid by gravelly material derived from limestone conglomerate, which extends down to the bottom land. The nature of the soil makes it probable that this canal also loses considerable water which finds its way down to the flat.

The greater portion of the flat was covered with bunch grass, called salt grass, in which there were some bare spots. The wettest portions were covered with true salt grass, and where water stood on the surface, in the depressions, with tule. The most important of the plants going under the name of tule are there. On the slope, from the ditch to the flat, the surface foot is mainly a sandy loam, and the second foot is loam. Below two feet the soil is lighter in texture and contains a large proportion of gypsum with gravel. The soil of the bottom land is the Hondo meadow type, consisting principally of the sediment which has been deposited by floods. The texture of the first foot varies from a heavy clay loam on the south side to a light loam on the north side, next the river. The second and third feet vary from clay on the south to clay loam on the north side. Although the most of this soil is quite heavy in texture, it appears much lighter when examined in the field. Its true texture is brought out on attempting to mix it with water, when it is found to be quite difficult to make into mud, for it acts like a very pure clay. When wet lumps of the deeper layers of the pete and muck were thrown out, in ditching, and allowed to dry, instead of baking very hard, as does the heavy soils of the Rio Grande valley, they soon crumbled into soil of splendid tilth. The breaking down reminds one of the slacking of lime. A practical application of these observations lies in the fact that if such a soil is cultivated when in proper moisture condition it is easily gotten into good tilth, but when worked too wet it will puddle and become very heavy and difficult to handle.

The drainage system consists of a main central drain 610 feet long running from the foot of the slope to the Hondo, its direction being about three degrees west of north. This drain is laid on a grade of four inches to the hundred feet. The first 100 feet from the Hondo is open, the next 270 feet is laid with 8-inch tile, and the upper 240 feet with 6-inch tile. At the foot of the slope the central drain is extended 150 feet southwest, somewhat parallel with the P. C. and B. canal, and laid with 6-inch tile.

On the east side of the center there are 12 lateral drains making an angle of about 18 degrees with the main drain, parallel to each other and 155 feet long. The first eight, from the south, are 30 feet apart, and laid with 3-inch tile at depths between 2 and 3½ feet; the next three are 40 feet apart, laid with 4-inch tile, and their depths are from 2½ to 4½ feet, and their greatest depth being where they join the main and the least at their east ends, due both to their grade and the slope of the land toward the east. The twelfth drain is 100 feet from the eleventh, is laid with 5-inch tile and has a mean depth of about 4½ feet.

On the west side of the main there are seven drains, each 155 feet long, and these also make an angle of about 18 degrees with the main. The first four are laid with 3-inch tile at a depth of from 3 to 3½ feet, and 60 feet apart, the next two are laid with 4-inch tile at a depth of from 3½ to 4 feet, and 60 feet apart. The seventh is laid with 5-inch tile at a depth of about 4¾ feet, and is 100 feet from the sixth. The end of the main drain, where it empties into the river, is about 6½ feet deep.

The slope of the land was such as allowed the east end of some of the drains to come within two feet of the surface, while the greatest average depth of any of them was about 5 feet. This gave an opportunity for studying the effect of various depths of water table on the rate of removal of alkali, and on the growth of crops. It was our intention to plant a portion of area to various crops in narrow plats running north to south, but unfortunately this portion of the experiment could not be carried on. The drains were put in

of different sizes and at different distances apart in order to test the effectiveness of different sizes of tile and to obtain an idea of the distances through which they would work. The work was begun on April 1st and completed by May 1st, 1900. Water commenced to flow in the ditches as soon as the water table was reached and there has been a steady flow ever since of seldom less than 75 gallons per minute. For the first few months the average flow was about 100 gallons per minute. The drains worked thoroughly and the soil cleaned of salts.

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American Seeding Machine Co.'s Office.

The above illustration will give our readers a very good idea of the general offices of the American Seeding Machine Company, which are located at Springfield, Ohio. This structure was built especially for office purposes. It is of pressed brick with slate roof. The interior finish on the first floor is of hardwood, consisting mostly of black walnut and quartered oak, while on the second floor the wood finish is of sycamore.

The offices are equipped with all modern time-saving systems, and the office furniture is of the most approved pattern. The building occupies an imposing position on a knoll at the corners of Galagher and Monroe streets and Gillette avenue. Every convenience for the comfort of the large office force and for the rapid and satisfactory conduct of the business of the American Seeding Machine Company has been provided. It is certainly one of the finest office building occupied by any company engaged in the manufacture of agricultural implements.

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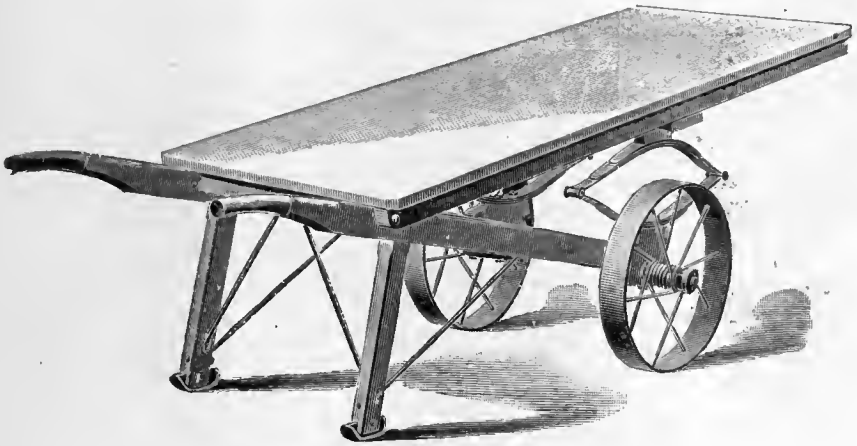

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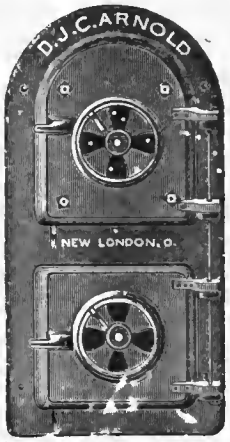

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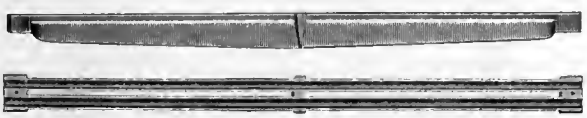

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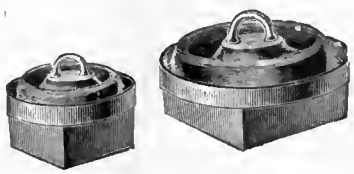

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THE IRRIGATION AGE

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THE IRRIGATION AGE

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EDITORIAL

The editor of The Irrigation Age visited Ogden, Utah, recently and found the local committee engaged in the details of an entertainment program that will eclipse anything of the kind ever before offered a similar gathering.

The 11th National Irrigation Congress promises to have an attendance of from one thousand to twelve hundred accredited delegates, and a large number of those in attendance will be accompanied by members of their families. The number of strangers in the city will easily reach three or more thousand.

The August issue of The Irrigation Age will contain a finely illustrated article setting forth the attractions of Ogden and Utah generally, and will also give an outline of the entertainment program.

Remember the date, September 15-18, 1903.

A California newspaper whose man has probably been there, says: "Arizona is a region of striking individuality." We should say so, particularly in that part of it where Roosevelt's "George" is driving stakes.

The *Arizona Blade* and the Florence *Tribune* thus defines a possibly well known humanitarian:

"George H. Maxwell, a gentleman who eats his bread in the sweat of his jaw, is working a stupendous bunko game on the National Irrigation Association, and if successful, that success will, eventually, result in a repeal of the national irrigation law, a calamity the people of the west in particular, and the people of the United States generally, should strenuously endeavor to avert."

A Fair Offer. We have on hand a few copies of "Land Drainage for Profit," which was prepared by scientific men and experts. For ten cents in postage stamps we will forward a copy postpaid. Or, every new subscriber sending $1, will receive a copy free with one year's subscription to THE AGE. For $1.50 we will send THE AGE for one year, a copy of "Drainage for Profit," and a copy of "The Primer of Irrigation," which is now in course of preparation.

Plain Logic. Self preservation is the first law of nature. If you do not wake up and protect your homes and farms against land and water grabbers, how do you expect the government to do so? This is a people's government, and you are the people. The plain logic of this is, that farmers and irrigators have it in their power to put a stop to the frauds and abuses that have crept into the application of the land and irrigation laws. If they spend their energies in lying down and complaining, they are like the man in a ditch waiting for the Lord to help him out—the Lord don't. Organize and fight for your rights with the same force as those do who deprive you of them. Unite, instead of trying to pull with a rope of sand.

The Slickness of the Thing.

It is the proud boast of the press that it stands for the interests of the dear people, and exposes schemes detrimental to their welfare. Truly, a laudable purpose; but sometimes the press is worked by the smooth, oily, and slick promoter in applauding, in editorials and general articles, schemes that will not bear the light in the regular advertising columns.

As a sample of the slick manipulation of the press, we find in the *Capital,* of Topeka, Kan., June 14, ult., a glowing telegram, or special correspondence, direct from Phoenix, Ariz., anent the Tonto Basin reservoir. The sensational headlines are: "Plans for Irrigation—Great Canal for Arid Lands in Arizona—Enormous Enterprise—A Three Million Dollar Reservoir Is Only the Corner Stone of a Gigantic Scheme of Development."

We feel inclined to say: "Phew!" at this appalling enormity, but when we investigate and find that the "Special" to the Topeka paper was a clipping from the *St. Louis Globe-Democrat,* we say: "Pshaw! another advertising dodge of the lively George." It reads like a patent medicine ad. that fools the reader by its interesting, perhaps sensational, beginning, and falls flat when he discovers it to be nothing but an ad.

Rip Van Winkle Wakes Up.

To learn something new about the Great Bounding, Pulsating West, something positively new and unique, one must scan the columns of the eastern newspapers.

The *Brooklyn Citizen,* in a recent issue, ventured to express an opinion upon the subject of irrigation, which is charmingly ingenuous, withal noncommittal.

After mentioning the fact that the government is taking steps to carry out the promises of the National Irrigation Act. and is about to redeem 600,000 acres of arid lands at a cost of about $7,000,000, the *Citizen* turns on its psychological calcium light thus:

"What may be grown on these lands remains to be seen; but as the only thing they lack to make them productive of something in the way of vegetation is a sufficiency of water, it is not unlikely that when that is supplied they will yield crops far greater in value in a single year than all the money spent on them for irrigation by the government, added to what the farmers who work them will expend for cultivation."

We should say. To estimate that antediluvian researches are limited to the great west, when there are mastodons to be had right on the surface in Brooklyn! The humor of this appears in a paragraph immediately following the above:

"This calculation is based on the results of irrigation elsewhere. For instance, the cost of the irrigation works already in operation in eleven states, including those above named, with California, Idaho, New Mexico, Oregon, Utah and Washington, was $64,289,601, and the yield in 1900 of hay, cereals, vegetables and fruits on the lands treated, aggregated $84,433,438; and this on an area of about 7,260,000 acres."

With 550,000,000 acres more to be redeemed, the market garden prospects in and about Brooklyn seem to be in a fair way of being overshadowed, or run out of the game entirely.

Light in a Dark Place.

The reader will find in another column the first chapter of "An Expose," in the matter of The San Carlos vs. The Tonto Reservoir, prepared by Hon. Thos. F. Weedin, of Florence, Ariz., editor of the *Arizona Blade.*

Mr. Weedin's article will prove interesting reading to those who have heard heretofore mere muttering thunder, and perhaps open the eyes of many to an astonishing condition of things connected with the manipulating the irrigation act of Congress for private purposes.

History demonstrates that few government enterprises intended for the benefit of the people, have ever been carried on for the purposes intended, until some syndicate headed by a few private parties, operating through facile government agents, have sufficiently crammed their pockets, and then the general public, the people, have been kindly permitted to come in and take the leavings.

The country has grown too big, become too thickly settled for the old successful land schemes to attain success, because by the simple method of organization, they can be either nipped in the bud by publicity or the government forced to take a hand in their suppression. The political pull of an organization composed of 75,000 actual settlers demanding an honest application of the land and irrigation laws of the United States, and of the small states, is too strong to be general, for it could make itself felt in local, state, and national affairs to some purpose.

After the dust of the first Oklahoma boom had settled, it was discovered that more land locations had been sold than there were locations mapped out, and that the money received by somebody in excess of that lawfully allowed to be collected, amounted to about one hundred and twenty-five thousand dollars. Of course, those who paid the government their money on fictitious locations, had only to demand it back and the beneficent government would return it. But it did not. The "government" happened to be vested in certain officials who raised the question that the money was a voluntary payment and therefore could not be recovered; that ignorance of the fact was no protection, and that a government official acting as such was the government and could do no wrong. These points have been sustained by the courts, and the defrauded got their moneys' worth in experience and the government— that is, the official understrappers—kept the money.

The people have grown somewhat wiser, as the recent postoffice investigation has demonstrated that official honesty is not a self-evident virtue, because peculations, swindles, frauds and schemes of robbery may be ripped open by the executive knife and the foul contents of the ulcer exposed to the public nostrils.

It is presumable that the same slogan of the president "Let no guilty man escape," will be dinned into the ears of the schemers who are setting at naught the will of Congress for private gain, and that if they cannot be shamed into honesty, they will keep their grasping hands off through fear of punishment.

Organize for Self-Protection.

The investigations now going on in the Postoffice Department—and soon to be begun in the other department of the government unless political pull prevents them—ought to be a lesson to the people in the arid and semi-arid regions who are dependent upon the recent irrigation act of Congress for the permanency of their homes or for the establishment of new ones.

We have the word of the President of the United States (moreover it was the object and purpose of that act) that it was intended for actual settlers, American citizens in pursuit of homes, and not to enrich certain government officials and private parties organized into syndicates to grab the best and most available lands and hold them against actual settlers at a high, even an unconscionable price.

That these perverters of the public law are at work to destroy the objects of the irrigation act has been demonstrated by the most conclusive evidence, and that they are pursuing their work without molestation is painfully evident. Time and again have the sufferers from their frauds complained, but their complaints are derided or treated with sublime indifference. It is now time to take active steps to scotch this venomous serpent in its infancy and before it develops fangs dangerous even to the government. Under the circumstances, it would not be wise to leave to some future administration an investigation into frauds originating under that of Theodore Roosevelt.

Had the powers that were in charge of the government listened to the complaints made against the postoffice and other departments for fraud, there would not now be any fraud to investigate. The people are only affected indirectly by department stealing, but in the land frauds now on the eve of being perpetrated, without any attempt at concealment, they are directly made to suffer. Will the people stand for this governmental apathy, particularly where the home hopes and aims are to be ruthlessly destroyed?

The article of Alfred Sears, on another page, gives some insight into the manner in which the government is made a party to land-grabbing schemes, at least, enough to put the people of other portions of the United States on their guard against the same conspiracy. The fact is, it is useless to appeal to certain government agents whose duty it is to investigate, for they are parties to the wrong, or are induced by certain promises to wink at the shady transactions. In plain language, so far as the individual sufferer is concerned, the government is engaged in a scheme to rob or, at least, to deprive him of his rights under the laws enacted for his benefit. To him, the government officer is the government, and that portion of the government which he sees and with which he is in immediate contact, is corrupt.

It is a curious condition of things in a people's government, as there is no way of reaching the executive power, who alone can apply a remedy, except by a powerful organization that will manifest enough political pull or influence to stir it into action. This government has changed hands more than once on issues of less importance than land stealing, and now, to the great body of home-seekers and home-defenders of the great west, it is the paramount issue.

THE AGE is pleased to learn that an organization of irrigators is about to be perfected for the purpose of protection against the public and private land frauds that are springing up everywhere, apparently under the domination and control of a gang which assumes various names in different localities, but which has always the same individuals back of them.

Such an organization cannot fail to obtain the ear of the executive power, at least, proportionate to its size and influence. Our advice is to organize at once in every district, in every locality, and prepare for a national convention at the earliest possible date.

THE AGE will gladly give all the information in its possession concerning this organization and, as a pointer, it desires to say, that its members will be only actual homeseekers and settlers; none of them will be connected with any syndicate, interested in any land-grabbing scheme, or connected with any official of the government in diverting the irrigation act from its true purpose. On the contrary, it purposes to be an organization for protection against the defrauders of the people, whoever they may be, and whatever public or private position they may occupy.

THE AGE, moreover, purposes to lay before this organization the most convincing evidence of a conspiracy to defraud, not only the government, but the people, and enable it to strike at the right time and hit the proper parties.

There is every reason to believe that President Roosevelt will listen to the voice of this organization—he has given every evidence of being averse to fraud on the part of government officials and their private partners—but even if he will not, then some other executive will, the matter having reached such a pernicious stage that something must be done, and that very soon.

THE SAN CARLOS vs. THE TONTO RESERVOIR.

AN EXPOSE OF A SCHEME TO CONVERT THE NATIONAL IRRIGATION FUNDS TO PRIVATE USE.

BY HON. THOS. F. WEEDIN,
Editor *Arizona Blade.*

The San Carlos reservoir was the breastwork behind which the national irrigation forces successfully fought the battle for government aid in the reclamation of the arid public domain of the west.

It was the one slogan that could enthuse alike the practical business and the religious and philanthropic elements of the country, because it was the only possible water-storage project that could be made to serve the dual purpose of giving permanent relief to and making self-sustaining eight thousand industrious but starving Pima Indians, and at the same time effectually demonstrated the feasibility and beneficent results of national irrigation by reclaiming one hundred thousand acres of the arid public domain in a locality where the soil and climatic conditions combine to produce the greatest results that are possible under the best-regulated irrigating system.

HON. THOS. F. WEEDIN,
Editor *Arizona Blade.*

It had received the unqualified endorsement of the leading hydrographic, reservoir and irrigation engineers of the United States.

The Geological Survey had, after two years' careful investigation of its engineering and hydrographic features, etc., made a most elaborate report on this reservoir, in which it was shown that there were neither engineering nor legal difficulties in the way of the construction and operation of this reservoir and the irrigation system to be connected with it. Also that the unappropriated water supply was sufficient, in years of minimum flow, to fill a reservoir of the capacity proposed, namely, two hundred and forty-one thousand acre-feet and fully irrigate one hundred thousand acres of government land in addition to the Indian lands. This report had received the official approval of Secretary Hitchcock, of the Interior Department, who earnestly presesd Congress for an appropriation providing for the immediate construction of the reservoir. This was prior to the passage of the irrigation act.

The continual discussion of this San Carlos reservoir, both in and out of Congress, did more than any other one thing to enlighten the public on the subject of national irrigation and crystallize public sentiment in favor of that movement. When the final struggle came on the Newlands-Hansbrough bill it was the unanswerable facts and figures that the Geological Survey had compiled in support of the San Carlos storage proposition that broke down the opposition and carried the bill through Congress.

But the moment the bill became a law the rich land owners and speculators of the Salt river valley, who had been pronounced and persistent opponents of this beneficent measure and equally as pronounced advocates of cession of the arid lands to the states and territories, inaugurated a scheme to gather the first fruits of the national irrigation victory and divert the reclamation fund from the legitimate purpose for which it was created. The most exasperating feature of this diabolical scheme, and the only thing that makes its consummation possible, is the fact that Director Walcott and Chief Hydrographer Newell, through George H. Maxwell, seem to be aiding and abetting it. While the evidence of this truth is only circumstantial, it is sufficiently clear and convincing to carry conviction to the mind of a disinterested and unprejudiced person. It is as follows:

As soon as the National Irrigation Act passed, Colonel Christy, one of the leading bankers and landowners of the Salt river valley, wrote Chief Hydrographer Newell, asking if there was any way by which the Salt river valley could be made a beneficiary of the national irrigation fund. Mr. Newell replied that he had no control in the matter of selecting reservoir sites beyond passing upon their feasibility from an engineering standpoint, but that he would refer the writer to his friend, George H. Maxwell, for the information desired. This letter was published in the Phoenix papers, hence there can be no question of doubt on this point. It is quite evident that Mr. Maxwell pointed out "a way" to the satisfaction of the land barons, for a few weeks later he arrived in Phoenix, as he now states, on an invitation sent him by Mr. Fowler and other "friends" of the valley. He has remained there since, almost continuously, for

a period covering eight or nine months. In truth, he has become a resident of the valley and the owner of a farm there. And I desire to remark here, parenthetically, that in selecting his ranch Mr. Maxwell exhibited characteristic business shrewdness. Knowing the Tonto scheme would be a failure as a storage proposition, he selected a ranch under the Maricopa canal, one of the two oldest canals in the valley, and, therefore certain of water for irrigation purposes, when there may be water in the river, because of its adjudicated prior right thereto.

The first work performed by Mr. Maxwell, after his arrival in Phoenix, was to organize and incorporate the "Salt River Valley Water Users Association," and have that organization levy a $35,000 assessment to meet "expenses." This association is composed, to a large extent, of holders of idle and speculative lands, acquired by capitalists during the early boom days and before the limit to the water supply in the Salt and Verde rivers had been definitely ascertained by a long series of official measurements.

In discussing the articles of incorporation of this association in the *Phoenix Enterprise* of June 3, 1903, Mr. D. B. Heard, of the Bartlett-Heard Land and Cattle Company, of the Salt river valley, says: "There is no question in the world that these articles, if operated under by the government, will be greatly to the advantage of the idle, speculative lands and not to the advantage of the farmer who desires to retain and cultivate his land." He terms it "a speculative unloading proposition," and states that "Maxwell's Speculative Plan" would be a more appropriate title for the organization. Of the one hundred thousand acres of patented land controlled by this Maxwell organization, 28,760 acres are under the Mesa consolidated canal, one of the "boom" creations having such a belated water appropriation that only 1,320 of the 28,760 acres under the canal are now cultivated, the remaining 27,440 acres being held for speculative purposes. The syndicate owning this canal also owns forty sections, or 25,600 acres, of the land under the canal. And this is the kind of a "water users' association" Messrs. Maxwell, Walcott and Newell would have the government build the Tonto dam for out of the National Irrigation Fund. "A speculative unloading proposition," as Mr. Heard terms it. Or, in other words, a scheme to enable a lot of land speculators to unload on unsuspecting strangers, while a government reservoir, that will have no water to store, is in course of construction, a lot of waterless land with which they loaded themselves during the early "boom" period in Salt river valley. This is the "Water Users' Association" whose articles of incorporation and plan of procedure for the evasion of the provisions of the National Irrigation Act and larceny of the national irrigation fund has been approved by the Secretary of the Interior, through the very efficient efforts of Messrs. Maxwell, Walcott and Newell.

In last April Director Walcott, of the Geological Survey, arrived in Phoenix. He announced that the purpose of his visit was to personally investigate conditions in both the Salt and Gila river valleys with reference to the advantages they offered for the reclamation of *public* lands through the instrumentality of the San Carlos and Tonto reservoirs. He remained in Phoenix three weeks under the chaperonage of George H. Maxwell, whose guest he was, investigating land conditions within the walls of the cosy office of the genial but juggling Mr. Maxwell and the luxuriant environment of the Hotel Adams. After enjoying the lavish hospitality of the Phœnecians for three weeks he was speeded, under the pilotage of the discreet Mr. B. A. Fowler, across the Pima reservation in a Pullman, in the dense darkness of the night, lest he should note the desolation that marks the lands of the deserving and starving Pimas and the sight should touch a chord of pity in his heart and move him to make an investigation of conditions in this valley in accordance with his announced original intentions. Passing directly on to Tucson the discreet Mr. Fowler stopped over there a day with his official protege to have him interviewed by the newspapers and announce in those interviews that the San Carlos dam was "not feasible because of its great depth to bed rock," a deliberate falsehood that I shall fully expose further on in this article. From Tucson Mr. Fowler escorted his official protege, by rail, around through Cochise and Graham counties, then down to the San Carlos dam site, to make sure that he would not get a glimpse of any of the land or conditions under the proposed San Carlos reservoir. They remained at the San Carlos dam site less than one-half day, then passed on to the Hudson Reservoir Company's Tonto dam site, the dam site recommended to the government by Messrs. Maxwell, Fowler, Walcott, Newell & Company, and for which the government must pay $250,000 if it desires to build the Tonto reservoir. Among the several, this is one of the Ethiopians in the Tonto woodpile. The Hudson Reservoir Company has held legal title to this Tonto reservoir site for over eighteen years. The company is made up, principally, by large owners of the idle and speculative lands in Salt river valley, and for all these years they have been trying to induce outside capital to undertake the construction of this dam so that they could unload their idle and speculative lands during the progress of construction work. But capitalists would insist on investigating the water supply before investing their money in so gigantic an undertaking, and investigating they would discover that the entire water resources of the valley had been appropriated and were being fully utilized in irrigating the patented lands of the valley, and that there was no surplus to store. With these facts before them they would decline to give the Tonto project further consideration. The syndicates owning large blocks of this idle and speculative land were financially able to build the dam, but the cost of building it from bed rock to the surface of the stream, which they would have to do in order to create a boom that would enable them to unload their land at a very great advance over the cost of it, would more than consume any profit they could derive from the sale of the land and leave them nothing but a valueless, but costly, piece of dam work.

Having "investigated" at the Tonto dam site to his heart's content, Mr. Walcott returned to Phoenix for a few days, then left for home. The citizens of this valley sent a committee to Phoenix to interview him and lay the facts of the land and water conditions under the San Carlos reservoir before him. He admitted that this committee had presented a very strong case, but no amount of persuasion would induce him to visit this valley and investigate for himself.

There seems to be a hypnotic power in the ozone of the Salt river valley, especially when the lungs of a government geological engineer or employe become filled with it.

This fact is amply attested by the course and conduct of Messrs. Walcott and Newell of the Geological Survey.

The moment those distinguished gentlemen got a few whiffs of that peculiar ozone they forgot that they had ever recommended the San Carlos reservoir and supported that recommendation with facts, figures and arguments that are positively unanswerable. In truth, forgot everything except that they had suddenly become enamored of the Tonto reservoir project and the managers of the private land syndicates who are endeavoring to turn a beneficent public measure to private account.

To what peculiar quality in this ozone is its hypnotic power due? A curious public would like to know. Has it in it merely a sort of love gas that enchants and enchains, or other seductive quality that captivates?

But whatever the cause, the effect is painfully apparent. It has caused these geological gentlemen to repudiate all their reports and recommendations relative to the feasibility of, and necessity for, the San Carlos dam, and placed them in the unenviable position of having discredited themselves in the estimation of all fair-minded people.

From 1889 up to the time when the breathing of this Phoenix hypnotic ozone began to work a reversal of their opinions as to the feasibility of the San Carlos project, these geological gentlemen widely proclaimed the San Carlos reservoir as the only feasible storage proposition in Arizona that could be taken up by the government with justice to itself and to the people. After devoting two years' time to the work of surveying, sounding, testing the bed-rock borings, making contour and other maps, making estimates, studying conditions, etc., and expending about $30,000 in the work, they recommended the construction of the San Carlos dam, in reports to the Secretary of the Interior, in such strong terms, and supported this recommendation by such an array of alluring figures, as to cause the secretary to earnestly press Congress for an appropriation for its immediate construction.

These recommendations are still on file in the department, together with all the official maps, data, etc., and in view of the present attitude of these gentlemen toward the San Carlos dam they will make very interesting reading. I cannot quote them in full, as they would fill an hundred columns of THE AGE. On the recommendation of Mr. Walcott they were printed by the government in pamphlet form as document "No. 33, Irrigation Papers of the U. S. Geological Survey." Any one can obtain a copy by writing a request for it to the department of the Geological Survey.

In transmitting the reports to the Secretary of the Interior, Mr. Walcott states that the investigations upon which they were based were originally entrusted to Arthur P. Davis, assisted by J. B. Lippincott; that before they were completed Mr. Davis was called away and the work was completed under the direction of Mr. Lippincott. Mr. Walcott also stated in the letter of transmittal that the conclusions of Mr. Lippincott had been verified by Mr. James D. Schuyler, one of the greatest engineering authorities on dams and reservoirs in the United States. Mr. Schuyler submitted a separate and detailed report from which we quote only a few of his conclusions and recommendations as follows:

That the Gila river is the only available source of permanent supply for the Pima Indians.

That feasible reservoir and dam sites exist on the Gila at the Buttes, Riverside and San Carlos.

That it is feasible to construct a masonry dam at Riverside at a cost of $1,898,605, including damages for right of way and diversion dam at the head of the Florence canal, forming a reservoir with a capacity of 221,-134 acre-feet.

That it is feasible to increase the height of the dam at the Riverside dam at least 70 feet higher than the one estimated upon, giving an ultimate reservoir capacity of about 650,000 acre-feet, which would not be filled with solid matter short of sixty-seven years.

That it is feasible to construct a masonry dam at San Carlos at a cost of $1,038,926, including damages for right of way and diversion dam at the head of the Florence canal, forming a reservoir of 241,396 acre-feet capacity and that the water supply is ample to fill such a reservoir in the years of minimum flow, and that the volume of storage will irrigate at least 100,000 acres in addition to the irrigation of the lands of the Indians.

That it is feasible to construct a dam at San Carlos at least 70 feet higher than that contemplaed in the estimates, forming a reservoir whose ultimate capacity would be approximately 550,000 acre-feet and whose probable life of usefulness would be sixty-three years before being filled with silt.

That provision should be made in the working plans for these ultimate extensions suggested and the right of way reserved in the reservoir basin for the additional area that may ultimately be flooded.

That the working plans for the San Carlos dam should be drawn to permit of the complete utilization of all power which may be developed from the head of the water issuing from the reservoir and steps be taken for realizing upon the full commercial value of the power.

From Mr. Lippincott's report we make the following extracts:

"The information concerning the bed rock is meager, but it is considered fair to estimate the maximum depth of bed rock at 74 feet. The bed rock itself is a very close grained; hard limestone and *all that could be desired for foundation purposes.*"

Estimated cost of San Carlos dam on a basis of 74 feet to bed rock:

Rubble masonry, laid in concrete, 94,730 cubic yards, at $6	$ 568,380
NOTE.—With sand cement at $4.63 per barrel, or $4.28 per cubic yard. (See Duryee's report.) This figure is based on half of the mass being large rock and half concrete.	
Excavation, foundation, pumping, etc.	150,000
1 semi-circular tower of concrete, 13,632 cubic feet, at 50 cents	6,816
1 tower, same diameter inside, 60 feet high, 4,388 cubic feet, at 50 cents	2,119
2 tower houses, including the semi-circular base of concrete, at $750 each	1,500
10 inlets for towers, at $500 each	5,000
2 balance valves, at $1,000 each	2,000
2 balance valves, at $750 each	1,500
610 linear feet of footbridge, at $10	6,100
5 miles of railway, moved, at $10,000 per mile	50,000
New irrigation system above the Indian agency	20,000
Damage to agency and post buildings	60,000
Low water diversion tunnel	10,000

Wooden crib diversion dam at head of irrigation canal	20,000
	$ 903,415
Contingencies, 10 per cent	90,341
Engineering, 5 per cent	45,170
Total	$1,038,926

Total number of acre-feet stored is 241,396, at a rate of $4.30 per acre-foot.

It will be observed that Mr. Walcott, in an interview published in the Tucson *Star,* April 18, 1903, said:

"Boring operations are now going on at the site of the proposed San Carlos dam. The best borings so far made finds bed rock at a depth of sixty-five feet. Owing to the great expense occasioned by so great a depth, unless better borings are found, that depth would be practically prohibitive."

If this statement is true how is it that the fact only "dawned" on Mr. Walcott after he had been breathing that hypnotic ozone of Phoenix? It is evident that Mr. Walcott, in casting about for an excuse for his sudden hostility to the San Carlos dam and surprising conversion to a scheme that will make private land syndicates the chief beneficiaries of the National Irrigation fund, evidently forgot that all the geological and consulting engineers who have been recommending the feasibility of the San Carlos dam have based all their conclusions and estimates on a *depth of 74 feet to bed rock,* as will be seen by their official reports. These facts alone are sufficient to discredit Mr. Walcott.

But I am pleased to learn from Mr. Walcott even if his statement was intended to injure instead of benefit the San Carlos project, that the later borings have located bed rock at a depth of sixty-five instead of seventy-four feet. This discovery will call for a reduction of nearly one-fifth in the estimates of the cost of the dam and bring the total considerably below the million mark.

I am pleased to be able in this connection, to call Mr. Walcott's attention to what the government engineers are finding at San Carlos at present. The *Globe Times,* published within eighteen miles of the San Carlos dam site, published the following information in its edition of May 27, 1903:

"The hydrographical branch of the United States Geological Survey is employing ten men on the Gila river at the site of San Carlos dam under charge of W. G. Stewart. They have been making soundings for bed rock and have covered a distance in the river about 175 feet, comencing at the mouth of the box, six miles below San Carlos, and working up stream. They employ a Peirce well-driving machine to drive the casing or outer pipe to bed rock, and a steam diamond drill does the rest. The average depth of bed rock at this point is forty feet and the width of the canyon is about one hundred feet, with walls five hundred feet high. The rock is said to be the hardest ever encountered by the survey, giving evidence of permanence. In fact, the result of the survey so far demonstrates that every requisite for a dam site exist; almost perpendicular walls, a phenomenally narrow box and bed rock at the depth of only forty feet.

"The party expect to complete their labors by July 1st."

In the light of this additional information as to the unsurpassed natural advantages offered by the San Carlos site for the csonstruction of a great dam at a very small cost, Mr. Walcott will be compelled to offer some new excuse for his curious conduct.

This further investigation of the San Carlos dam site demonstrates that it is the greatest dam site yet discovered by the geological survey. Because of the great vertical height of the canyon's walls and the narrowness of the canyon, a dam could be constructed here to a height of five hundred feet, at one-third the cost of the Tonto dam, and create a reservoir of equal capacity in acre-feet to that of the Tonto. The proposed Tonto dam will be 830 feet in length at the top while a five-hundred-foot dam at San Carlos would not be over three hundred feet long at the top and one hundred feet in length at the river bed level. According to official measurements the annual inflow at the San Carlos dam site would be amply sufficient to irrigate 200,000 acres of land. Less than three per cent of this annual flow of the Gila at the San Carlos site has been appropriated for the lands lying under the San Carlos dam, (see page 94, report of J. B. Lippincott, geological engineer, 1900), hence the remaining 97 per cent could be stored for the reclamation of public land without interfering with legal vested rights, while the entire annual flow of the river at the Tonto site has been appropriated by the farmers whose lands lie below the dam site, and they have acquired an adjudicated vested right to it that cannot be disturbed by the Government or others. These farmers use this entire annual flow as fast as it comes into the river, consequently there is no surplus there to store.

In discussing in his report on the San Carlos dam, the lands that would be watered by it, Mr. Lippincott said:

"An examination was made of the records of the United States Land Office at Tucson to determine what portion of this area outside of the reservation remains public domain. Nineteen townships were examined and it was found that 389,211 acres therein are still public domain and that 52,162 acres, lying mostly under the Florence canal—which canal has a very deficient water right—is held in private ownership."

In compliance with Mr. Lippincott's recommendations all this Government land was withdrawn from entry and remained withdrawn till about three months ago, when it was again opened to homestead entries, subject to the provisions of the National Irrigation Act and subject to reduction to an eighty or forty-acre tract if the Secretary of the Interior should decide, after the completion of the San Carlos dam, that the land under it can be entered only in tracts of that size.

Of the 52,000 acres reported as entered land, by Mr. Lippincott, title to only 45,000 acres was perfected and the remainder reverted back to the public domain. hence we have only 45,000 acres of patented land under the San Carlos reservoir site, and only 25,000 acres of this land have water rights in the Casa Grande Valley canal, the only canal under the San Carlos reservoir. But owing to the present condition of this canal only about 6,000 acres of the 25,000 with water rights, are cultivated.

Speaking further of this land, Mr. Lippincott says:

"It is high-grade agricultural land, suitable for irrigation. The climate is adapted to the raising of diversified crops, the grade of the country is uniform and suitable for the application of water, and the soil is exceedingly fertile. The river which carries a large amount of sediment containing many fertilizing mate-

rials, will keep these lands in a state of continuous productiveness. Without water this land is a desert and has no value. That it is of no tangible value in its present condition is proved by the fact that many thousand acres which have been taken up at previous times under the desert and homestead land laws have been permitted to revert to the government before title was perfected by the settler even afer expenditures had been made on the land. In the event of the construction of a large dam (at San Carlos) there will be built up in the valley of the Gila river, where a desert now exists, a community of fully 40,000 souls, and the creation of many million dollars of taxable wealth without permanent outlay on the part of the Government."

Do any such possibilities exist under the Tonto reservoir site? No. According to the estimates of the geological engineers that reservoir, at best, can only provide water to irrigate 50,000 acres less than the number of acres now owned and actually occupied by individuals and land speculators. Not a single acre of public domain can be reclaimed by the Tonto dam. Not a single new home can be made by the construction of that costly pile. Of this truth the Geological Survey is well advised, yet, for reasons best known to themselves, several prominent members of that branch of the government are moving heaven and earth to divert the attention of the public from the San Carlos reservoir and to enlist the government in the construction of the Tonto. Strange, is it not?

There is another thing in Walcott's interview I have to thank him for. He mentions that a high line canal will be constructed along the side of the Tonto reservoir and that this canal will develop three thousand horse-power. He neglected to state, however, that this canal involves the construction of twenty thousand feet of costly tunnel. Mr. Lippincott, in his report on the San Carlos, on page 41, suggests a high-line canal along the margin of the San Carlos reservoir and states that this canal would develop *"over 8,475 horse-power,"* and no tunneling would be necessary in the construction of this canal. This power is in addition to the fifteen or twenty thousand horse-power the dam itself would develop. Then Mr. Lippincott goes on to say:

"The section of Arizona in the neighborhood of San Carlos is highly mineralized. Copper mines of great value are found at Globe and Riverside. New and effective processes have been discovered for reducing copper matte electrically. Fuel is high priced. On the above basis it is reasonable to presume that when the time arrives for the building of this canal around the reservoir, sufficient revenue can be obtained from power to pay the interest on the cost of construction. This power could also be used in cleaning out the reservoir with dredges."

Mr. Lippincott's investigations of the San Carlos reservoir project were completed and his report filed in December, 1889. Since that date there has been great activity in the mineral districts immediately surrounding San Carlos, especially to the west of the reservoir site. Within a radius of thirty-five miles around the site lies Globe, Troy, Kelvin, Riverside, Ray, Mammoth, Dudleyville, Saddle Mountain, Phelps, Dodge & Co. camp, Oracle, the camps on the eastern slopes of the Santa Catalina mountains, the Gold Fields and other mining camps. Millions of dollars have been invested in these camps since Mr. Lippincott's report was filed, and a number of great mines have been developed. If the San Carlos dam was in a completed state today, there is not, in my judgment, the shadow of a doubt that the government could sell its power privileges for more than the cost of the dam and sell the 200,000 acres of fertile domain reclaimed at $10.00 per acre, in 80-acre tracts, in less than three years from the date of the completion of the dam and thus make a clean, clear profit of $2,000,000, or more than 200 per cent on the original investment. Not only that, but, as Mr. Lippincott has stated, would make "new homes for forty thousand souls," and at the same time relieve itself of the responsibility and expense of caring for over eight thousand Indians. On this latter subject we will again quote from Mr. Lippincott's report, as follows:

"The Government has expended large sums of money for the introduction of irrigation on the Indian reservations where it is desired to educate the Indian into agricultural habits as a means of his civilization. This is a well-established and wise policy, and has already been productive of much good, but is always in the nature of an experiment, and more or less difficulty and uncertainty is attendant upon the attempt to induce the Indians to accept this mode of livelihood. In the present case we have a tribe of Indians who have for centuries been engaged in agriculture by irrigation, and who were until recently the only successful irrigators in Arizona. These Indians have been deprived of their water supply through the agency of the white man, directly encouraged by the United States Government. It is an imperative obligation of honor that their supply should be restored to them, and the only practical means of this restoration is by storage on the Gila river. In addition to this there is held out the certainty that unless this is done these Indians will retrograde from a condition of industry and prosperity to one of mendicancy and vice. Instead of an uncertain possibility of elevating a savage tribe, we are confronted with the necessity of preventing the destruction of a civilization already attained.

"The Government being the owner of more land under the canal than can ever be watered by it, can entirely control the appropriation of the values which will be created by the construction of a reservoir and can entirely recoup itself for all expenses incurred, and thus discharge its obligations of honor with no expenditure except the utilization of its own natural resources. It is not a proposition for the Government to expend money for the benefit of private individuals nor of any particular section, and hence is not comparable with river and harbor improvements, although the general benefits are so comparable, as homes will be furnished at low rates to thousands of industrious people, who will come from all parts of the country, and a forbidding desert will be transformed into a rich oasis, and a large community will be thus practically added to the domain of the United States."

(To Be Continued.)

The irrigation expert sent to Oklahoma to survey the territory for irrigation purposes reports to the Government at Washington that Oklahoma is so muddy that he is unable to proceed with his work.

GANADO.

THE ARIZONA HOME OF J. L. HUBBELL.

Nestled among the mountains of northern Arizona is a namesake of that famous Spanish city, Ganado. The new Ganado excites a wonderful interest in the traveler who may stop there and enjoy the hospitality of its principal citizen, Mr. J. L. Hubbell.

Mr. Hubbell established the post for the purpose of trading with the Indians, and his fair dealings with them, his understanding of their labors, trials and difficulties and his sympathy for them has endeared him to the heart of every tribe within two hundred miles of Ganado. Long before the setting apart of that large plot of land in Arizona known as the Navajo reservation Mr. Hubbell was at Ganado doing business with the Indians. His heart is in his work. For forty years he has been the Indian trader of northern Arizona, and for forty years, strange as it may seem, the Indian has always found him to be a staunch, true friend. Never has he had any trouble with the tribes that knew him. He has always given them more for their produce, and

J. L. HUBBEL, Ganado, Ariz.
[As he appears at his trading post.]

when sickness came he visited their homes, soothing and encouraging with words of comfort and supplying, when needed, more substantial comfort for the body. Take a trip with Mr. Hubbell fifty miles or so from his home and you will appreciate his character and understand why the Indians trade with him and love him as a friend and benefactor. It was my good fortune to make such a trip with Mr. Hubbell in 1901. When we met an Indian we stopped, hands were shaken and inquiries made (in the Indian language, which Mr. Hubbell speaks fluently) regarding the health, prosperity and happiness of the Indian, his family, his father and mother. The simplicity and kindliness of the greetings, the light of friendship in the stoical eyes, all proclaimed most eloquently the fact that these men were friends. Not merely friends of barter and exchange, but friends of heart and soul, each understanding the other, each sympathetic and kindly, always ready to lend a helping hand. When we parted a short word or so was spoken and away would fly the Indian on his pony to tell his family that Mr. Hubbell was coming. Within a mile or so we would find a group of women hurrying across the sage brush plain toward the road, or already waiting there for us. Mr. Hubbell would alight, greet them, encourage them, entering their sphere of life so completely that to him they brought their cares, their troubles and their happiness. Some old woman who had not seen Mr. Hubbell for a long time would put her arms around his neck and cry and croon, as if he were her first-born returned, recalling to his mind things that had long been forgotten. "Do

HUBBELL STORE AND WAREROOM, GANADO, ARIZONA.

you remember the dismal winter when our food was gone? We were sick and could not pay, and you brought us the flour. God bless you, my friend. God bless you." More than once the pathos of these scenes brought a tear to my eye. Year after year has he been the Indian's friend, and year after year will he be. The Indian appreciates him more than we can imagine. Beneath his stoical surface you cannot read except you know him as Mr. Hubbell knows him. It is only in Mr. Hubbell's store that you can appreciate the Indian's

GANADO, ARIZONA, LOOKING ACROSS STREAM.

love for Mr. Hubbell. There you find the choicest of the Indians' produce. The finest blankets in the oldest patterns and rarest colorings, the choicest jewelry, strings of wampum that would adorn the modern belle, amulets, stones and pottery that Mr. Hubbell alone could buy. Year after year has he encouraged them to better work, more conscientious effort. He preserves

for them and for his own pleasure many of the oldest and rarest patterns and colorations of the famed Navajo blanket. He contracts for all the blankets a family can make and supplies them with pattern blankets or with water-color reproductions when the sample is unusually valuable. When the work comes in, if of exceptionally fine quality, he gives the weaver from one to ten dollars more than the contract price, depending

VIEW OF LORENZO HUBBELL'S HOME
KEAM'S CANYON, ARIZONA.

upon the size and cost of the blanket. If the work is poor another chance is given. Then if the weaver does not improve, the best known market for blankets in all the west is closed to her and she must sell the product of her loom to the railroad blanket shark for a mere pittance.

Ganado is on the least known, but by far the best road to the Indian snake dance at Walpi. The route is a little longer, but the roadway is level and well packed by the passage of Mr. Hubbell's many freight wagons. Forty or fifty miles a day can easily be made with comfort to traveler and team. In taking this route

GANADO TRADING POST SHOWING STREAM FROM WHICH WATER FOR IRRIGATION IS TO BE TAKEN.

to Ganado and Walpi the Santa Fe train is left at Gallup, in the extreme northwestern part of New Mexico. This little town of two thousand people boasts a number of industries, enough at least to keep its inhabitants busy, contented and peaceful. There are a number of livery stables that make it a business to care for travelers, and satisfactory arrangements at reasonable rates can be made for the round trip. The scenery

ONE OF J. L. HUBBELL'S "BLANKET FACTORIES"
ARIZONA.

along the route is always interesting and in some places grand. The air is delightful and the shady places cool and refreshing even on the hottest days. The light

EXHIBIT AND EXAMINATION OF PRODUCT OF "HUBBELL'S BLANKET FACTORIES" GANADO, ARIZONA.

wagon is bowled along over the hard, smooth roads at a rapid rate, and many miles are covered before luncheon. At the crest of some ridge the stop is usually

OLD HUBBELL HOUSE, GANADO, THE FIRST-BUILDING ERECTED IN 1876 STILL STANDS.

made. The driver turns out of the road into the deep cool shade of a pecan tree and with a cheery "Whoa! All out for dinner," bounds from the wagon to attend

to his team. Luncheon is spread on a table of velvety softness, the thick carpeting of pine needles on the dry earth. Two hours pass quickly and the journey is continued. The pictured rocks and fantastic shapes of the next twenty miles entertain the traveler. The Indians, father and son, carved high on the jagged face of an immense granite cliff, the cow's head, the battleship and the combat, a novel picture made by shadows, and ever-changing, so engross the attention that the evening camp is reached without weariness. This stop is about forty miles from Gallup and is at a Jesuit mission in a valley where there is water all the year. The priests of the mission take the best care of the unknown guest. Food and lodging are free, but a donation is a pleasure to the traveler after he has been there a few hours and observed the result of their labors. Early the next morning the journey is continued. All the forenoon is spent in climbing to the top of the divide between Gallup and Ganado. There is an ever-changing panorama behind one as successive heights are reached. The morning sun sending long lance-like beams of light

TRADING STORE OWNED BY LORENZO HUBBELL. KEAM'S CANYON, ARIZONA.

into the canyons brilliantly illuminating bold cliffs that stand out in strong relief. At the summit the long stretches of the descent come into view. The winding way of the stream of living water that flows by Ganado is seen as if but a few miles away, though thirty miles distant. Many flocks of sheep and goats, the property of the thrifty Navajo, are passed. The hogans (homes) of the Indians and their summer villages are frequent. Here much interest is excited, especially among the children, who look for candy and stray coins of silver. Toward evening Ganado comes into view. The large, low, one-story store building of Mr. Hubbell, the adjoining buildings, the public well with its old-fashioned bucket and pulley, the river and the ford make an impressive scene that is not soon forgotten.

However far you may travel you will never have extended a more hearty welcome than at Ganado. Whether friend or stranger, Mr. Hubbell will meet you with the characteristic hospitality of the West, putting at your disposal the best the place affords. You are at home at once to enjoy the strangeness of the surroundings. In the evening the sun, slowly setting, lights up the sky with a wealth of splendor unknown in lower altitudes and denser air. The brilliant colors disappear as the night comes on with its entrancing charm, the cool pure air, the brilliant moonshine.

Ganado is famous for its Navajo products. Rugs, blankets, portieres, sashes, kilts in the woven line, and baskets, plaques, jewelry, Moqui and ancient pottery comprise the stock in general. It is in the blanket rooms that the visitor is delighted. The richness, beauty and durability of the genuine Navajo blanket have never been equaled by a native people anywhere in the world. It is here only that the old native patterns of these blankets can be seen, and here only that perfect reproductions of them in weave, pattern and color, woven and finished by the best native weavers, can be bought. There are only a few weavers now living that have sufficient skill to weave portieres in pairs where design, color and proportion must be the same in each. The passing of this skilled craft, one formerly very necessary for the comfort of the tribe, adds an interest to the strange beauty of the goods.

Ganado is more than half way to the Mesa at Walpi, where every other year that most peculiar of all religious ceremonies, the snake dance, is held. The way is pleasant, though a rather hard day's drive. At Keams Canyon on the main road to Walpi, Mr. Hubbell has a branch store dealing largely in Moqui goods. Farther on the government schools and military post is passed and late in the evening the Mesa at Walpi comes into view.

One who visits the snake dance at Walpi feels well repaid for the long drive through the mountains. The stops at the priests', Ganado and Keams Canyon, each at the end of a day's drive, rests and refreshes one with the comforts of civilization.

After the return trip is finished and you are home again it is to Ganado, the trading post in the heart of the Navajo reservation, that your mind will oftenest revert. You will never forget Mr. J. L. Hubbell, the Indian trader, the greatest blanket man in all the West.

RUFUS ELEY.

IRRIGATION INVESTIGATIONS IN UTAH.

The office of experiment stations of the United States Department of Agriculture has just issued Bulletin No. 124, a report on the laws and customs under which water is diverted, controlled, and used in irrigation in Utah, prepared under the direction of Elwood Mead, chief of irrigation investigations. The object of the investigation is set out by Mr. R. P. Teele in the opening paragraph of the report, as follows:

"All the studies of irrigation lead to one conclusion—that some public control of the water supply is necessary to the best use of the resources of an arid country. In the very nature of things conflicts will arise, and when they do arise some power beyond the conflicting parties must come in to define their respective rights. The most important question in irrigation in this country is, Who shall be the arbiter when such conflicts over water rights arise? Or, is it not possible to create a system of water administration which will anticipate such conflicts and render them impossible? This report is a study of these questions in the state of Utah. This state is not a new field, giving free opportunity for the creation of an ideal, but one in which rights have become vested, customs have grown up, and legal principles have become established. It is, therefore, necessary to study the history of the state in its dealings with water, both within and with-

out the law, to see wherein the laws and customs have produced good results and wherein they have failed; to see what principles have become established with which new laws must conform or be declared void. Such a study has two objects. The first is to help the people of Utah in the establishment of an irrigation system which will bring about the largest use of their water supply; the second is to present to other states having like conditions the lessons of Utah's experience."

The plan for this investigation was to select typical streams in various parts of the state and describe the actual conditions created by the appropriation and use of their waters. Thus the Virgin and Sevier were selected in the southern part of the state, the Weber and Logan in the northern part, and the Jordan and its tributaries in the central part. In this way practically every feature of the state's irrigation system, many of them having a curious as well as economic interest, are described. Three of the reports were prepared by residents of the state, two of whom have had official as well as personal opportunities of becoming fully informed regarding existing conditions, one being Hon. A. F. Doremus, state engineer, and the other Prof. G. L. Swendsen, professor of irrigation engineering in the State Agricultural College. The other reports were prepared by the regular agents of the department who had carried on similar studies in other parts of the West and were, therefore, able to compare the institutions of Utah with those of other states. This makes the report especially valuable, since the conditions are discussed by those who have a deep personal interest in the state, and also by those who are, in a measure, disinterested students of the questions involved.

For the people of Utah, probably the most valuable features of the report are the view it gives them of the conditions which demanded a change in the laws of the state, and the explanation of the law passed in 1903, showing that it does not create an entirely new system, but is a natural outgrowth of the former system of water control.

The distinctive features of Utah's economic life is coöperation, and the reports give an interesting view of the organization and operation of coöperative canal companies, showing the cost of water rights, the annual cost of water, and the returns obtained from the use of water. These coöperative companies furnish water to farmers cheaper than any other companies, since the farmers pay no profits to anyone, the assessments being just large enough to cover the cost of keeping their canals in order, and distributing the water. The average annual cost of water is about $1.25 per acre irrigated.

The point in which Utah irrigators excel those of other states is in their distribution of water from ditches Instead of dividing the water supplied by a canal in proportion to the interest of each stockholder, each is given a good-sized stream, the time which each is allowed the use of a stream being proportioned to his interest in the canal. These methods can well be studied by the people of the other arid states, while the people of Utah can study with profit the administrative laws of the neighboring states.

Economists and others who wish to study the subject of irrigation in its broader respects, will find in them much valuable data as to laws and forms of organizations, and their effects, while the irrigation farmers will find them full of suggestions as to methods and crops. This bulletin is the second of a series of reports.

THE PRIMER OE IRRIGATION.

BY D. H. ANDERSON.

CHAPTER IV.

ALKALI SOILS; THEIR NATURE, TREATMENT AND RECLAMATION.

The "alkalis," as they are called, are common to all soils wherever they may be found on the globe; they belong to earth and are part of its essential constituents.

Originally, they were brought or carried into the soil along with the other elements which form its inorganic bulk (as has been explained in Chapter II), by the pulverization of rocks and minerals, the deposition of inorganic sediment held in solution by water, by glacial action, by seepage from rivers, and numerous other ways.

These elements, if unacted upon, would forever remain in an insoluble, inert condition, incapable of exerting any influence upon each other, or of performing any functions whatever; in which case, however, there could not be any plant life of any kind. But nature comes in and begins action upon these elements and changes their form so that they may become capable of aiding in the production of plants by furnishing them with the food to make them grow and ripen their fruit or seed.

First, we have the atmosphere, or air, which, however arid the region, contains oxygen in a very large proportion, and this oxygen attacks the inorganic elements, transforming them into various substances, or rather fits them to be acted upon by other substances so that they may become useful or otherwise. Thus, oxygen acts upon potash, soda, lime and magnesia to form what are known as "alkaline bases," that is, the foundations for the "salts," which are beneficial in moderate quantities but injurious in excess. The forces of nature are always at work, regardless of the quantity of the product; certain laws are followed, and these laws keep on operating in certain unvarying ways, according to a fixed program, which is never changed unless man comes in and compels a change. The following table will enable the reader to understand in a general way how nature works upon the elements in the soil through oxygen:

OXYGEN

Unites with Potassium and forms Potash.
Unites with Sodium and forms Soda.
Unites with Calcium and forms Lime.
Unites with Magnesium and forms Magnesia.

The oxygen acts upon the above four metals just as it does on iron exposed to the air, when it forms the familiarly known "rust," which is technically called "oxide of iron." So the potash, soda, lime and magnesia are really the earth oxides, the four of them being "alkaline bases," that is, the foundations upon which to compound all the various kinds of alkalis.

These "oxides," or "bases," in themselves, would be of very little use or harm while in that state, but the oxygen in the air and everywhere else attacks the other essential elements in the soil as well as the potash, soda, lime and magnesia, that is, the silicon, carbon, sulphur and phosphorus, but instead of converting them into oxides, or alkaline bases, turns them into "acids." The following table will explain:

OXYGEN

Unites with Silicon and forms Silicic Acid.
Unites with Carbon and forms Carbonic Acid.
Unites with Sulphur and forms Sulphuric Acid.
Unites with Phosphorus and forms Phosphoric Acid.

Here is where the whole trouble about alkali soils begins, for these acids mentioned in the last table, which may be called mineral, or metalic, acids, have a great affinity for the alkaline bases mentioned in the first table, and greedily seize upon them, forming "salts," as they are commonly called. When these mineral acids attack the alkaline bases, this is what happens:

Silicic Acid froms Silicate of Potash, Soda, Lime and Magnesia.
Carbonic Acid forms Carbonate of Potash, Soda, Lime and Magnesia.
Sulphuric Acid forms Sulphate of Potash, Soda, Lime and Magnesia.
Phosphoric Acid forms Phosphate of Potash, Soda, Lime and Magnesia.

It is the carbonate of soda, or what is commonly called "sal soda," which makes "black alkali land," and sulphate of soda, or "Glauber salt," which constitutes "white alkali land." There are numerous other salts formed by combining the alkaline bases and the mineral acids, but sufficient are given here to make the principle clear; to enumerate the others would require a volume, and complicate too much the idea sought to be conveyed in this book. Moreover, their action is the same as the sodas, though in a much less harmful degree.

So far, water has been kept in the background, as unnecessary to the formation of these salts, but when water is brought in the distribution of these alkaline salts is largely aided, for the alkalis are extremely soluble in water, the latter taking up nearly its own weight of the salts. When this happens, the alkalis are carried wherever the water penetrates, and when it comes to the surface it evaporates into the atmosphere, but leaves the alkali salts behind to accumulate, until the soil is ruined for purposes of vegetation unless they are removed, or got rid of in some way and the soil thus "reclaimed," as it is called.

In this inorganic matter, plant life is impossible. As has already been said, organic matter in combination with the inorganic matter, is essential to plants of any kind, and here originates a phenomenon as common as the continual process of the formation of alkalis by combinations with the mineral, or metallic, acids, as above specified. Organic matter also combines to form acids which are called "vegetable acids," and they also readily combine with the alkaline bases, the result of which is mutual destruction. This will be understood from a simple experiment that any reader can try.

Vinegar is the most commonly known vegetable acid, the technical name of which is "acetic acid," it being formed during the germination of seeds in the ground, as will be explained in the chapter on Plant Foods. The plant forms it within its tissues and then rejects it for the purpose of permitting it to continue dissolving the earthy substances with which it is in contact. It is also formed artificially for domestic use. Now this vinegar is the natural enemy of the alkalis. When poured upon any of the alkalis of potash, soda, or magnesia, it causes a hissing or effervescence. When this ceases, there is left neither an alkali nor acid, both have disappeared, and their substances are totally changed into something else, a new salt called an "acetate," which is neither one thing or the other; they have mutually destroyed each other.

These acetates are not noxious to plants, and appear to be freely created by the plant itself during the process of developing acetic acid, which is essential for the purpose of transforming starch into sugar, whether of the cane or grape variety, and for laying the foundation of woody fiber and cellular tissues, all of which, alkali tends to prevent if in excess. It is well known from actual experience that sugar bearing plants, such as sorghum, sugar beets, and trees of abundant starch and woody fiber will flourish luxuriantly in alkali soils that will not even permit the germination of cereals, or alfalfa. The reason why this is so is not far to seek, and when well understood the partial reclamation of alkali lands, even under adverse conditions, may be attained, and wholly so where the conditions are opposed to the accumulations of alkali from artificial sources.

DANGEROUS PERCENTAGE OF ALKALI.

There is much controversy about the dangerous amount of alkalis in arable soils, but the entire question may be resolved into four divisions:

First—Soils naturally so heavily charged with alkali as to be worthless.

Second—Soils in which the alkali is increased by fortuitous or artificial means.

Third—Alkali soils suitable for general crops.

Fourth—Alkali soils adapted only to certain special classes of plants.

The sodas are the most dangerous of the alkalis, both the carbonate, or "sal soda," which is the cause of "black alkali land," and the sulphate, or "Glauber salts," which is the deposit on most of the "white alkali lands," because they are so very easily soluble in water, whereas the sulphate of lime, or "gypsum," and all the other sulphates, and the phosphates, are very much less soluble in water. The consequence is, the soda alkalis are always shifting their location, always following the water, because the latter takes them up greedily whenever they are brought in contact, whether on the surface or in the subsoil, or under the influence of seepage which carries the alkalis from a higher to a lower level. The tendency of water when in motion, or flowing, is first downward, it leaches, or percolates through the soil, but after it has become stationary, that is, when it does not find an outlet through drainage, either natural or artificial, it begins an upward movement toward the surface through capillary action, and carries with it the alkalis it contains in solution, evaporates and leaves the salts on the surface. It is not difficult to understand how the alkalis accumulate in the soil, the difficulty begins when the attempt is made to remove them and fit the soil for plant life.

As the amount of alkali deposited in the soil increases, the number of species or varieties of plants decreases. Where soils are charged with an excess of alkalis by fortuitous or artificial means, the reader will understand that the excess has been added to the natural supply by the flooding or rains, or by irrigation. The alkali has not been washed out of the soil by the water, it has been carried into it by water charged with the soluble salts, directly, or by seepage from irrigating ditches. In either case, deep cultivation, surface, or sub-drainage, will tend to restore the soil to its normal condition. Moreover, it is not difficult to wash out of the soil the elements necessary to plant life through the application of water, and, inasmuch as the alkalis are more soluble than any of the plant foods, it should be

less difficult to eliminate the former by the same process that carried them into the soil, intelligently applied.

One per cent of alkali salts in an average soil one foot deep equals 40,946 pounds dry, and 55,146 pounds wet, too great a quantity for the successful growth of cereals, although the soil may be very rich in all the other plant foods, which is generally the case in all alkali soils, and this percentage will prevent the growth of trees, bushes, vines and root crops in general. Sometimes the alkali is near the surface, in the first two inches of it; indeed, the tendency of the alkalis is toward the surface, in this case the one per cent of alkali would mean a weight of the salts in a foot deep acre of only about 6,824 pounds dry, or 9,191 pounds wet, a quantity not in excess if distributed uniformly through the soil. But lying at the immediate surface, the cereal grains cannot germinate, or if they do the young and tender plants perish from thirst, literally, the alkalis absorbing all the water around them, although there may be plenty of untainted water in the subsoil, in which case deep plowing and turning the soil over will furnish a top soil in which the seeds may germinate and reach a growth able to resist the alkali turned under. In fact, the roots of the plants will reach beyond the alkali, for the latter will then have again sought the surface, where it can do no harm.

Alfalfa, for instance, will grow in a moderately alkaline soil, because the long tap roots penetrate to the subsoil depths, where there is less alkali. Moreover, the thick growth and luxuriant foliage shade the ground and prevent evaporation, which is the handmaid of alkali deposits.

All soils showing less than one-fifth of one per cent of alkali salts, that is, less than 9,000 pounds to the foot acre dry, or 12,000 pounds wet, may be considered safe for all kinds of crops, and there will never be any danger from excess of alkalis, so long as good water is used and the land well drained and cultivated. When the alkali goes beyond one-fifth to two-fifths per cent, general crops fail, as a rule, and spots begin to show when cultivated. And when the alkali reaches four-tenths and six-tenths of one per cent, while general crops will not grow, sweet clover and the common run of fleshy, scented and sugary plants will grow and produce large crops, but must be harvested early in the case of forage plants, as has already been said, else they will become bitter and uncatable.

There are, as has been said, about 197 species of plants which possess a great affinity for alkali and will luxuriate in masses of it where all other vegetation fails to gain a foothold. Thus, greasewood, or creosote bush, will flourish in a soil containing 194,760 pounds of alkali salts per acre one foot deep, which is more than four per cent of alkali. Scrub salt bush will grow in soil containing 78,240 pounds per acre, equal to about one and one-half per cent. Samphire luxuriates in soil containing 306,000 pounds of alkali per acre, or about six per cent. Wheat, however, will not grow where the soil contains a total of 20,520 pounds of the sulphates, carbonates, chlorides and nitrates of soda and potash per acre one foot deep, which is less than one-half of one per cent of the weight of the soil.

ATTEMPTS AT RECLAMATION.

It is impossible to establish any rule or set of rules for the adaptation of alkali lands to profitable crops. The natural growth of numerous varieties and species of plants on strong alkalis is of very little moment to the farmer, his main inquiry being: How shall I get rid of the excess of alkali? The whole object of cultivating the soil is to compel it to produce something useful as well as profitable, otherwise it is labor lost to put a plow in the ground. But in the arid and semi-arid lands the soil may be exceedingly fertile for general crops, and after cultivation and irrigation may become so impregnated with alkali as to lose that fertility in spite of the quantities of essential plant food still in the soil.

Where this calamity overtakes the farmer he can not very well wander about and take up a new location on fresh land and again go through the same experience. He must remain rooted to the soil, so to speak, and use all the information he can gather to restore his land to its normal condition, or so much of it as has gone wrong. It is a well-known saying: "All signs fail in dry weather," and there are several others equally as apt. Some say: "It is useless to pray for rain with the wind from the wrong quarter," or, "It is a dry moon, and the horns up won't let the water out." In the case of alkali soils there are no apt sayings, but there ought to be one, and a very good one seems to be: "Alkali laughs at the established methods of cultivating the soil."

When crops begin to look "sick," and black or white patches appear here and there, the reason is not far to seek: alkali is at work. The subsoil may be alkaline; there may be a stratum of hard pan which prevents the water with its solution of alkalis from leaching down through beyond the reach of the roots; the irrigation water may contain a large percentage of alkali in solution, and, coming to the surface, carry its alkali along with it; there may be an irrigation ditch above and beyond, or a stream, or reservoir, from which the water seeps and comes up wherever it can find an outlet. In all these cases, and there are many others, except where the soil is naturally strongly alkaline, he looks for the cause, and he finds it in fortuitous or accidental additions of alkali. Excess of alkali has been carried into the soil, and he first stops any further arrivals. The beginning of a remedy is the same in the case of a thousand or more acres as in the case of but one, there is merely a difference in extent of operations. Then the alkali having got into the soil, he quite naturally thinks that it may be got out in the same way it got in. This is true as to methods. It drains or seeps in; let it drain and seep out. It came to the surface with the water through capillary action, therefore let that capillary action be stopped or impeded. The water from the subsoil evaporating at the surface left the alkalis behind to interfere with plant life, hence, if that evaporation be prevented or reduced, there will be no more, or, at least, less surface deposits.

Without stopping to consider drainage, which requires a chapter of its own, there are two conditions or processes which are keys that nearly fit the situation: cultivation and rotation of crops.

Cultivation serves a double purpose; that of breaking up the uniform capillary spaces in the soil and preventing the rise of the water from the subsoil to the surface, and that of covering the ground with a layer of dry soil, or a mulch, that prevents evaporation. Indeed, there are cases where frequent cultivation, or stirring up of the soil, have reduced the accumulations of alkali to one-third the amount on uncultivated land. As to its preventing evaporation, every farmer is too well acquainted with the effect of cultivation as a con-

servative of the moisture in the soil not to know this thoroughly.

The incorporation of organic matter in the soil, such as stable manure, leaves, straw, plowing under a crop of weeds, or green manure, tends to break up the capillary pores in the soil and retard the upward movement of the subsoil water. But this retarding process is much greater if this organic matter is spread over the ground in a uniform layer or mulch. This method alone has saved many an orchard when an adjoining one in the same kind of soil was perishing from an excess of alkali.

It should not be forgotten that it is water that dissolves the alkalis, not moisture. For which reason the water in the subsoil must be kept below the surface at least three, four, five and six feet, according to the soil and the crops. It is the standing water below the surface which soaks up the salts, and they must be drained away until the water table will not send up water, but moisture only, a sort of subsoil evaporation, to coin an expression, the water coming up as wet vapor, or merely wetness, leaving its salts behind, they being unable to follow unless held in solution.

As soon as water from rain or irriigation begins to fill the soil, the standing water below with its alkalis in solution commences to rise, but by keeping this subsoil water at a depth of five or six feet, and thus allowing an easy movement of moisture through the land, the work of reclamation is easily attained. Here is where the rotation of crops may be called upon to aid. The farmer has been growing wheat, barley, small fruits, corn, etc., and the soil has become so impregnated with alkali as to prevent the growth of any more similar crops. Now when he is leaching the alkalis out of the soil he plants gross feeders, plants that have an affinity for alkali. Sorghum and sugar beets are recommended for correctives of alkali soils, but there are many other plants that may be used for the same purpose, such as asparagus, onions, sweet clover, and among the fruits, pears, figs, pomegranates and date palms, all of which withstand the action of alkalis when they would kill cereals and small fruits.

The reason is that all sugar-producing plants require large quantities of alkali, particularly the carbonates, for starch is produced by the decomposition of carbonic acid, which the plant breathes in through its leaves, and takes up from the soil through its roots. Now, taking the carbon out of the alkalis renders them innocous, just the same as does vinegar or acetic acid, which is also always forming in plants that produce sugar. Not to be misunderstood, it may be well to say here that this starch is transformed into sugar, woody fiber and cellular tissue. When it comes to raising 20 to 40 tons of sugar beets per acre, carrying 17 to 22 per cent of sugar, and reflect that 100 parts of the green syrup of sugar beets carbonated show 9.18 per cent of alkali ashes, and that the leaves and root fibers will show nearly as much more, it is a simple sum in arithmetic to demonstrate that it will not take many such crops to remove the alkalis, and make it necessary to add more voluntarily as a fertilizer. Indeed, in non-alkali soils it is necessary to add alkalis as fertilizers in cultivating beets. Within two or three years the alkali-devouring plants will have removed so much of the alkali from the soil that barley and wheat can be introduced, and afterward a good stand of alfalfa secured. All of these attempts at reclamation are, in the opinion of the author, equivalent to a rotation of crops, since they benefit and strengthen the soil by taking away elements that certain plants do not require, as well as add those which they need.

The following general rules to follow in reclaiming alkali soil may be considered as a recapitulation of what has been said in this chapter, and in all the authorities on the subject:

First—Insure good and rapid drainage to a depth of three or four feet, in which case flooding the land with water is a simple and sure method of washing out the alkali.

Second—Plow deep; say, twelve inches.

Third—Furrow land and plant sorghum in the bottom of the furrows. Irrigate heavily, and gradually cultivate down the ridges to uniformity.

Fourth—After two years in sorghum (or sugar beets, etc.)—deeply plowed each year and cultivated frequently—plant barley. Have the surface of the ground well leveled, and flood heavily before planting.

Fifth—Seed to any desired crop, for if the land is at all porous a stand of any ordinary crop can be secured, except in the worst spots.

What has been said with reference to the black and white alkalis, is applicable to the other alkali salts, the chlorides (common salt, etc.), nitrates, muriates, etc., most of which are beneficial and necessary to plants in reasonable quantities, but deleterious and destructive in excess, but, we repeat, not so dangerous as the sodas.

The processes of chemical transformations are always going on in nature, and every soil, together with the plants or crops growing upon it, constitute a vast laboratory, in which materials of an almost infinite variety are in a constant state of manufacture, and by acquiring even a superficial knowledge of what nature is doing and trying to do, man will be better able to direct nature in his direction to his profit. Nature is perfectly willing that this should be done, and if she is diverted from her purposes and does too much or too little, it is because the man behind the plow is looking the other way.

Adobe soils and the hardpans have been reserved for another chapter, as having a closer relation to drainage, water, and cultivation, than to arid lands. Adobe is a peculiar kind of clay of several varieties, and the hardpans, though sometimes arable, in general resemble the cement plaster which has been found unimpaired in the pyramids and temples of Egypt after thousands of years' exposure to the elements.

It is reasonable to suppose that plants which will grow in heavily charged alkali soils, do so because they have an affinity for the alkaline salts, and take up large quantities of them. Whence it is clear that, by continually growing, cutting and removing this "alkali vegetation," the excess salts in the soil will be gradually eliminated, and thus the soil be fitted for the growth of other desired plants. This is the law and the gospel in the case of the commonly known "salt meadows," of which there are estimated to be in the United States over one hundred thousand square miles. The attempt to reclaim these lands in this manner has proved successful in Germany and Holland, and has passed beyond the mere experimental stage in the United States. Wherefore the query: Is not the same law applicable to the overcharged alkali lands of the arid and semi-arid regions?

CAN AMERICAN LAW PREVENT LAND GRABBING?

BY ALFRED F. SEARS, C. E.

M. Am. Soc. C. E. M. Nat. Soc. C. E. of Peru, S. A. Cor. M. Geographical Soc., Lima, Peru.

Does there exist, within the limits of any human brain, the ability to devise a law that, being in accord with the principles of the American constitution, will prevent "land grabbing," *i. e.*, the acquisition of more than 160 acres of the public domain by a single owner, one man, or corporation?

Why, certainly! Make it criminal for the individual to be caught with more than the proper amount of acres in his pouch.

Concerning which, two observations occur. One, the query: Has law been able to prevent crime? Has it even prevented the pursuit of crime as a profession? And second: Such a law cannot be sustained under the American system, which not only permits, but dares not forbid, the commercial exchange of property of any class. Whatever a man wants and can pay for he may buy, provided he can find a seller; and every man may sell that of which he is lawfully possessed. The most the law can do is to regulate transfer by taxation.

The United States government, for the encouragement of settlement on the unoccupied lands of its territory, has enacted that no one man shall become possessed as an original settler of more than 160 acres of those lands; and yet, in sections of the country, vast areas comprising thousands upon thousands of acres have come under the ownership of a single individual, a man, or corporation, for purposes that positively repel families and prohibit settlement. In this state of Oregon, 18 per cent of all the farms are cultivated by tenants hiring from absentee landlords, owners of the soil and not its settlers.

I invite notice to a few typical instances of "land grabbing" in legitimate ownership and in control of territory without ownership, in this state; and, what is more remarkable, in a part of the state which has been especially under the gaze of the distinguished Mr. Williamson, who has been so alert to expose the machinations of corporations acting under the Carey act, with the intention of appropriating vast sections to the damage of his pals, the land pirates of the region, who have, thus far, prevented the settlement of the finest inhabitable portion of southern Oregon, by its occupancy with enormous herds and flocks. I shall make use of fictitious names in designating the parties to whom reference is made.

Several years ago John Doe went into the upper valley of the River Des Chutes with a stock of merchandise, entered a homestead claim and opened a store to sell his goods. Presently came Richard Roe and Thomas Brown, who entered claims and bought Doe's goods for their daily subsistence upon arid land. All three of these men had tracts that lay upon both sides of the stream, but the narrow productive strip failed to support the families of Richard and Thomas who, discouraged, having proved up their claims, received their patents and surrendered their estates to John Doe, in settlement of their debts for his goods. John Doe is today the owner of three homestead tracts along the river, all fenced in with fair houses and a river bank five miles long, on which he is raising a family and a flock of sheep, with a kitchen garden.

Who may dispute the right of this "land grabber"?

Farther up the valley is another case; that of two men, father and son, who are the terror of all the region, where, having proved up on two homestead claims, and established a home ranch for their cattle, have with shotguns and all manner of mischievous devices driven off several settlers, who had built fences and cabins, before being put in fear of their lives. As a result, two pirates have a valuable and extensive private cattle range by intimidating men who wished to be settlers, raise crops and families. These two men have undertaken to drive all enterprise from that part of the valley, and had thus far succeeded, until they threatened the lives of an irrigation engineering party engaged in a survey, when the neighborhood magistrate took them, somewhat timidly, in hand. Still, they command all that fine range, which has not cost them a cent, but has been stolen from the sweat of hard and honest labor. What can be done to dislodge them? I say there is no law that can reach them, so far as their past conduct is concerned, for there is no man to prosecute them; the oppressed have left the region; the neighbors fear them.

Still another example, for proof of which see Census Bulletin No. 237. Crook county, with an area of 4,963,000 acres, contains a population of only 5,000 souls, who live upon 783,485 acres, divided among 576 farms, being an average of 1,330 acres to the farm! In all this vast tract of nearly 800,000 acres only 56,000 are improved and but 14,000 are under irrigation.

Still one more and a last example of "land grabbing" in Crook county. Of the 4,000,000 acres not yet absorbed by "settlers," it has been stated that 3,000,000 are susceptible of cultivation if irrigated, for which there is abundant means within reach. At the present time all this region is under the feet of a wealthy corporation of sheep and cattlemen who occupy the entire territory with their stock, for which it furnishes pasturage, costing the stockmen not one cent. Now, every citizen recognizes the value of the stock business to the state, but not the right of these men to make use of the public property without making due compensation. They object to leasing and their instrument, Williamson, has made it appear to the people that leasing the public pasture lands, though under provisions that would release them to settlers, would be to deliver them into the hands of a corporation. Which is true enough, but which, in the present instance, means that the men who are now using and will continue to use them as free pasturage, shall pay the country just compensation for what they get, as every man in every other condition of life must do or die.

These men have had the audacity to advertise to the world their opposition to irrigation by which the territory would be brought into the market and filled up with settlers. They have made this opposition in face of the demand of the farmers, merchants and hotel men of the country, all of whom pray for irrigation. Here, then, are four cases of "land grabbing" existing right under the nose of the Hon. Mr. Williamson, who came to the State Irrigation Congress with the intention of killing the Carey act for Oregon and brought 50 claquers to howl and heel him into acceptance. This man was the author of the state law devised to aid irrigation and prevent the inordinate acquisition of land under the Carey act. He has seen the failure of his law as the sheep men have instructed him to see it; he has passed two years in thoughtful mourning and severe meditation on the possibility that a Carey company may appear and introduce the hated settler, and when,

after this long season of reflection, he finds himself again in the state legislature and at the head of the same committee, under a promise to so amend the law he had constructed that it shall be utterly impossible to the companies to improperly acquire land, he funks, and ends the struggle in his ponderous brain by asking that a commission be appointed to do what he promised the irrigation convention he would do as soon as the legislature gave him the opportunity.

It should be understood by the people that meddling with the laws as they stand will bear very close watching. The speculator is abroad in the land and never had such tremendous influence in the United States Senate as he has today. All the law can do is to punish violators of its provisions and evaders of its enactments, which must be discovered by a thoroughly rigorous inspection conducted by honest trustees.

Punish fraud, that is duty; dishonest schemes against the public welfare will be found as possible under the government system as under any other. No system has yet been devised for the government of the human family, whether by Divine or human lawgiver, that has not recognized the inevitable and unpreventable presence of sin and crime.

A RUSH TO THE RESCUE.

The recent floods in the West called for some rush orders for pumps for drainage purposes. One received by Henion & Hubbell, of Chicago, was filled in so short a time that it deserves special notice.

The entire outfit was shipped by express. The order was received in Chicago about half past ten, and within seven hours the pumping plant complete, dismantled for express shipment, ready for connection to steam, left the warehouse. Within twenty-four hours the outfit was at its destination. The pump was a No. 12 Centrifugal, directly connected to Vertical Stationary Engine. A six million gallon pumping plant, furnished in seven hours from receipt of order, with piping and connection, is, indeed, establishing a "a record for quick service."

THE AGE has been making some inquiry about a "packing" plow, one that will "pack" the bottom of the furrow and practically convert it into a water runway. Among others, Deere & Company, of Moline, answer:

"In reply wish to say that the nearest we could come to filling this want would be our regular subsoil plow. There is no special device in connection with it for packing the earth at the bottom of the furrow, but we would consider the shovel pressure of the subsoil shoe to be all sufficient for this work."

TOO MUCH WATER.

"To reclaim our arid lands all that is needed is plenty of water," is an old saying, and a true one; "but," says the *Reedley Exponent*, there is such a thing as having too much of it." This is the cold storage truth, also. Why not have our pumps and irrigation ditches labeled: "Touch not, taste not, handle not?" Kentucky is a State that may be relied upon to adopt the suggestion.

However, joking aside, the Fresno paper tells some sad truths.

"There are," he continues, "so few irrigationists who can tell when the land has had plenty of water that it invariably happens, in giving it plenty, it gets too much, and the result is that some of the lands that were made to 'blossom as the rose,' in their early stages of cultivation, are now suffering from an over supply of water. The West Park, for instance, a district four miles west of Fresno, which at one time was the garden spot of the county, is now in such a condition from the use of too much water that the owners are compelled to inaugurate a drainage system. In Utah thousands of acres of excellent land were ruined by the rise of the water table driving the alkali to the surface. Near Fresno the United States government is experimenting with tile drains for the purpose of draining the land and washing out the alkali. This condition would never have been brought about had irrigators used less water and more intelligence in cultivating their land. There are thousands of acres in this district today that would be greatly benefited if they received less water than they are now getting."

DEEP WELLS IN OKLAHOMA.

Professor Charles A. Long, connected with the University of Oklahoma, has made some investigations in Oklahoma deep wells, which present some interesting, not to say curious features. In an article upon the above subject, the professor says:

"In almost every county in Oklahoma wells of over 200 feet have been drilled. A few have been put down for prospective purposes, more, however, were drilled in search of water. In general, no water of any practical value is found below a depth of four hundred feet. In many places a strong flow is found at a depth of from two hundred to three hundred feet. As a rule water below this depth is salty. Near the base of the Redbeds sandstones are found. Above the sandstones there is a large mass of clays and shales, then the horizon of the gypsum ledges comes in and above this horizon is another sandstone member."

The results, which Professor Long collected from records sent in to Professor Charles N. Gould, resident hydrographer, U. S. G. S., Norman, Oklahoma, do not appear to be very satisfactory along the line of deep wells.

Perhaps the investigations now being made for the Division of Irrigation of the United States Geological Survey, by Professor Gould and a corps of students from the Oklahoma University, will bear better fruit. They are working west, carrying on two lines of reconnoissance along Beaver Creek and the Cimarron river as far as Northern New Mexico, then they will cross to the head waters of the South Canadian and follow that stream down across the Panhandle to Oklahoma, completing the work about the middle of September. The investigation will include a study of the water problems of the plains, streams, springs, wells, reservoir sites, chances for artesian water and the like.

CORRESPONDENCE

EDITOR IRRIGATION AGE:

Hon. W. A. Clark, who has kindly consented to act in the capacity of president of the Eleventh National Irrigation Congress, which is to be held at Ogden, Sept. 15th to 18th inst., 1903, is a pioneer of Montana, a practical irrigationist, a banker, a miner, a railroad man, and a first class statesman, whose high intellectual endowments will illuminate its deliberations. Thus it is that the National Irrigation Congress from day to day, from year to year, grows more important and it is a happy omen when men of Senator Clark's calibre will consider it an honor to preside, forever precluding the idea of merging, a paramount issue, which means the creation and development of our inland empire, to a sectional organization.

I hold that the law passed for the reclamation of the desert in its effect will be even more far reaching than the Homestead Act, which President Roosevelt says is first, in that the Homestead Act but applies a principle to favorable conditions already existing, whilst the Irrigation Law *creates* the conditions and promotes intensive and diversified farming on small holdings—it eventually will solve economical, educational, race, tariff and financial questions, it will keep the people on the land, in the county, make them independent and self supporting, teaches them to work and diffuses wealth generally, as in France, the most recuperative country in the world, the result of small proprietorship and close cultivation of the soil.

Respectfully,

FRED J. KIESEL.

Chairman Executive Committee, Eleventh National Irrigation Congress, Ogden, Utah.

DES MOINES, IOWA, June 6, 1903.

THE IRRIGATION AGE AND DRAINAGE JOURNAL, *Chicago:*

Dear Sirs:—I just received a copy of *Drainage Profit*, published by you. Do you put out a periodical on land drainage; if so, send me a sample copy. I am somewhat interested in land draining and may be a great deal more so soon, for I am now figuring on buying some ditch machinery. I wish you would tell me if you know where there is dredge machinery made for cutting a ditch, say, 12 to 16 feet wide and 4 to 10 feet deep. If you know where such machinery is made please enclose their addresses to me in the enclosed envelope and oblige.

Yours truly,

G. WALDO GRINSTEAD.

COLONY, KAN., June 16, 1903.

EDITOR IRRIGATION AGE, Chicago, Ill.:

Dear Sir: We are desirous of posting up on the subject of steam ditching machines. Will you do us a favor by giving us the addresses of the builders of such machinery? Would like a machine that we can use with our 8 H. P. traction engine.

Thanking you in advance for the favor, we are

Yours,

L. M. WHITE.

A correspondent, writing from Meridan, Idaho, under date of May 19, says: There was a large and enthusiastic meeting of the farmers held at the Woodman hall yesterday for the purpose of taking steps toward the organization of an irrigating district. Those present were representative men and are deeply in earnest to do something for the bettering of the water question. The following gentlemen were here from Nampa: J. M. Bray, J. M. Crill, John Griffith, H. A. Partridge, R. Meador and Attorney Van Duyn. A. R. Stalker, of Meridian, was made chairman. An organization committee was appointed, consisting of L. P. Corcoran, A. R. Stalker and C. Hedges, of Meridian, to represent Ada county, and A. H. Partridge, J. M. Bray and John Griffith, of Nampa, for Canyon county. It was almost unanimously agreed that it was best to organize an irrigation district. Mr. Greer, of the Ridenbaugh Canal Company, has expressed himself as favoring the plan and promises to put in his private holdings, about 600 acres, as a part of the district.

McMILLAN, N. MEX., June 11th, 1903.

D. H. ANDERSON, EDITOR, Chicago, Ill.:

Dear Sir: Your correspondent, Mr. W. H. Boothroyd, from Tacoma, Wash., under date of April 1st last, and in your April issue, makes reference to a statement concerning a "machine" for lifting water from the channel of a stream to the surface of adjoining land for irrigation purposes, which appears quite remarkable.

Not only remarkable because of the stupendous results accomplished, but also because he neither definitely describes the "machine" and the mechanical principles involved in its operation, nor names it, its inventors or manufacturers. If it is capable of accomplishing the results he claims for it a great many persons would wish further information concerning it.

If Mr. Boothroyd has withheld the information desired from the knowledge of the public to the end that he might be compensated for imparting it, I, for one, would cheerfully pay liberally for the information and in proportion to the substantial value of same.

My plant contains one thousand acres of choice alfalfa lands situated fifteen miles north of Carlsbad, N. Mex., in the Pecos valley and two miles from the P. V. & S. W. R. R.

The Pecos runs through the eastern portion where the lands are lowest, and its waters are appropriated. Seven Rivers enters my inclosure at the northwest corner and empties into the Pecos within my inclosure. At the entrance the lands are the highest, just twenty feet above the surface of the water, and water thereon would flow to any part over a smooth surface with gentle slope. Nature has admirably adapted it for irrigation purposes, and no grading is anywhere needed. Seven Rivers, under my appropriation, has a minimum flow of not less than one hundred and twenty-five miner's inches of water, and usually much more. To hoist that water to the surface of the land in a manner both economical and effectual is a problem in which I am greatly interested and Mr. Boothroyd's machine might be of great value to me.

I wish to know more about it. I own and use now two-thirds the flow of a spring, the minimum yield of which is one hundred miner's inches. With the water from Seven Rivers I could bring nearly all my land under irrigation.

Yours truly,

W. V. JOHNSON.

JUNCTION CITY, TEX., June 6, 1903.

EDITOR IRRIGATION AGE, Chicago, Ill.:

Dear Sir: Can you give me any information or put me in the way of finding out where I can get moulds for making 18-inch cement pipes to carry water, and the manner of making such? I believe they are used in Colorado and California.

Am desirous of making 1,500 feet to irrigate my field, the present wooden flume having rotted out. Freight rates are against my buying the pipe, as I am 70 miles from a railroad and have to pay 50 cent per 100 pounds from the nearest depot. Hauled a carload of 10-inch pipes a year ago and had more than one-third broken in transit.

Hoping you may be able to help me in the matter, and thanking you for the trouble.

Yours truly,

G. K. GORDON.

NEW WILMINGTON, PA., July 1, 1903.

THE IRRIGATION AGE AND DRAINAGE JOURNAL:

Chicago, Ill.

Dear Sirs:—Drainage has never been practiced much in this section, mainly on account of scarcity and high price of tile. Some farmers are putting in glazed tile or sewer pipe, where it is practicable. This is a heavy clay country, flat and wet, except on the border of streams. Plenty of railroads here, and a big demand for drain tile if it could be got at a fair price. Will not some tile maker come here and start a plant? This is a virgin field for a tile-maker, and the people are waking up to the benefit of drainage.

Yours respectfully,

J. C. M. JOHNSTON.

OCEAN PARK, CAL., June 19, 1903.

D. H. ANDERSON PUB. CO., 112 Dearborn Street, Chicago:

Gentlemen—Enclosed please find P. O. money order for $1.00 for IRRIGATION AGE AND DRAINAGE JOURNAL, which I desire to continue. Hoping to enjoy your paper in the coming year as much as in the past, and wishing you every success in your enterprise, I remain,

Yours respectfully, H. ROWLAND LEE.

STEVENSON, ALA., June 20, 1903.

THE IRRIGATION AGE AND DRAINAGE JOURNAL:

Gentlemen—Enclosed find check for $2.00 to pay for THE IRRIGATION AGE AND DRAINAGE JOURNAL.

I want a good and competent man to put up a tile and brick plant at this place. It is a fine location for the business; the clay is good. The people want the tile and brick, and there is no plant of the kind near us.

A fine opening for an enterprising man; railway and water transportation good, and this county is now building $250,000 worth of pike roads—about eighty miles already built.

Help me in this matter. Respectfully,

I. P. RUSSELL.

NEW CASTLE, COLO., June 17, 1903.

EDITOR IRRIGATION AGE, Chicago, Ill.:

Your favor of May 14 at hand. Will say my invention is of that class of irrigating machinery that takes the water out of a river, well or pond. It is an elevator that runs on a track. Each bucket runs on two wheels, just like a car. Is so constructed that it can be made to any size. The smallest plan I have made has buckets that hold two gallons each; the largest size holds 88 gallons and is large enough to irrigate three thousand acres of land in one body. This elevator is designed to reclaim lands along rivers where water power can easily be had or take water out of wells, where the underflow is of sufficient capacity to supply water to irrigate a larger quantity of land and these conditions I find in many places on our western prairies and deserts; for instance, in the large prairies of the eastern part of Colorado, also Kansas and Nebraska and throughout the extreme western states, especially California and Arizona.

My experience for twenty-two years in these countries has led me to this invention and those that have seen it work agree with me that it is the most successful plan for irrigation yet known. It is not altogether new, but an old plan improved. I claim I can raise water as high as any machine and in as large quantities with one-half the expense and one-half the power and that this machine will last longer and does not require a machinist to look after any part of its construction. I shall be pleased to receive a copy of your valuable paper and subscribe for it. Yours truly,

W. A. CONNOR.

SHOULD IRRIGATING CANALS BE BUILT CONTOUR.

JOHN G. HALL, GREELEY, COLO.

Nine out of ten civil engineers who have had no practical knowledge of irrigation will recommend building the canal upon a contour basis. With twenty years' experience, I will try and show up the good and the bad side of contour canals: First, in running a canal on a contour basis, makes a nice, even embankment on the lower side of canal. It is easy to estimate the amount of earth to be removed; again, it is not so difficult to follow a given fall per mile, whatever has been assigned to give it. But on the other hand, and what becomes detrimental in practice, is the cutting away of the banks, which must take place, because there are always elevations and depressions in the land that must be followed to make a contour canal. Following these elevations and depressions gives short crooks to the canal and every time the water goes around one of these crooks throws the main current to the outside. The force of this current is constantly cutting away the outside bank which causes much expense in rip-raping to prevent the bank from washing completely away. This endangers the safety of canal, besides making the owners liable for the damage caused by said break; not only this but the water must be turned out to repair the break, which generally takes from one to five days and the loss of water for this time to those who could use it is again a big loss which on large canals runs into thousands of dollars. Again, the soil or bank of canal that has been cutting away and before the break comes must stop somewhere and will lodge and make a big sandbar, or against some flume check, that must be taken out with slips, dredges or by some other means. This entails a cost to stockholders year after year. As we at Greeley, Colo., have grown up with irrigation, we can look back on our mistakes, as everyone can, and I should recommend to anyone or company taking out a new canal for the saving in future years of expense, *not* to build exactly upon a contour basis; do a reasonable amount of cutting and filling to get the canal reasonably straight, or with long curves to prevent this cutting and washing.

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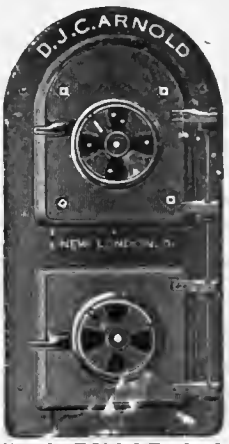

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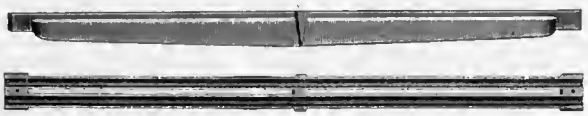

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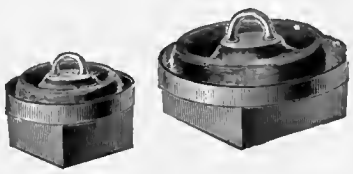

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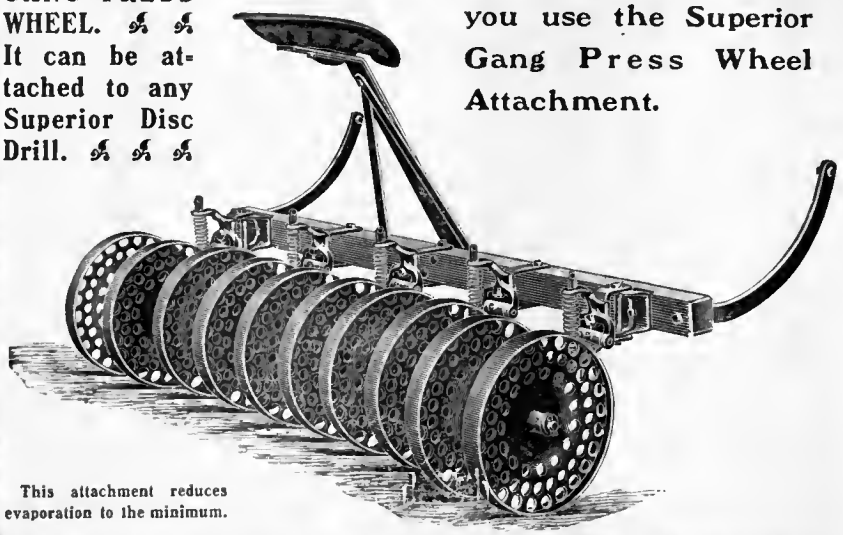

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THE IRRIGATION AGE

VOL. XVIII. CHICAGO, AUGUST, 1903. NO. 10.

THE IRRIGATION AGE

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D. H. ANDERSON, Editor.

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A monthly illustrated magazine recognized throughout the world as the exponent of Irrigation and its kindred industries. It is the pioneer journal of its kind in the world, and has no rival in half a continent. It advocates the mineral development and the industrial growth of the West.

EDITORIAL

The Campaign of Education.

Have you noticed how the newspapers in "God's country," that is the Atlantic coast, are beginning to talk about irrigation? Some of them have actually got beyond the idea of a tin sprinkling pot as the sole machinery necessary in the business.

One Fare for Round Trip.

Get ready to start for Ogden. One fare round-trip tickets to the Congress from all points between Chicago, St. Louis and the Pacific ocean. President Roosevelt said: "I want to see the National Irrigation Congress at Ogden a thorough success in the interest of the Union." Go and make it a success and you will see something you never dreamed would come to pass. What that something is you must find out for yourselves; we should like to tell you in advance but a solemn promise prevents us, much to our regret.

A Source of Regret.

We feel regretful, not to say remorseful, that the artist who provided the beautiful views and portraits connected with the city of Ogden, should have been so forgetful as to omit the fair members of Ogden's scenery. A few of the numerous beautiful women would have enlivened the *tout ensemble,* and made this issue of the IRRIGATION AGE something to be indeed proud of. As it is—well, the least said the soonest mended, and we promise that on another occasion we shall insist upon portraying the rose gardens of Ogden as well as its alfalfa patches.

No Reason Why He Shouldn't Be.

The Chicago *Record-Herald* has advertised the name of Mr. George H. Maxwell as a candidate for Vice-President. There is no reason why there should be objection to this, inasmuch as it is the right and privilege of every American citizen to run for anything. The only surprising part of this is that Mr. Maxwell should content himself with the Vice-Presidency when he might run for President.

There was once a man who shot at the moon and missed. He blamed his fate, but another man came along and told him why he missed:

"Friend," said he, "there is nothing the matter with your aim; that is all right, and you would have made a center shot if the target had not been out of your reach."

Valuable Matter Crowded Out.

Owing to the great importance of the Eleventh National Irrigation Congress some exceedingly interesting matter has been unavoidably omitted. The beautiful half-tones of views in the city of Ogden, Utah, with the descriptive matter therewith connected, and the general features of what the Eleventh Con-

gress has laid out to do will relieve us from the necessity of making an apology for omissions. The kindness of our subscribers on all occasions of this nature leads us to so believe, and, in compensation, we desire to say that THE IRRIGATION AGE is endeavoring to faithfully carry out its promise to be the only true and disinterested medium for irrigation in the great west —disinterested in the sense that it is laboring for the interests of all irrigators without distinction, and without regard to its own advantages.

A Few Words of Praise.

The citizens of the city of Ogden, and the people of Utah generally, merit the highest praise for their energetic action with reference to the sessions of the Eleventh National Irrigation Congress. They have not hesitated to display an open-handed generosity, liberality, and an expectant hospitality that deserves more than mere verbal commendation. The people of Utah see in their state the making of a vast empire of productiveness, and they are bound to make it come up to the spirit of their intention to make it so. This will necessarily create a great city of Odgen, which already shows more than a beginning in that direction.

Their energy is not limited to themselves, but spreads out over the entire arid and semi-arid West, injecting energy into the veins of the pioneers of irrigation, and nerving them up by an example which men regard as the only one to be followed if success is to be attained.

With her dynamic force affecting the entire West there is no reason why Utah should not become, in the near future, the center, the *entrepot*, the great mart of the teeming millions bound to come, and why Ogden should not become the gigantic metropolis of the empire of which she is almost the parent.

The unanimous, hearty welcome of Utah and Ogden, spontaneous, let it be said, betokens hearty cooperation by the delegates in whatever may be offered for them to consider. THE IRRIGATION AGE believes that the delegates will be as pleased with Ogden and with Utah, as the latter will be pleased with the delegates. The coming together of them will be productive of mutual benefit, and that benefit, we sincerely hope, will be far reaching, and be the beginning of the dawn of a bright, glorious day for irrigation. This carries with it everything else in the way of material prospects.

Eleventh National Irrigation Congress.

On September 15, 16, 17 and 18, at the city of Ogden, Utah, will be held a Congress of an important part of the people of the nation of as great a significance and importance as any that has ever been held since the memorable Congress that sounded the toesin of American independence.

Its proceedings will relate to an extent of territory of vaster dimensions than the original thirteen states, and its deliberations must cover a possible population running into the millions. The brawn and muscle of the nation, toiling millions seeking homes, comfort and comparative ease, look to that Congress to blaze for them an unobstructed path to plenty. Our cities are crowded with millions of helpless infancy who, when they shall have reached maturity, will have no other haven to seek but the vast plains of the West. There are other millions yet unborn whose future must be provided for in the vast area which is looming up as the jewel of the nation, the feeding ground of the world.

It will not be an easy thing for this National Irrigation Congress to acquit itself of its task without the most bitter and determined opposition from interested persons who care as little for the interests of millions of people as the Tories of the Revolution cared for American Independence. Its delegates will be buttonholed, cajoled, threatened, flattered, and even their bribery attempted for the purpose of seducing them from their great purpose of protecting the arid and semi-arid world from the horde of land and water grabbers who have already set the machinery in motion to pervert the act of Congress and destroy the intent and purpose of the Government to create an empire for the benefit of the people—the home seekers.

But THE IRRIGATION AGE believes that the petty triflers with the rights of the people are too small and insignificant to be regarded as of any more importance than mere disturbers of the peace, blood suckers on a vigorous corpse, gnats that do not require sledge hammers to be crushed. It believes that all these small people, whether they be private individuals or petty officials working schemes through private individuals, will all be brushed off the main question, which is: "Shall the irrigation of the arid and semi-arid lands of the West be controlled for the benefit of a few land and water grabbers, or for the benefit of the people of the nation?"

It seems ridiculous to think that a few persons can subvert the designs of the legislative and executive branches of this great nation, and pervert, as well as set at naught, the objects for which beneficent laws are enacted. But so it is. The Government is so great that it overlooks the gnats penetrating its armor, fails to see the rats gnawing into its wealth of grain. Its machinery is too cumbersome to crush its petty officials who are robbing it of a little oil here and there and making it creak and run awry, but there are those interested who will clear away the obstacles to its beneficent purpose, and do it so effectually that their memory will be nothing but that of a passing nightmare.

The delegates of the Eleventh National Irrigation Congress will be men of experience and will work with a will over the numerous vexing problems that have confronted every irrigator for years. There are prac-

tical benefits to be achieved, progress to be made, and in bringing that about, conflicting interests, diverse laws, vexatious controversies must be smoothed over, settled, provided against or put beyond the possibility of doing harm. It is no small labor to weld conflicting irrigation interests into a homogeneous mass that will work smoothly. But it must be done, otherwise the work will be of small avail, of little profit, and the gnats, the rats, and the petty disturbers of the peace of the home seekers will continue their underhand, nefarious work, and render inoperative (except for themselves) laws that are passed for the benefit of the people at large.

The "Works" Irrigation Bill.

In one of our articles on the influences affecting the national irrigation program, we had occasion to refer to the defeat of the reform irrigation bill presented to the Legislature of California last winter by the California Water and Forest Association, and in this connection disclosed the purpose of a meeting held at Riverside, Cal., on December 29, to create a sentiment against the bill. Our words were:

"The Riverside convention was composed almost wholly of the great water companies of Southern California, who have the irrigator in their power, and who, for this reason, do not favor state restrictions to their influence, or any provisions which might bring relief to the actual user of water."

Now comes the Riverside (Cal.) *Press* with an abortive attempt to show that the bill was defeated by the will of the great body of water users of California and not by corporate and greedy influences. It says:

"We wonder where this man Anderson has been slumbering for the last six months. As a matter of fact the Riverside convention was composed almost entirely of irrigators, of actual users of water; and the water companies that Mr. Anderson inveighs against are mutual organizations composed of irrigators. They do not sell water, in the ordinary sense of the term, but supply it to their stockholders. The idea of their having 'the irrigators in their power' is entirely absurd. How could a man oppress himself?

* * * * * * *

"Somebody ought to kindly wake Mr. Anderson from his trance, and after playing the hose on him to fully arouse him, give him an opportunity to read the files of the California papers for last winter. At present he evidently hasn't even a remote conception of what he is talking about."

It will be somewhat astonishing if the people of California permit themselves to be deprived of reform irrigation legislation by any such statement as that contained above. It is true that the Riverside meeting was composed largely of representatives of mutual water companies, but the idea that water companies who "supply water to their stockholders" can not be oppressive is as ridiculous as the idea that California can reach its full agricultural development without so defining and establishing water titles that they will be beyond the reach of periodical attacks in court. It has been contended that farmers, when effectively united, make the most unreasonable of monopolists. The truth of the contention seems well illustrated by the attitude of the "mutual" water companies of southern California. There is no more reason why an incorporated body of farmers and wealthy landowners should be allowed to control more water than they need, or to blackmail the unprotected irrigator into relinquishing that which is rightfully his, than there is that this should be done by a company organized wholly for making profit from the sale of water; if anything, the former is the more reprehensible.

Our contemporary suggests that we read the files of the California papers for last winter. Wishing to be accommodating we have taken down some of them and find the following, in an editorial comment on the opposition to the bill in question, in perhaps the most influential daily newspaper of California and of the Pacific coast:

"Some idea of the bill can be gathered from the character of its enemies. These, in a word, consist of every man in California who has or hopes to obtain the control of any quantity of water, more or less, of which he may hope to make merchandise. These are headed by the transcontinental railroads, whose unavowed but effective agent has been in constant telegraphic correspondence with the opponents of the bill at Sacramento, whose movements he has assumed to direct, and it is believed that they have all taken his orders. The open fight has been made in the name of certain 'co-operative' water companies of Southern California. These are all moved by the same considerations which control others in possession of water. They wish to get all they can and to keep all they get. If they have grabbed more than they need they want to sell it. They have made common cause with the railroad and other water monopolists and will continue to do so. The alignment for and against the bill may now be very plainly seen. *Those opposed to the bill are those in possession of the water. Those for it will be the rest of the people as fast as they become educated to a knowledge of the situation.*"

We trust that the great mass of irrigators of California, and the business men who have at heart the agricultural welfare of the state, will persist in their effort to seek out and expose the enemies of irrigation development among their supposed friends. We understand that the "Works" bill is to be again presented to the Legislature of California two years hence, and that in the interval the progressive people of California are proceeding with their campaign of education.

ELEVENTH NATIONAL IRRIGATION CONGRESS.

ITS SCOPE AND PURPOSE.

Origin of the "Congress" and What It Has Accomplished.

ITS FUTURE WORK.

Something over twelve years ago, at Salt Lake City, Utah, there was held a "First National Irrigation Congress," the object of which was to agitate the reclamation of arid lands through national aid. The states and territories which required and demanded reclamation of their useless, unproductive lands to convert them into happy, productive homes, fit for the habitations of millions of people, were:

Arizona, California, Colorado, Idaho, Kansas Montana, Nebraska. Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington and Wyoming. Texas may very properly be included for its western extremity lies far within the arid region, altho' the greater part of the state is what is known as "subhumid," a condition common to North Dakota, South Dakota, Nebraska. Kansas and Oklahoma.

At the time of the first session of the National Irrigation Congress, as above mentioned, there were only 66,965 acres of irrigated land in the states classed as "subhumid," a very small proportion of the total surface acreage of those states, which amounts to 392,220,800 acres. At the same period the total irrigated area in all of the states classed as "arid," was only 3,564,416 acres, out of 17,199,925 acres of farm or agricultural holdings, or 20.72 per cent of the total area of the farms which were partially irrigated. But, in these eleven states and territories, less than one-half of the farms contained irrigated areas, the total farm area being 40,278,844 acres, the percentage of irrigated acres therefore being only 8.85 per cent of the land owned by farmers. The total area of these eleven arid states being 715,187 200 acres, it will be perceived that not only the irrigated acreage, but the entire amount of farm holdings, when the National Irrigation Congress began its work, were very small spots on the landscape.

OFFICERS OF ELEVENTH NATIONAL IRRIGATION CONGRESS.

Hon. W. A. CLARK, Butte, Montana, *President.*

Hon. L. BRADFORD PRINCE, Santa Fe, N. M., *First Vice-President.*

E. H. LIBBY, Clarkson, Wash., *Third Vice-President.*

Hon. F. J. KIESEL, Ogden, Utah, *Chairman Executive Committee.*

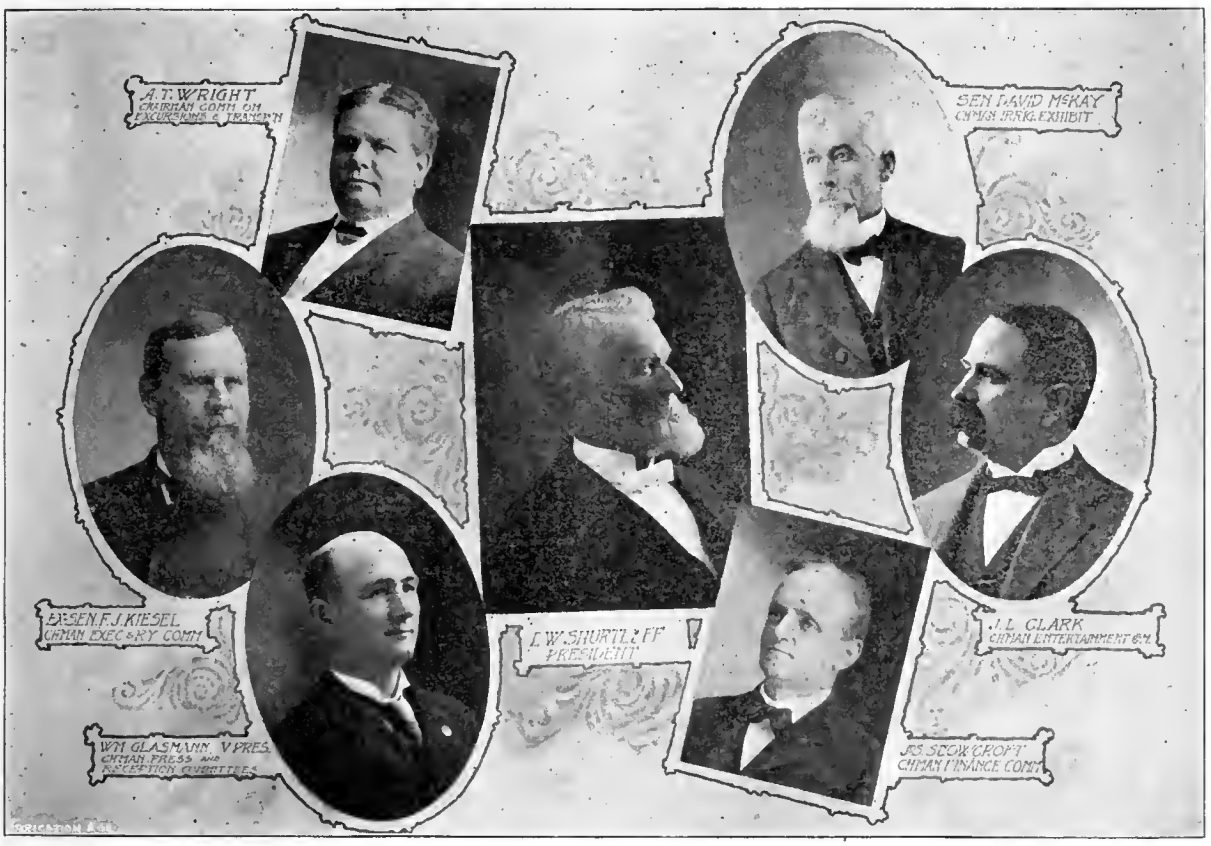
ADDISON J. McCUNE Colorado, *Second Vice-President.*

H. B. MAXSON, Reno, Nevada, *Secretary.*

The Congress undertook the work of empire building; that is what it must be credited with, and it foresaw that the time would soon come when water for irrigation purposes would be an imperative necessity or else the colonization of the arid states would cease. It was a significant fact, so declared by Government officials who made a detailed examination of all the irrigated localities, that, as a rule, the greater part, if not all, of the easily available water supply had been utilized, which meant, practically, that private capital was inadequate to supply the deficiency, although there were oceans of water to be had for the ditching of it, or by storing it in reservoirs. The time had arrived when the aid of the National Government was necessary to solve the difficulty, and provide means for reclaiming the vast territory that needed only water to make it blossom like a rose garden, and provide homes for millions. It was impossible for State Legislatures to accomplish any results beyond the several State boundaries, and an irrepressible conflict of irrigation

laws prevented any uniform legislation on the subject. The states were hampered by their constitutional inhibitions from raising money for private purposes or benefits, and, moreover, there were Federal lands exclusively subject to the sovereignty of the National Government, and over these lands any state law would be absolutely inoperative without the consent of the Congress of the United States. Hence the National Irrigation Congress began its agitation of the great question of irrigation for the reclamation of the arid lands belonging to the Government. The United States had on hand unsold about seven hundred millions of acres of land of every variety, of which it was estimated that from seventy-five to one hundred and fifty millions of acres were susceptible of reclamation by the application of water.

All this meant ditches, dams, enormous reservoirs.



BOARD OF CONTROL, ELEVENTH NATIONAL IRRIGATION CONGRESS, OGDEN, UTAH.

But the National Irrigation Congress never stopped boring, mole-like, through this uncongenial, incompatible mental soil, until President Roosevelt came, and in his message to Congress in December, 1901, he placed the cause of national irrigation in a position where it could not be denied. That message marked a new epoch in the history of Western America. His words carried conviction to the minds of many of those who were still fancying that far-off possessions were the adjuncts of power and national greatness, and opened their eyes to the enormous possibilities of the arid and semi-arid lands of the great West, compared with which our so-called "Island Empire" would make a small garden patch in Montana. Mr. Roosevelt had lived in the Great West, he loved it, it had given him life and robust health; he knew its possibilities and its greatness, and by a stroke of his pen he conquered an empire that had been ignored by those of limited vision, or who saw nothing that was not gauged by New England spectacles, or seen through cannon smoke.

artesian wells, and gigantic engineering works beyond the resources of any amount of private capital. Small beginnings had been made toward enlisting the Government in this vast enterprise, or rather series of enterprises, long prior to the period referred to, but they came to naught because the time was not yet ripe, and the occupants of the Presidential chair could not comprehend the greatness of the undertaking and the enormous benefits to be reaped from it by the whole nation. Moreover, there was bitter antagonism at whatever would build up the West, intelligent men still regarding the idea of watering the soil of the "Great American Desert" as an act of stupendous folly, one prominent Senator who made the trip through the arid region publicly declaring that it would be a sin and a crime for the Government to expend any money to irrigate land where God Almighty refused to permit a tree to grow of its own accord.

Time crept on with stealthy feet; the little green patches, once microscopical in a vast ocean of desert, grew and spread until they began to touch one another. What Senator Broadhead declared were the "pitch burned pastures of Hell" became covered with nodding grain and began to supply the Orient with breadstuffs; the spot where Governor Brown of Georgia lay down and wept for the fiery furnace of Shadrach, Mesach, and Abednigo to cool off in, hangs heavy with golden and purple fruit, and the hot sirocco-like winds, blowing over moist, green, grassy fields, are changed to the balmy zephyrs of Spring. The Con-

gress kept on boring into the granitic intellects of the powers that cast obstacles in their way, until, on June 17, 1902, President Roosevelt signed the first national irrigation law.

Standing upon the same soil in which the first National Irrigation Congress had planted the seed, watered it, and husbanded its growth until it produced a glorious fruit, that is to say, at Ogden, on May 29, 1903, President Roosevelt thus addressed the citizens of Utah and the whole nation, in the following momentous language:

"Mr. Mayor, Senator Smoot, and you, my fellow citizens, men and women of Ogden, Utah—It is a great pleasure to come before you this afternoon, and if I needed, which I do not, a vindication of what was done in irrigation, I would appeal to the experience of the people who have made so marvelous a success of irrigation in this beautiful valley.

"What you have succeeded in doing with sugar beets alone is sufficient to show the wisdom of trying to develop in every way the irrigated agriculture of the country; and I was more pleased than I can say to have been able to render any aid whatsoever in putting upon the national statute books a law which I consider second in beneficence to none connected with our internal development since the homestead law was passed.

IRRIGATION PARAMOUNT QUESTION.

"I am delighted that the National Irrigation Congress is to be held here next fall, and I congratulate the state of Utah upon the fact that its legislature was the first ever to pass an appropriation for such a congress. There can be nothing of greater importance to the welfare and growth of our country during the half-century that is opening than this question of irrigation. It is of vital consequence to the growth of all of the states of the Rocky Mountains and immediately to either side; and anything that is of such consequence to one portion of our country is necessarily of consequence to all. I can not with too much emphasis say that every wise and patriotic man will favor any scheme for the betterment of a part of the country, whether it is in his own section or not, because whatever helps a part of us in the long run helps all.

ALL STAND TOGETHER.

"Fundamentally, we go up or down together. Prosperity does not stop at state lines, and neither does adversity. When prosperity comes, while it may come unequally, yet it comes somewhat to all; and when adversity comes, while some will suffer more than others, yet all must suffer somewhat. The greatest lesson which the American body politic need to take to heart at the beginning of the twentieth century is that it is out of the question permanently for our people to progress save on lines that tell for the progression of all; that you can not raise permanently one section by depressing another, one class by depressing another, and the man is recreant to the principles of our Government no less than to the welfare of our people who seeks to arouse any feeling among Americans against his fellow Americans, whether he makes his appeal in the fancied interest of a section or in the fancied interest of a class. We can go up—as we shall go up—only by each of us keeping in mind not merely his own rights, but his duties to his neighbors; meaning by neighbor every man living in this broad land. The safe motto on which to act is the motto: Not of 'some men down,' but of 'all men;' and therefore I feel that it was not merely my privilege but my duty to ask the National Government—the Government representing the people of the entire nation—to do all in its power for the furtherance of the interest of those states whose success is largely dependent upon the application of the principles of irrigation.

MUST HELP YOURSELF.

"And now you know the proverb 'The Lord helps those who help themselves.' If you throw all the duty of helping you on the Lord, He will throw it back on you. Now, it is the same way with your fellow-men. Providence is not going to do everything for you and the National Government can not. All that the National Government can do is to try to give you a fair show to help you to the chance of doing your work under favorable conditions, and then the work has got to be done by you yourselves.

SUCCESS OF THE CONGRESS.

"And as one step toward doing that work, I hope most earnestly that you and all the other states in interest will push forward and will in every way endeavor to make the meeting of the Irrigation Congress here in Ogden a thorough success. And I say that, not merely in the interest of Ogden, not merely in the interest of the states which are to be benefited by irrigation, but in the interest of the Union, I want to see that Congress a success; I want to see the work of irrigation made the greatest possible success."

THE FUTURE OF THE CONGRESS.

When the Revolutionary Fathers in Congress assembled, announced to the world the Declaration of Independence, they did not stop at that and dissolve and disband; they remained in session and continued on with the work of building up the nation, and seeing to it that the great principles they had adopted were properly and effectually carried out and enforced, and they are still in session; that is why we have a great nation. Had they stopped their work and left the nation to the mercy of chance or designing persons, we should now have been saddled with a king in whose nostrils freedom would have been a stench, and irrigable lands would have been crown preserves to distribute among favorites.

It follows for similar reasons that the National Irrigation Congress may not dissolve and disband with honor to itself. It is the bulwark of a vast empire, the interests of which demand constant watchfulness lest they be prejudiced through being absorbed by a few designing individuals. It is its work, its business to see that the provisions of the national irrigation law are properly, honestly, and faithfully carried out and applied for the purposes intended, and to the persons intended. It must now inaugurate a system of government, establish a protective power and tribunal, which, by virtue of its organization will see that the just demands of the people it governs are heeded, and that its equitable, reasonable decrees are enforced. It must be prepared to say to this or that legislator: "You are betraying the interests of the people you represent and you shall meet with a political death." It must warn the state legislator that his hands must be kept clean of jobs, and it must set traps for the rats and mice gnawing at the public crib. It must unify conflicting irrigation laws, see that the present land laws of the nation, which were good enough to build up the West, be preserved, or so amended as to conform to the national irrigation laws. There is a vast amount of work for the Congress to do, and it is all within its scope and province, indeed, there is no other trustworthy body of men who can do it.

GILBERT McCLURG,
Gen'l Representative Executive Committee.

HOW TO PERPETUATE IT.

It is certain that a simple plan for

perpetuating the National Irrigation Congress will be presented at Ogden, one so simple in fact, that it will be accepted as not only advisable but necessary to avoid the evils that will surely follow upon any dissolution of its organization. More than this, THE IRRIGATION AGE is not at liberty to state. When the proper time comes, however, the plan will be so vigorously pressed, and such substantial reasons given for its adoption, that the only opponents will be those who have personal reasons for establishing a scheme of their own, one which will certainly not be for the best interests of the great army of irrigators.

OGDEN CITY, UTAH,

WHERE THE CONGRESS WILL BE HELD.

Ogden City, Utah, where the Eleventh National Irrigation Congress will be held, is one of the most beautiful cities between the Mississippi river and the Pacific ocean. The altitude of the city is 4,301 feet above the level of the sea. No city in the West is better located. It is situated on the foot hills of the Wasatch range, mountains that rise majestically and form a beautiful background to the city. Ten miles to the west is the Great Dead Sea of America—Great Salt Lake. Between this lake and Ogden City is Great Salt Lake valley with its productive fields of grain, vegetables and fruits. The entire valley is dotted with trees that have been planted since the arrival of Brigham Young in Utah.

It is the great railroad center between Denver and San Francisco, being the center of the Harriman system of 30,000 miles of railroad and the end of the Gould system. The Union Pacific, the Central Pacific, the Rio Grande, Western, the Oregon Short Line and the Ogden and Great Western railroads have their termini there. A large union depot is used by all the roads. The Central Pacific railroad now runs north from Ogden around Great Salt Lake, but at present the railroad is building a cut-off across the north arm of Great Salt Lake, which will reduce the distance forty-five miles, thirty-five miles of trestle work being built over the Great Dead Sea of America, which will be filled in on each side with dirt and rock 100 feet wide, with only a bridge in the center for the water to pass through as well as to accommodate the boats on Great Salt Lake. Over 2,000 men are today busily engaged in this greatest of modern engineering feats.

The railroad facilities naturally make Ogden a jobbing point, and the large wholesale interests of the intermountain country are located there.

The climate and sanitary features are first-class. The city is reported to have the finest sewerage system in the entire West, being a gravity system, and the climate is such that the reports show that Ogden has less than ten deaths out of each 1,000 population, and this rate includes the deaths of those who go to Ogden in the hope of gaining health, who have been given up by their physicians in the East and whose last hope was the invigorating Utah climate.

The city has a splendid electric street car system, electric lighting plant, as well as gas plants for heating and illumination.

It is a natural location for beautiful homes, the city being located at the junction of the Ogden and Weber rivers which flow between the mountains on each side of the city through two great canyons, thus forming air currents through the mountains directly over the city, making it cool and healthful during the warm summer months.

Accompanying this article will be found a few illustrations of the many beautiful residences in the city as well as a few of the substantial business structures. A glance at the illustrations will show that the buildings in Ogden City are erected for permanency, thus indicating the confidence the people of Ogden have in her future. The city is growing, not with boom methods, but in a substantial and permanent manner. The 1900 census gives the city a population of 16,350. Since then there has been a growth of over 3,000 population per year, and it is now estimated the city has a population of over 25,000 people. The completion of the cut-off across Great Salt Lake, which is a most important factor in locating the termini of all the railroads at Ogden, alone, is a guarantee of the continued growth of the city. The Central Pacific Railroad Company has had for several years past their shops in operation here. At the present time, however, the joint Harriman systems are constructing shops of gigantic proportions, which will be the greatest combination of railroad shops west of Omaha, and will employ all told, over 1,000 men.

Ogden City has an electric power plant, said to have possibilities second only to the great electric power plant at Niagara Falls. The street car system of Salt Lake is furnished with power from Ogden's power plant. Salt Lake City is also lighted by the electric current from the Ogden plant sent over wires forty miles away. This great power plant, which has not yet furnished one-half the power the owners of the plant contemplate developing, indicates what prospects there are in store for the city in the shape of manufacturing enterprises on account of the cheap electric power.

Already Ogden City has a few manufacturing plants established. The Ogden Beet Sugar Company plant, costing over $500,000, slicing 400 tons of sugar beets daily; the Ogden Broom Factory, employing forty people; the Ogden Box Factory, turning out 500,000 boxes annually; large vinegar and pickling works; two steam laundries; a large woolen mill; four creameries; three kniting factories; four flour mills; a pressed brick manufacturing plant; a sewer pipe and tile works; eleven canning factories and two foundries and machine shops, all located in the immediate vicinity of the city. Such manufacturing establishments as will require coal and coke can easily be accommodated with coal only forty miles from the city, and with coke of the very finest class within 200 miles of the city.

Great deposits of iron have been discovered just west of Great Salt Lake within a few miles of the new Central Pacific cut-off. This

WILLIS T. BEARDSLEY,

First Assistant Secretary Eleventh National Irrigation Congress and Secretary Board of Control.

iron ore runs from forty to fifty per cent metallic iron, and parties have now under consideration the erection of a blast furnace for the manufacture of pig iron in Ogden City, which will only be the beginning of numerous other manufacturing plants. The Wasatch mountains which run north and south of Ogden City are dotted with mining camps. Park City, one of the greatest silver producers of the world, is only forty miles across the mountains from Ogden. Other mining camps located nearer and farther away are all connected by railroads which, to a great extent, make Ogden City their base of supplies.

A word as to the numerous canning factories will not be out of place. The vicinity of Ogden has more canning factories than the whole intermountain country combined. The famous Utah tomato, which is canned in Ogden and shipped all over the globe, finds its home in the county of which Ogden City is the capital. Vegetables of all kinds, peas, beans, etc., together with the various kinds of fruit, are all canned by these numerous canning factories, all of which make the farmer prosperous because he is guaranteed a cash price for his product and his entire output is contracted for before he puts the seed in the ground.

STREET SCENES, OGDEN, UTAH.
23. Washington Avenue, Looking North.
24. Twenty-Fourth Street, Looking West.

In the arid states water is the great need of the hour. No city in the West is so abundantly blessed with water as is Ogden City and the immediate vicinity. Two rivers, the Ogden and the Weber, coming from the snow capped mountains of the Wasatch range and meandering through giant canyons, meet at Ogden City, affording water sufficient for a half million people.

In Ogden canyon five miles from the center of Ogden City is one of the pleasantest summer resorts on the continent. The summer days do not get very warm at Ogden City, but, owing to the nearness of this cool summer resort, thousands of people avail themselves of the refreshing and exhilarating climate in Ogden canyon.

Ogden City is blessed with educational institutions. In addition to what is said to be the best public school system in the West, the Catholic church has a school for girls and one for boys. The Mormon church has a theological seminary, and there is also located at Ogden City the Intermountain business college, also the Ogden high school, which latter institution is recognized by all the best colleges of the East as one of the best preparatory institutions in the country; all together forming educational advantages which can only be excelled in the Rocky Mountain country by Denver City. The Carnegie Free Library has just been completed, costing $30,000.

In addition to the five Mormon churches and Tabernacle, the Presbyterians have two churches, and the Methodist, Catholic, Congregational, Baptist, Episcopal, Lutheran and Christian Science, each have one church. Practically all of the secret societies are represented in Ogden City, including the degrees for ladies.

Financially the city is strong. It has three national banks, one state and two savings banks. In addition to the beautiful school and church structures, there are also located in Ogden the State School for the Deaf, Dumb and Blind and the State Industrial School.

The foregoing gives a brief idea of what Ogden City is. There are many other advantages, too numerous, in fact, to enumerate in so short an article as the present one.

It can plainly be seen that the last Irrigation Congress made no mistake in selecting Ogden City as the place for the Eleventh National Irrigation Congress to hold forth. This beautiful city of enterprising citizens has secured from the state of Utah $6,000, and will raise $9 000 more, making a total of $15,000, all of which is to be used toward defraying the expenses of the Congress and in entertaining the delegates. When the Eleventh Irrigation Congress shall have adjourned, there is no doubt whatever but that the delegates will, with one acclaim, declare that Ogden City makes an estimable host and that her people are most generous entertainers.

Among the features of entertainment which will be tendered the delegates of the Congress by the people of Ogden, free of charge, will be an excursion to the northern part of the state, passing through the great Bear River canyon and inspecting one of the greatest irrigation systems of the West; then on toward Logan, where is situated the government experimental station. Also a moonlight trip over the great trestle now being erected on Great Salt Lake. A scene of the moon rising or setting over Great Salt Lake is said to be one of the beauty wonders of the world. A trip up Ogden canyon (said to be only second to the grand canyons of the Yellowstone and Colorado) which lies at the threshold of Ogden City. A trip to the Ogden Sugar Factory where the delegates will witness the slicing of 400 tons of beets and see them converted into sugar while they wait, will be one of the interesting sights of the session. A bathing trip to Great Salt Lake as well as a visit to the great Mormon tabernacle and temple in Salt Lake City will form a part of the hospitality that will be ten-

dered by the people of Ogden and Utah, which alone presents sights well worth traveling across the continent to see.

THE PRIMER OF IRRIGATION.

BY D. H. ANDERSON.

CHAPTER V.

RELATIONS OF WATER TO THE SOIL.

When a small portion of soil is thoroughly dried and then spread out on a sheet of paper in the open air it will gradually drink in watery vapor from the atmosphere and thus increase its weight to a perceptible degree. In hot climates and during dry seasons this property of absorption in the soil is of great importance re-

THE HOTELS IN OGDEN, UTAH.

28. The Brown. 27. The Reed. 26. The Healy. 29. The European.

storing, as it does, to the thirsty ground, and bringing within reach of plants, a part of the moisture they have so copiously exhaled during the day. Different soils possess this property in unequal degrees. During a night of twelve hours, for it is at night that watery vapor is deposited on the ground (evaporation from the soil occurring during the day), 1,000 pounds of perfectly dry soil will absorb the following quantities of moisture in pounds.

Quartz sand	0
Calcareous sand	2
Loamy soil	21
Clay loams	25
Pure clay	27

Peaty soils and those rich in vegetable matters will absorb a much larger quantity from the atmosphere, sometimes becoming "wet" two inches deep, a surprising quantity of water when the weight of it on an acre of ground is calculated. The weight of dry and wet soils has already been given, and the difference between the two will, of course, show the quantity in weight of the moisture or water absorbed. The average weight of dry soils is about 94 pounds, the average ordinary wet weight is 126 pounds, the difference, being 32 pounds, represents the average weight of water per cubic foot. Now, multiplying 43,560 square feet in the acre by 32, gives 1,393,920 pounds to the acre one foot deep. and dividing by 12 to ascertain the weight of one inch, we have 116,160 pounds, or about 58 tons of water falling on an acre of ground in the shape of dew in a single night. Of course that quantity represents the highest possible absorptive quality in a heavily charged vegetable soil. Other soils would receive a less quantity as will be readily understood, but there is enough to be equivalent to quite a smart shower and worth encouraging.

In what are known as "dry" climates there is always some moisture in the atmosphere which is deposited upon the soil, for wherever there are oxygen and hydrogen there must be moisture. But the quantities vary in climates as much as they do in soils. Where there is evaporation from the soil moisture during the day there is also a re-absorption of moisture by the soil at night and, with this fact in mind, it may be laid down as an axiom: The tendency of water is to evaporate from the soil into the atmosphere during the day and to fall back upon the soil during the night. To reduce the idea to an axiom: A dry soil has an affinity for a moist atmosphere, and a dry atmosphere loves a moist soil.

SATURATION AND POWER TO RETAIN MOISTURE.

The rain falls and is drunk in by the thirsty soil;

the dew descends and is absorbed, and the waters of irrigation poured upon the ground quickly disappear. But after much water falls upon the earth the latter becomes saturated, can hold no more, and the surplus runs off the surface or sinks down through until it reaches the water table. This happens more speedily in some soils than in others. Thus, 100 pounds of dry soils, as here specified, will hold the quantity of water set opposite their respective names without dripping or running off.

Quartz sand	25 pounds
Calcareous sand	29 pounds
Loamy soil	40 pounds
Clay loam	50 pounds
Pure clay	70 pounds

But dry, peaty soils and adobe will absorb a much larger proportion before becoming saturated to the dripping point; sometimes such soils will absorb their own weight of water. Arable soils generally will hold from forty to seventy per cent of their weight of water.

This power of retaining water renders such a soil valuable in dry climates. But the more water the soil contains in its pores the greater the evaporation and the colder it is likely to be. Indeed, evaporation is a source of cold, sometimes to so great a degree that ice will be formed. In very hot regions in India where ice is inaccessible it is customary to place small, shallow saucers filled with water on the ground after nightfall, and they are gathered in the morning before sunrise, the water being converted into ice by the rapid evaporation from the soil during the night. Our modern ice machines owe their efficacy for making ice to the rapid evaporation of ammonia under pressure. Ether, chloroform, alcohol, and numerous other substances, produce a sensation of cold when rubbed on the skin, which is not due to anything in those substances, but wholly to their rapid evaporation or volatility. The presence of a saturation of water in the soil, however, excludes the air in a great degree and thus is injurious to plants, whose roots must have air as well as moisture, hence the necesity for drainage where there is a liability to saturation.

Unless rain or dew is falling or the air is saturated with moisture, watery vapor is constantly arising from the surface of the earth. The fields, after the heaviest rains and floods gradually become dry, and this takes place more rapidly in some fields or parts of fields than in others, in fact, wet and dry patches of ground may be seen on the same field, indicating a heavy or light soil. Generally speaking, those soils capable of containing the largest portion of the rain that falls also retains it with greater obstinacy and require a longer time to dry. The same thing happens when the land is irrigated. Thus, sand will become as dry in one hour as pure clay in three, or peat in four hours.

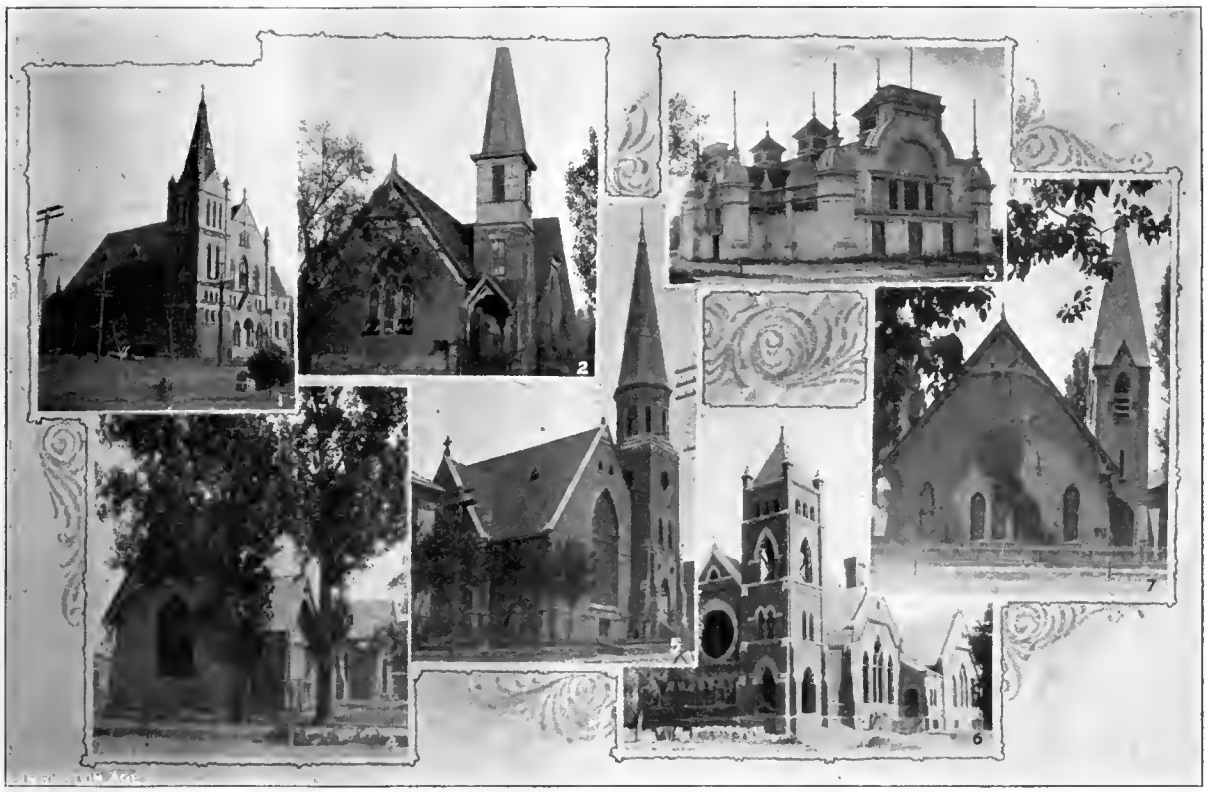
There is one fact every irrigator should constantly bear in mind and that is: Water saturation of the soil is never necessary to plant life; it is, in fact, positively injurious except in the case of acquatic plants. A long time ago men, seeing rice growing luxuriantly in swamps, imagined that plant would not grow anywhere else, and, accordingly, rice culture meant a swamp. But it was discovered that rice would grow better and produce a larger and richer crop in arable soil generally,

PUBLIC BUILDINGS, OGDEN, UTAH.

13. Sacred Heart Academy.
14. City Hall.
15. Industrial Building of State School, for Deal, Dumb and Blind.
16. State School of Deaf, Dumb and Blind.
17. State Industrial School.

and now it is cultivated with astonishing success the same as wheat, barley, or any other cereal.

Nature, through heavy rains and other water sources, converts the soil into a storage reservoir by establishing a water table beneath the surface from which the water vaporizing up constantly moistens the growing stratum of the soil, decomposes and dissolves the salts which are necessary to plant life, and is itself decomposed by the principle of life in the plant and its elements, oxygen, hydrogen, and nitrogen, utilized in the interior of the plant itself. Where there is no natural supply of water for this storage purpose irrigation must copy nature and provide one, or at least furnish an adequate supply of moisture for solvent purposes. When that has been done everything has been done that should be done.



SOME CHURCHES OF OGDEN, UTAH.

1. Catholic.
2. Congregational.
3. Mormon Tabernacle.
4. Church of the Good Shepherd.
5. M. E. Church.
6. Presbyterian.
7. Baptist.

A familiar illustration of the action of moisture may be witnessed in the slaking of lime in the open air without the direct application of water. The same transformation takes place in the case of all the other soluble mineral salts when in the presence of moisture. This transformation effected, the plant thrives, and, to give it an excess of dissolving liquid is to float off the material needed by the plant and thus deprive it of its nourishment. It is like feeding an infant on thin, weak soup instead of nourishing bouillon and expecting it to thrive.

EVAPORATION FROM PLANTS.

The tendency of plants is to exhale or perspire moisture as well as the soil. The flow of the sap is constant from the roots to the leaves to receive oxygen and carbonic acid and back again to the roots; like the circulation of the blood in animals it travels in a circuit. When the sap reaches the leaves it parts with a portion of its water, and in some plants the quantity is very considerable. An experiment with a sunflower, three and one-half feet high, disclosed the fact that its leaves lost during twelve hours of one day, 30, and of another, 20 ounces of water, while during a warm night, without dew, it lost only three ounces, and, on a dewy night, lost none.

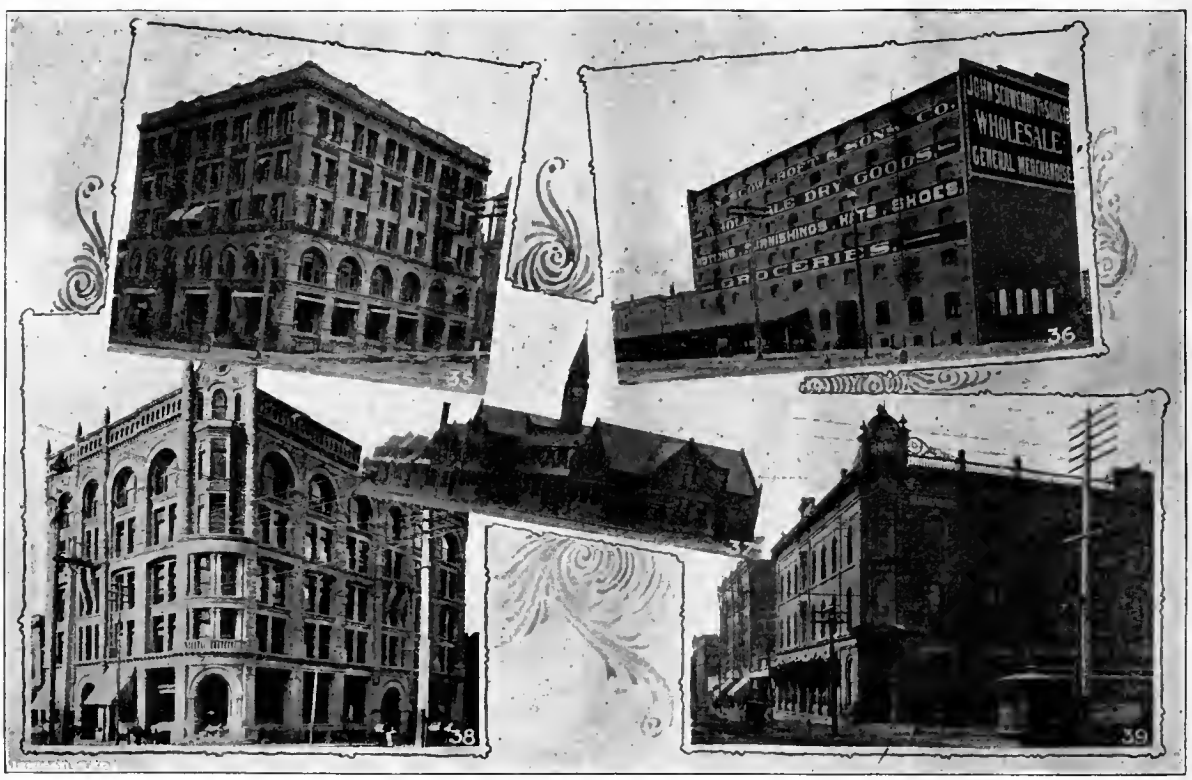
All this evaporation or exhalation of water from the leaves of plants is supplied by the moisture in the soil, for plants generally do not drink in water through their leaves but through their roots, and when the escape of water from the leaves is more rapid than the supply from the roots the leaves droop, dry and wither, because then they are drawing from their sap, living, so to speak, upon their own blood. This evaporation in the plant is similar to the perspiration constantly exuding from the skins of healthy animals and it has added to it the mechanical evaporation which takes place on the surface of all moist bodies when exposed to hot or dry air. There can be no growth or health without it, hence, it is often beneficial to wash or spray the leaves of plants and trees to remove the dust or other clogging material that has accumulated upon the leaves and "stopped perspiration." To stop this leaf evaporation is to kill the plant as surely as was killed the boy in the Roman pageant. His entire body was gilded with gold leaf, the intention being to have him pose as a golden statue. His entire body was covered with gum on which was laid the gold leaf. He died in a few hours and it was not until the cause of his sudden death was investigated by scientific men that it was discovered that the closing of the pores of the skin,

thereby preventing evaporation from its surface, was the cause. On dry, dusty soils, where there is none, or very little rainfall, the accumulation of dew during the night is generally sufficient to "trickle" along the leaves and carry down the dust and other accumulations on the leaves which interfere with evaporation. Sometimes the plant, as if aware that there is a stoppage in its circulation, will throw out fresh, new leaves to cure the defect, but this is done at the expense of the root, tuber, or fruit.

The amount of loss due to natural and mechanical evaporation from plants, of course, differs very greatly in the various species of plants depending, in a great measure, on the special structure of the leaf, whether fine or coarse meshed, large or small, lean or fleshy, the natural perspiration, however, always exceeding the mechanical. Both processes, moreover, are more rapid under the influence of a warm, dry atmosphere aided by the direct rays of the sun.

As showing the quantity of evaporation an experiment was tried with an acre of maple trees containing 640 trees. The calculation is not positively exact, but it is worth accepting as a basis for other experiments on crops of all kinds and may come somewhere near enabling the irrigator to determine the quantity of water to be applied to the soil, whether there is a water table within the reach of the surface or none at all.

The evaporation was assumed to take place only during a day of twelve hours and each of the 640 trees were estimated as carrying 21,192 leaves. From an estimate based on the quantity of evaporation from one tree containing the number of leaves above specified, which were carefully counted, the 640 trees evaporated from their leaves in twelve hours 3,875 gallons of water, or 31,000 pounds. During ninety-two twelve-hour days, the life of the maple leaf, the evaporation would amount to 2,852,000 pounds. During that period the rainfall was 8.333 inches or 43.8 pounds to every square foot of surface, equal, per acre of 43,560 square feet, to 1,890,504 pounds. The evaporation from the leaves of the trees, therefore, exceeded that of the actual fall of rain by nearly one million pounds. Whence did the surplus come? Evidently from the water stored in the water table and drawn up by the action of the roots of the trees. Where there is no water table or ground water and the soil is dry "all the way down," it is necessary to create one by irrigation and this is not so difficult as might be imagined, for we must consider that in the case of maple trees the roots may reach down into the subsoil for fifty feet, and in the case of ordinary fruits, vegetables, and cereals, a water table at that depth would be wholly unnecessary even if generally impracticable. Soil saturation at any depth beyond four feet with unlimited surface cultivation is sufficient, although in the case of vines and trees it should be much deeper.



SOME BUSINESS BLOCKS, OGDEN, UTAH.

35. First National Bank Building. 36. John Scowcroft & Sons Co.
37. Union Depot.
38. Eccles Building. 39. Z. C. M. I.

The above experiment with the maple trees although, perhaps, of no practical value on account of its uncertainty, being more or less guess, demonstrates two things, when there is also taken into consideration the quantity of sap in plants and the amount of salts held in solution in it.

First—How easily a soil may be exhausted by cutting and removing plants and crops therefrom.

Second—As a direct corollary, through its diametric opposite, it shows how easily alkaline salts may be removed from the soil by cutting and removing the plants and crops. These alkali-consuming plants hold large

quantities of the earth salts in their sap in solution, the carbonates, sulphates, the sodas, and potash, literally taken up out of the soil. Of course, when removed a certain amount of alkali is removed with them. This has been the experience with the "salt meadows" in Germany and Holland, and in the United States, as has been already noted, and, in a small way, with the alkali lands of the West where the experiment has been made.

CAPILLARY POWER OF SOIL.

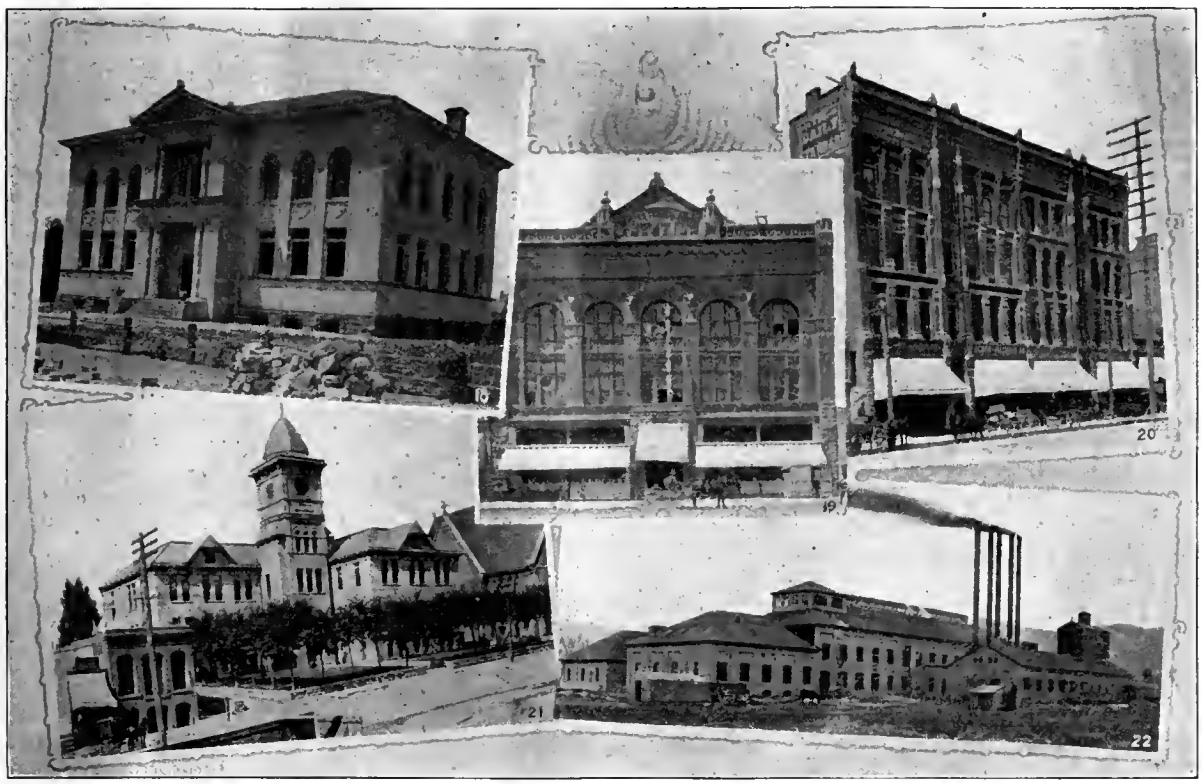
When water is poured into the saucer or sole of a flower-pot filled with earth the soil gradually sucks it up and becomes moist even to the surface. This is what is known as "capillary action," and exists in all porous bodies to a greater or less extent. A sponge is a well-known instance of this power, and if the small end of a piece of hard chalk be held in water the entire mass soon becomes saturated. The experiment with the flower-pot, however, represents the action in the soil, the water from beneath—that contained in the sub-soil—is gradually sucked up to the surface. It is one of the operations of the laws of nature which maintains all things in constant motion to preserve their life and vitality, for, if permitted to remain at rest without motion, they sicken and die, afterward putrefying as happens even with water which becomes stagnant, that is, ceases to be in motion.

In climates where there is winter, or even a moderate degree of cold weather, this capillary action ceases and the tendency of the water is to "soak" downward, and it is not until warm weather that capillary action begins and the water commences "soaking" upward toward the surface. In a warm, or hot climate, this action is constant and it also takes place whenever the soil is parched or dry.

This suspension of capillary action in winter, or cold weather, furnishes a strong point in favor of winter irrigation, which really takes the place of the autumn and spring rains, and of the snow that slowly melts and its waters carried down into the soil to the water table ready to begin an upward movement when the weather becomes warm and the surface soil dry.

The dryer the soil and the hotter the atmosphere, the more rapid is the rising of the water to the surface by capillary attraction, and, as the water ascends, it carries along with it the saline matters dissolved by it and, reaching the surface, evaporates, leaving the salts it carried behind. It is this capillary action which has incrusted our own lands with alkalis of all kinds; it is the same in India, Egypt, South Africa, and elsewhere. On the arid plains of Peru, and on extensive tracts in South Africa, alkali deposits, several feet in thickness, are sometimes met with, all of which are caused by the capillary action of water bringing up to the surface the salts in the subsoil. So it is that the enormous beds of nitrate of soda in Peru and those of the carbonate of soda in Colombia were created; and in our own black and white alkali and sodium bad lands capillary action may be blamed for their condition. It must not be forgotten that wherever there is seepage there is also capillary action, for that power is exercised in every direction. It does not matter which end of the sponge or piece of chalk is held to the water, both become saturated. It may be said that capillary action is a violation of the law of gravity, or, rather, is a law of itself acting independently.

This tendency of water to ascend to the surface of the earth is not the same in all soils. It is less rapid in stiff clays and more rapid in sandy and open, porous



SOME BUILDINGS IN OGDEN, UTAH.

18. Carnegie Library.
19. W. H. Wright & Son Co. Dry Goods House.
20. Daily Standard Building.
21. Weber County Court House.
22. Ogden Sugar Factory.

soils generally, and it is of especial importance in relation to the position of the water table in the soil when considered as a source of water supply or shallow rooting plants. Gravity draws the water downward toward a water table, and in a dry subsoil it is capillary attraction that impels it down. But when the water in the surface soil is less than that below an upward movement begins as though nature were desirous of maintaining an equilibrium which, scientifically speaking, it always does, or attempts to do. However, there is a zone of capillary action, a space between the water table and the surface, in which moisture rises and with it carries food substances to the roots of plants. Where the water itself rises it means more than capillary attraction, it means a rise of the water table through additions from some new water supply or saturation of the soil, in which case plants are injured vitally and drainage must come to the rescue. It is the rise of the water table that is to be feared in irrigation. The reason is because the rise of alkaline solutions is greater than in the case of pure water. Thus, a fifty per cent solution of sodium chloride (common salt) and sodium sulphate will rise faster than pure water, and a much stronger concentration of soda carbonate will rise still faster. Hence the necessity of preventing soil saturation and the maintaining of a zone of capillary action, in which the roots of plants may be fed by material furnished through that action when they would be killed if saturation were permitted to overcome it.

SOME PUBLIC SCHOOLS, OGDEN, UTAH.

40. Five Points. 41. Grant. 42. Central. 43. Madison.

A few practical ideas may be gathered from the foregoing which are worth considering:

First—It is evident that deep plowing will enable the rainfall or the irrigation water to penetrate deeper into the soil, in which case it will remain longer and the effects of a small quantity of rain may extend over a period long enough to mature a crop where half as much again would show nothing.

Second—To be effective and beneficial to vegetation the water in the subsoil must be in constant motion. When water ceases to flow in the subsoil streams, or when capillary action is entirely suspended, the water becomes stagnant, ceases to imbibe oxygen, nitrogen and carbonic acid, and practically rots, causing vegetation within its influence also to decay. Running water coming from the clouds or irrigating ditch enters the soil charged with gaseous matters above specified, mixed in their proper proportions, and carries along with it various dissolved inorganic substances which are not permitted to be deposited out of it while it is in motion. Hence, to derive the full benefit of the water, the land must be drained even where irrigation is practiced so that the surplus water, after irrigation is stopped, may find a ready outlet. If there should be no surplus no harm is done by drainage facilities; on the contrary, the tendency of all drainage is to open the soil below and "draw" the moisture from above as well as to carry off the surplus water in a soaked subsoil if there be one. Drainage does not carry off moisture, but only the surplus water; capillary attraction will always hold the moisture.

Third — Whenever sufficient water is added to the soil to compensate for loss by evaporation from soil and plant the business of the irrigator is accomplished. To keep on adding, to soak the soil continually, would be to injure vegetation as much as by furnishing too little water, as it is only by keeping the surface soil loose and finely pulverized—the deeper the better—that evaporation from the soil may be retarded.

As to the quality of the water the more impure it is, particularly in organic matter, the better it is for vegetation. There is no more impure water in the world

than that of the river Nile, yet it gives fertility and produces luxuriant vegetation where there would be barrenness and sterility were it pure. The exception in the case of irrigating alkali lands would be water heavily charged with alkali salts, this kind of water being one of the causes of deleterious alkali deposits.

THE SOIL AND THE ATMOSPHERE.

The oxygen of the atmosphere is essential to the germination of the seed and to the growth of the plant. The whole plant must have air, the roots as well as the leaves, therefore it is of consequence that this oxygen should have access to every part of the soil and thus to all the roots. This can only be effected by working the land and rendering it sufficiently porous.

Some soils absorb oxygen faster and in greater quantities than others. Clays absorb more than sandy soils, and vegetable molds or peats more than clay. It depends, however, upon their condition as to porosity, and also upon their chemical constitution. If the clay contains iron or manganese in the state of oxides these latter will naturally absorb oxygen in large quantities for the purpose of combining with it, having a great affinity therefor, while a soil containing much decaying vegetable matter will also drink in large quantities of oxygen to aid the natural decomposition constantly going on.

In addition to absorbing oxygen and nitrogen, of which the air principally consists, the soil also absorbs carbonic acid and portions of other vapors floating in it whether ammonia or nitric acid. This absorption of atmospheric elements and gases of every kind occurs most easily and in greater abundance when the soil is in a moist state. Hence it is that the fall of rains and the descent of dew, or the application of irrigation water, favors this absorption in dry seasons and in dry climates; it will also be greatest in those soils which have the power of most readily extracting watery vapor from the air during the absence of the sun. It must be clear from this that the influence of dews and gentle showers reaches much farther than the surface of the soil, watery vapor following the atmosphere down deep into the soil, penetrating as deep as the porous nature of the soil will permit it. Some say that, under proper conditions as to cultivation, the soil will gain in dew at night nearly as much as it loses by evaporation during the day. It appears reasonable enough to suppose that the atmosphere, under a pressure of fifteen pounds to the square inch, will penetrate to any depth and carry with it whatever of moisture and gases it contains.

HOMES OF OGDEN MAYORS.

30. Ex-Mayor Peery.
31. Ex-Mayor Eccles.
32. Present Mayor Wm. Glasmann.
33. Ex-Mayor Kiesel.
34. Ex-Mayor Browning.

THE SOIL AND THE SUN.

In addition to the chemical effect of sunlight upon plants the rays of the sun beating down upon the earth impart to the soil a degree of heat much higher than that of the surrounding atmosphere. Sometimes this soil heat rises from 110 degrees to 150 and more, while the air in the shade is between 70 and 80 degrees, a quantity of heat most favorable to rapid growth. The relations between the heat of the sun and the color of the soil is of little importance where sunlight abounds, although in some locations it is of considerable importance. This has already been alluded to and all that need be said here is that the dark-colored soils, the black and the brownish reds, absorb the heat of the sun more rapidly than the light-colored, for which reason, as to warmth, the dark soils more rapidly promote vegetation than the others.

As to the power of retaining heat it is interesting to note that sandy soils cool more slowly than clay, and clay more slowly than peaty soils, or those rich in vegetable matter. Vegetable mold will cool as much in one hour as a clay in two, or a sandy soil in three hours. That is, after the sun sets the sandy soil will be three hours in cooling; the clay two, and the soil rich in vegetable matter, one hour. It is also interesting to note that on those soils which cool the soonest dew will first begin to be deposited.

Man possesses very little power over the relations between the soil and heat other than growing plants whose abundance of leaves and luxuriant growth will shade the ground, prevent, or retard evaporation, and enable the soil to maintain a uniform heat, or mixing sand with less heat-retaining soils. These matters are of more importance in kitchen garden culture than in the fields; but there are deep valleys among the mountains where the sun rises about 9 a. m. and sets about 3 p. m., and in these, there being so little scope for the sun's rays and the soil being cool for a much longer period than it is warmed by the sun, the power of retaining heat would render one soil more valuable and favorable to plant growth than a soil less retentive.

OUR AIM.

We are striving to reach the seventy and more thousands of irrigators in the great west, believing that they will appreciate our efforts and give THE IRRIGATION AGE such support as it is entitled to claim. We have always said, and we repeat, that we are honestly laboring for the homeseekers in the arid and semi-arid regions of this country, and have no object in view other than their welfare. Moreover, we purpose to make this paper one for the family—one that will be always acceptable. It will be the organ of all irrigators, and if any one has anything on his mind that will be for the benefit of himself or of his neighbors, let him write us, and the mere subscription price will be nothing to the services we shall at all times be ready and willing to render him.

Our October issue will be one of monster proportions and well worth preserving, as it will contain, among other valuable matter, a full report of the proceedings of the Eleventh National Irrigation Congress, the importance of which can not be over estimated. Subscriptions should be sent in without delay to insure possessing a copy for which there will be so great a demand that the supply will soon be exhausted.

SOME RESIDENCES OF OGDEN, UTAH.

8. William Driver. 9. Judge L. W. Shurtliff. 10. A. T. Wright.
11. John Browning. 12. Joseph Scowcroft.

The following telegram will explain itself:

"Ogden, Utah, Aug. 5-03. Irrigation Age, Chicago. Senator Clark gives five hundred dollar loving cup best fruit display, and Pabst Milwaukee cup like value best barley at arid states fruit exhibit of Irrigation Congress, gold medals and cash prizes also all exhibits grown under irrigation arid states and territories.

"Nat'l Irrigation Congress Headquarters."

THE NATIONAL IRRIGATION CONGRESS.

OFFICIAL CALL ELEVENTH NATIONAL IRRIGATION CONGRESS.

The Eleventh National Irrigation Congress will be held at Ogden, Utah, September 15 to 18, inclusive, 1903:

A convention of vital concern to the American nation; to those who would make two blades of grass grow where one grew before; to all who realize that water is the Midas touch which turns the desert sands to gold; a convention of specific significance to the states and territories whose arid lands are to be reclaimed by the Federal Government under the provisions of the National Irrigation Act, namely, Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, North Dakota, Nevada, New Mexico, Oklahoma, Oregon, South Dakota, Utah, Washington and Wyoming.

Government and leading irrigation experts, practical farmers, irrigationists, fruit growers, representatives from state agricultural institutions, state engineers, Government and noted foresters, as well as press representatives, business men, officials and law makers, will be in attendance and participate in the discussion.

The program will include:

Practical Irrigation and Forestry Lessons.
Reports of Experts.
Application of Provisions of the Reclamation Act.
State Progress under the National Act.
Views on Settlement of Legal Complications.
And the Pertinent and Important Theme of Colonization.

Utah being the pioneer state in irrigation science proffers special opportunities for the study of its history and progress. Railroad and other excursions covering this field will be arranged for delegates by local committees.

For the first time in the history of the irrigation congresses, the eleventh convention has been liberally fostered by state appropriation—which sum has been doubled by private subscription from officers of the Congress and the citizens of Ogden and Utah—so that a large fund guarantees the successful conduct of the program and hospitable entertainment of all visiting delegates.

Business men will be interested to meet here with electrical and irrigation engineers to discuss the dual values in storage of torrential streams.

In the far eastern and southern states of the humid region irrigation methods are being studied and put into practice to save crops in seasons of drought and to increase the value of natural resources. Flood sufferers in southern states should confer at this Congress with those requiring reservoirs at the head waters of the great rivers. It may be said, therefore, that the East and the South can here learn from the West, and delegates should attend this Congress, not alone from the sixteen specially interested far western states, but from every state in the Union.

President Roosevelt, throughout his recent western tour, frequently gave utterance to his belief that National aid for the reclamation of the arid West is of paramount importance in our National policy; and to foster this policy is the work of this Congress—"To Save the Forests and Store the Floods."

The program for the Congress will be carefully arranged with the view of achieving practical benefits and progress. Specially favorable railroad rates have been secured, details of which will soon be published. Arrangements for the entertainment of delegates in the attractive city of Ogden will be complete and satisfactory, and reception committees will meet all trains. The citizens of Ogden have appointed a board of control to entertain all delegates in co-operation with officers of the Congress. There will be no advance in hotel rates.

Newspapers everywhere are earnestly requested to give publicity to this official call and to inform their readers of the importance of this Congress.

Governors of the states and mayors of cities and officers of organizations entitled to appoint delegates are respectfully requested to select men sincerely interested in the work of—and likely to attend—the Congress.

The basis of representation in the Congress will be:

	Delegates
The Governor of each State and Territory to appoint	20
The Mayor of each City of less than 25,000 population	2
The Mayor of each City of more than 25,000 population	4
Each Board of County Commissioners	2
Each Chamber of Commerce, Board of Trade, Commercial Club, or Real Estate Exchange	2
Each organized Irrigation, Agricultural or Live Stock Association	2
Each Society of Engineers	2
Each Irrigation Company, Emigration Society or Agricultural College, and each College or University having chairs of hydraulic engineering or forestry	2

The following are delegates by virtue of their respective offices:

The President and members of his cabinet.

The duly accredited representatives of any foreign nation or colony.

The Governor of any State or Territory.

Any member of the United States Senate or House of Representatives.

Member of any State or Territorial Commission.

W. A. CLARK, *President.*
F. J. KIESEL,
Chairman Executive Committee.
L. W. SHURTLIFF,
Chairman Board of Control.
H. B. MAXSON, *Secretary.*
By WILLIS T. BEARDSLEY,
First Assistant Secretary.

WHERE WE STAND.

The following letter from William E. Smythe, author of "The Conquest of Arid America," and founder of the "Irrigation Age," tells some home truths about us, which we purpose using to good advantage:

"D. H. Anderson, Esq., Chicago, Ill. My Dear Sir—I beg to acknowledge receipt of your favors of July 14th and 27th, the latter including pamphlet (Influences in the National Irrigation Program).

"In your account of the beginnings of national irrigation you deprive your own magazine of the credit to which it is entitled. 'The Irrigation Age' was the instrument of those who founded the organized irrigation movement, stood by its cradle, fought its battles, established it as a force in the life of our times,—and all without money and without price. We had an idea. We believed it was big and righteous. We fought for it for all we were worth.

"WM. E. SMYTHE."

(Father of the National Irrigation Congress, and one of its first presidents.)

CORRESPONDENCE

GREELEY, COLO., July 12, 1903.

EDITOR IRRIGATION AGE, CHICAGO, ILL.

Dear Sir: I send you a few hints on "practical irrigation" which may be of value to some of your readers.

Some of the necessary conditions to make irrigation a success, are a good supply of water that will continue through the months of July and August; land with a smooth surface, that has a gradual fall of about six feet to the mile; land prepared in a thorough manner for the seed—and one of the most essential conditions is the best seed obtainable—thorough cultivation and careful irrigation.

At the proper stage of development, as a general rule, I will say the time to apply the water is when the crop is making that which the crop was planted for. To illustrate: Wheat, while it is making the head; corn, when the ears are setting in; fruit while in blossom. In the case of root crops, care must be taken not to soak too much while the weather is extremely hot. Put a good stream in each alternate row, and hurry through and shut out, as this will be sufficient the first time over. In about a week water the other rows in same way. Next time over if weather is getting cooler, irrigate every row.

Third Irrigation—Every row may be watered, raising in each row a small stream whereby it will take longer to go through, consequently soaking the ground more thoroughly.

JNO G. HALL.

EMMETSBURG, IOWA, Aug. 5, 1903.

IRRIGATION AGE AND DRAINAGE JOURNAL, CHICAGO, ILL.

Mr. Editor: Could you kindly put us in correspondence with some parties who operate a dredging machine, and oblige.

Yours truly,

NEARY & MENZIES.

NEW CASTLE, COLO., Aug. 3, 1903.

EDITOR IRRIGATION AGE, CHICAGO.

Dear Sir: When I wrote you in regard to my water elevator I did not think very much about it, but as you asked for an explanation of my invention, I answered your request in rather a crude manner. My experience for the past twenty-six years in the west and twelve years in Arizona taught me that water is king and seeing so many acres of the best of lands that could not be reached by canals, I have constructed this very valuable machine. I can operate it in wells where plenty of water can be obtained. It is so built that it can be run by any kind of power, as the buckets only run at their greatest speed 150 feet per minute. They are built in sizes from one miners' inch to (1200) twelve hundred or larger if desired. They are the best machine known for windmill power, as in case it should run slow and take all day to raise a bucket and it starts from the bottom full in the morning and reaches the top at night it is a bucket full just the same, when in a rotary or cylinder pump there will not be a drop of water raised. Sand or muddy, makes no difference with the elevator. No chains to break; no hooks to give out and no wheels to break; not a cog in it; one bucket just firmly bolted to another and would remind one of a railroad running at an angle of forty-five degrees. It is strong, durable and light draft. Since my short description in your May number, I have had a great number of communications, all of which mention their seeing it in THE IRRIGATION AGE, so I take this way to answer them. Please find within one dollar for one year. There are a number of more that I will send in a few days. Send mine from May last to me at New Castle, Colo.

W. A. CONNER.

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17 RUTLAND SQUARE, BOSTON, MASS., July 30, 1903.

THE IRRIGATION AGE, 112 DEARBORN STREET, CHICAGO, ILL.

Gentlemen: Referring to the article in your June issue, entitled "The Western Floods," I herewith enclose a published letter which I wrote upon reading an article along the same line, published in the *Daily Live Stock Reporter*, and in addition to same I would like to suggest, inasmuch as your paper is published in the interest of irrigation, that it might be possible in large arid districts along rivers, which have their outlet into the Mississippi, to utilize underground sand beds as reservoirs for irrigation water—that is, from sections having an abundance of winter snow or early spring rains, the water could be sent underground, and during the hot summer months be pumped to the surface for either irrigation or the purpose of watering stock on the western ranges. On the other hand, this underground water might of itself create never-ceasing springs which would not be affected by the heat during the summer.

I do not assert the feasibility of any of the suggestions, but it seems reasonable enough to receive consideration by those who are working to solve the flood problem.

Very respectfully yours,

J. N. SWANSON.

The following is the article referred to in Mr. Swanson's letter:

"Upon reading an article in a recent issue of your paper entitled 'Rainfall and the Floods,' I am again reminded of a thought that has come to me several times during the last few years—an idea which might be of interest to those who are giving this problem serious consideration. I believe it is worthy of investigation.

"My suggestion is this: If the United States would ascertain along rivers, brooks and feeders of the great Mississippi where there may be found deep underground sand veins, containing little or no water, and sink to this sand innumerable wells, setting them with large sewer tile, arranging it in such a way that any overflow or rise of water in these small streams would find its way into these wells, affording an underground outlet into these sand veins, many of which would doubtless drink in an endless amount of water, the great flood disasters would be partially obviated.

"It is at once apparent that it would involve a heavy expenditure of money to perfect such a system of wells to produce any effect at the time of a heavy rainfall such as recently visited Kansas, yet I believe there are enough water-dry sand beds underground, were the wells numerous enough, to drink in a great portion of this overflow. Anyway it should greatly lessen the danger by diverting a part of the water.

"By thus diverting the water underground, it would also afford an inexhaustible supply of water to the farmers living in the districts having these drainage wells, as they could sink their own supply wells to the same sand veins and secure clear filtered water, obviating the necessity (which has been the cry of late years) of making new and deeper wells every year, the surface water having entirely disappeared. An arrangement could also be made whereby these farmers could use the same wells sunk for drainage purposes.

"I submit the above for what it may be worth to those who are interested in this problem."

IT IS A SHAME.

It is a shame to allow the fakirs to spring up and gull the public every time an opportunity presents itself. Just as soon as it became known that the government was going to lend a hand in reclaiming the arid lands, so-called associations sprang up advertising by circulars and otherwise to direct homeseekers to vacant public land under the proposed projects. These associations pretend that they are formed to represent homeseekers and claim to possess inside information. As a matter of fact these fellows are rank swindlers and do not have any inside information. They do not know what lands the government intends to irrigate, for no one knows this, not even the department. They simply defraud susceptible people and are taking fees ranging from $50 to $100 for valueless service. They are sending people onto lands that will never be irrigated either by the government or by private enterprise and we know instances where these sharks have pointed out to victims lands on hillsides which could not possibly be irrigated. We are having too much burlesque of the Maxwellesque order and it is time for Uncle Sam to shut these scamps out of the mails. *The Field and Farm* has refused to handle the advertising of these fellows and therefore they do not like us a little bit.—*Denver Field and Farm.*

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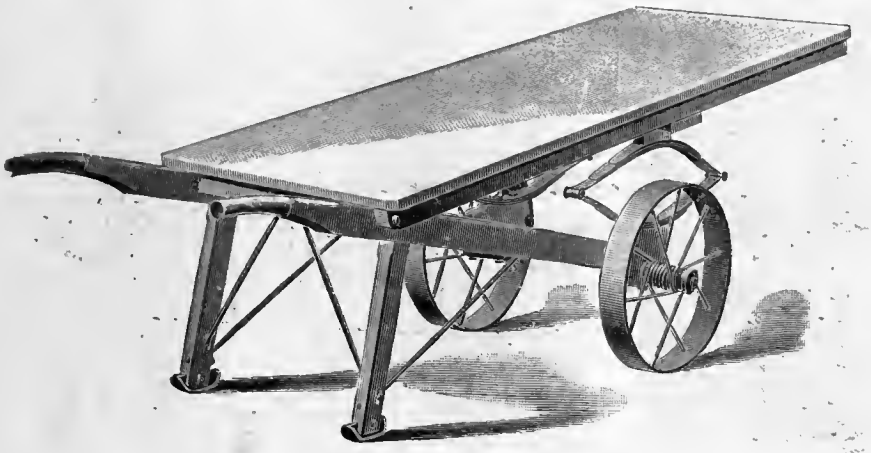

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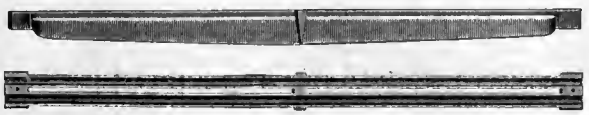

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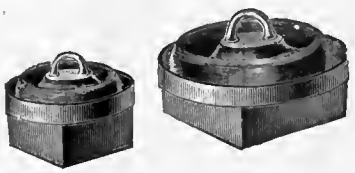

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THE IRRIGATION AGE

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THE IRRIGATION AGE

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A monthly illustrated magazine recognized throughout the world as the exponent of irrigation and its kindred industries. It is the pioneer journal of its kind in the world, and has no rival in half a continent. It advocates the mineral development and the industrial growth of the West.

EDITORIAL

Fiat Justicia Ruat Coelum.

It is impossible to believe that the Eleventh National Irrigation Congress will prove so weak an organization that it will succumb to the blandishments and become a catspaw for any specific class of persons who aim to realize enormous fortunes out of the expenditures of the government in carrying out the provisions of the national irrigation law, and out of private land and water schemes a la Dawes Indian land commission.

There is no man in this country great enough to dictate what that Congress shall or must do, no man is too insignificant that he may not make a suggestion worth consideration.

The organization of the Congress is complete, and to save time, anxiety, put an end to the machinations to destroy its organization, the first business undertaken after coming to order, should be the adoption of a resolution making the National Irrigation Congress a perpetual and independent organization, the main object of which at this stage of the irrigation problem shall be governmental and protective, to the extent of seeing to it that the national irrigation law be honestly and justly enforced for the direct benefit of actual homeseekers.

It is a sorrowful fact that must be admitted that the Government is not strong enough to protect its citizens in their home rights under any land or water law that was or ever will be enacted. A middleman, practically a "sooner," springs from somewhere and wards off the Government with one hand and the homeseeker with the other until his ambitions are realized, and when he lets go there is little left but husks.

The universal demand is for an honest and just enforcement of the national irrigation law, but who is there to see that it is honestly and justly enforced? We know by the Indian land revelations that where there is a dollar and a helpless citizen or individual, the latter loses that dollar. We know also from the pages of the United States court reports that a man with land at stake finds no friend in a government agent if he stands alone without a protective influence behind him. And will it be any better with water, and tens of millions to be expended by the Government, perhaps hundreds of millions before the entire matter is fully adjusted?

There is already deprecatory talk in the newspapers, a haunting fear lest the irrigation law be diverted from its purpose into the hands of schemers. That is as sure to come as fate in the shape of interest, taxes, death. It is human nature and until the leopard can change his spots land grabbing and now water grabbing will go on merrily.

The National Irrigation Congress stands as the representative body of the very men who are to be helped by the irrigation law, the constituents of the

members of that Congress are the homeseekers who are to benefit by the honest and just enforcement of that law. Shall they be ignored and their Congress turned over to any voluntary organization with private objects in view, an absolutely irresponsible and therefore unreliable organization? The homeseekers of sixteen arid and sub-humid states ask their representatives for bread and they are given a stone.

The national irrigation law is passed, but the work of this Congress is still before it. To pause now is to belie their past efforts, to throw down their badge of office, for another to pick up and sway for his own benefit, is to commit an act of cowardice that deserves eternal obloquy.

We do not believe the Congress will surrender its prerogatives; we do believe that it will continue on and settle all the conflicting problems connected with irrigation; reconcile conflicts of laws; interest itself in the location of reservoirs, wells, ditches, canals, and everything pertaining to or belonging to irrigation for a multitude of homeseekers and the building up of a vast irrigated empire. There is colonization to be considered, for the day of small farms has arrived, complaints are to be heard, wrongs righted, the rights of the helpless farmer protected, and numerous duties and obligations resting upon this Congress of the people of sixteen states which they can not lightly cast aside, or delegate to middlemen.

Their labors will not pass unrequited, for there is not an irrigation farmer in the West who will not help hold up its hands, and assist in carrying out the provisions of the irrigation laws to their fullest extent. If the law does not work to advantage, it must be amended, not by those who want a law through which they can drive a wagon load of fraud, but by those who will suffer if not adequate to their needs, and whose little homes will be all the wealth they desire if it goes well with them.

There is a great principle at the bottom of the problems of irrigation in the great West, a principle of right and justice, it means also the public welfare, the greatest good to the greatest number, the striking from the limbs of the farmer slave of land monopoly the chains that have been fretting them for years, it means the taking away from private, unreliable, irresponsible schemers the right to dominate land and water, and the privilege of enriching themselves at the expense of the Government and the small farmer.

What this Congress may do is to issue a proclamation of emancipation from the slavery of land and water monopolies, and declare to the people of this nation and of the world, that they are invited to aid in building up a great empire and that they may come to it without fear that they will be driven out and lose their homes by any perversion of the irrigation and land laws.

Merging, Fusing and Amalgamation.

Whenever two organizations possess identical objects, adopt similar methods to carry them out, it sometimes happens that strength is acquired by what is known as merging, fusing, or amalgamating. It is the community of interest which makes our great industrial combines so powerful.

But where the objects are not identical and the methods are diverse, a merger, or a fusion, is fatal to one or the other, which must go to the wall, and the party who succumbs is generally the better and cleaner one of the two. It is a house divided against itself, a combine that is contrary to good business principles, unphilosophical, unethical.

On August 21, ult., the Transmississippi Congress ended its 14th annual session at Seattle, Wash., after passing resolutions to the following effect: Favoring statehood for Oklahoma and Indian Territory combined; a territorial government for Alaska, and placing the consular service under civil service. It will be perceived that the objects of the Transmississippi concern are far-reaching and purely political, and of the quality known as "intermeddling" politics. They may be considered legitimate, however, under our system of government that admits all kinds of bedfellows under its blanket, but they concern business interests of every kind and complexion, even into boodling if deemed requisite to further those interests. For what other purpose do outsiders mix in local matters?

On September 15, 16, 17 and 18, the Eleventh National Irrigation Congress will meet at Ogden, Utah. The sole great object of this organization has always been and must be *irrigation*. Its members have fought a good fight for the homeseekers of the country and they have advanced the building up of the empire of the West many decades. Moreover, they have laid the foundation of the only true solution of the problem of irrigation, that it be kept out of private, uncontrollable, irresponsible hands.

It is said that this single minded, specifically created Congress will be asked to merge with the Transmississippi concern and become an appendage, a mere tail to its kite. Why?

The National Irrigation Congress can certainly die a natural death without going through the wretched agony of being asphyxiated with a combination of incompatible objects, and have its vitality sapped by the introduction of an incongruous, unassimilable serum.

With what wasting disease is the Transmississippi Congress, or the National Irrigation Association, for that matter, afflicted that it needs a transfusion of the blood of the National Irrigation Congress? Is it not a confession of a moribund condition to even ask a merger? Are annual subscriptions falling off, or contributions lessening?

If the National Irrigation Congress has expended

all its force, its power and authority by securing the passage of the national irrigation law, it is defunctus officio and can not merge with anything. The Transmississippi and the National Irrigation Association concerns do not want to take a corpse to their arms, do they? Perhaps it is the machinery of the National Irrigation Congress the two outside organizations are after, and need in their business. This hath a lean and hungry look. If that machinery is to be used for the same purpose as it has already been used by the National Irrigation Congress, wherefore should the latter not keep on with the working of it? Suspicion grows apace. If, however, there is to be a transformation that transformation can be no other than its conversion into a personal machine, to be operated by personal combined interests for personal profit. What else can it be turned into when the objects for which it was organized can not be altered, amended, or bettered? Why?—but pshaw! It is bad policy to swap horses while crossing a stream.

Good Cause to Rejoice.

THE IRRIGATION AGE is at a loss to account for the misgivings expressed by so many present ardent supporters of the national irrigation law, that the same will not be honestly carried out.

It is quite true that our public land laws are not ideal, and it is also true that they never will reach a state of perfection. Every law enacted for the public benefit has a flaw in it big enough to drive through a coach and six of fraud. Witness the exemption and homestead laws, the Pacific railroads, and now the Indian lands. Think also of the army contracts, postal diabolics, river and harbor bill—every governmental scheme has tied to it a string that is positively sticky with fraud and corruption.

Yet, somehow, the nation has flourished, and is now at such a prosperous height that the people are actually growing dizzy. Why is it, and how does such an anomaly come about? Can right come out of wrong? Is it good theology that men may do evil that good shall come of it? It may be remarked incidentally that there is no code of laws so badly broken into as the Ten Commandments, yet it is said we are more piously inclined than when men's heads were removed for disobeying a single precept.

In the midst of the boundless sea of fraud and corruption, with so many stealing for the benefit of the nation generally and for themselves particularly, it makes our hearts glad to perceive a gentle glimmer of honest, determined piety. Quoth the stuff that has been deluging the mails and the columns of the country press for the past several weeks: "Land Speculation and Stealing Must be Stopped (for use not before Monday, August 17)."

We rejoice that this is so, for after about fifty years of attempts on the part of the Government, with the aid of the courts, and an army of officials, that unpleasant condition of land affairs has not even been scratched on the surface. Can it be that we are to be blessed with the mighty aid of some supernatural power to do that which the weak arm of mortal man has been powerless to do?

It must be so, for in connection with the gratis stuff aforesaid, come columns of assurances from the same central supply press bureau, that the "national irrigation law shall be honestly and justly carried out for the benefit of the homeseekers," and contributions are called for. The grandeur of the idea grows by thinking, and it looks as if some one really intended to take charge of the entire business and manage it as it should be. We are glad that this is so, and in the full realization of its meaning according to the canons of interpretation in such cases, we sing in unison with the pious gentlemen who are repeating the refrain from one end of the nation to the other, for the plain purpose of earning a testimonial of good conduct from the Eleventh National Irrigation Congress: "Land speculation and stealing will be stopped when there is not enough of it left for speculative purposes or worth stealing."

A certain Man of very exalted Proclivities was one Day walking along a Highway, with his Eyes turned up toward Heaven, which he had concluded to make his future abiding Place.

While so occupied in gazing upward he did not notice a Ditch across his path and he accordingly fell into it.

As he floundered about in the mud and water at the bottom, he angrily charged the Ditch with gross Negligence in not keeping out of his way.

"You saw me coming," he exclaimed in a fine Rage, "and it was your Duty and Business to keep out of the way."

"It is true I saw you coming," admitted the Ditch politely, "but as I noticed that your Eyes were looking up toward Heaven, I thought you were going in that Direction."

Honor to Whom. Honor is Due.

The Board of Control of the Eleventh National Irrigation Congress, together with the citizens of Ogden, Utah, generally, deserve the highest praise and credit for the energy they have displayed in preparing for the great event of the 15-18. Such energy deserves success and will attain a full measure of it. There has nothing been left undone to make the visit of outsiders one to be remembered by them, and that they will remember it whenever the name of Ogden, Utah, is mentioned is as certain as sunrise. If the great Congress shall be in successful accord in working out the vast important problems under their charge and auspices, it will be due in a great measure to the spirit of brotherly love and abiding friendship that [illegible] the

THE PIONEERS OF NATIONAL IRRIGATION.

LAND AND WATER FOR THE PEOPLE.

The Reclamation of a Desert; The Creation of an Empire.

TO WHOM SHALL IT BELONG?

There are men still in the enjoyment of vigorous health, sound minds, and faithful memories, who remember when the vast region, now represented by sixteen bright stars in the shining firmament of a great nation, was a nameless waste, a dreary, inconceivable desert. All they knew about it in their school days was its name across the map: "The Great American Desert." Many who attempted to traverse its horizonless expanse left their bones to bleach upon its sun baked soil, and those who escaped were regarded as heroes worthy of as high a niche in the Hall of Fame as they who sought to break through the icy barriers of the polar ocean to find the great north pole.

The magnetic attraction of yellow gold drew a host from the world's haunts of civilization, and the California miners, with their little cradles, and their petty inch of mountain water, washed the soil for their hearts' ideal, gold, and still gold, and more gold after that. Soil, climate, the perfume laden atmosphere, the bright blue vault of heaven, the songs of birds presented no visions of a terrestrial paradise to their distorted, yellow, fevered brain. The demands of the stomach, however, created a diversion in their thoughts, and turning the petty miner's inch of water upon the thirsty, fertile soil, food grew at their beck, and more plentiful and luxuriant than they had ever conceived. The discovery was greater, and more far reaching than the discovery at Sutter's mill, and from that trifling miner's inch of water, out of that little patch of corn, planted as a last resort by gold-rich but food-poor starvelings, grew a paradise, which in yellow grain surpassed the yellow gold ten to one, and soon began to feed the world.

Over beyond the range, toward the rising of the sun, in the very midst of sand and alkali, where to dig or to plow meant a blinding, suffocating, burning dust, an expatriated man and his followers poured a little water, and behold! the earth laughed with a rich harvest. They poured more water upon the arid soil and again the earth smiled, but more broadly, and from that little patch of corn an inter-mountain empire was created. By and by the outer edges of the two empires touched and they melted into one mighty one, the fame of which spread over the earth and brought a myriad who established homes and lived in comfort beneath their own vine and fig tree.

So it came about that "The Great American Desert" was expunged from the map, and one after another vast areas of it became stars in the firmament of this great nation, this great world power, one destined to become the recognized arbiter for the nations of the world, and the inexhaustible purveyor of the main portion of the food of the inhabitants of the earth.

But the vast empire still grew and it is still growing; it has grown beyond the scope and control of those who set it on its course, its limitless possibilities are no longer within the reach of the dribbling miner's inch of water. Every pioneer of the early days came to a point in his labors where new blood was needed to take up his burden and it became a pioneer in his stead in a new, unbroken field. And a third class of pioneers took up the burden of the second one when he came to a stop, and went on with the work of empire building. This third class of pioneers will meet at Ogden, Utah, on September 15, 16, 17 and 18. Make a note of this date.

So it went on and so it has been going on for two generations, a short period in which to build so magnificent a work as that which every man young or old may see and wonder how it was done, for two generations, be it repeated, and at the end of the second there sprang up a third, a necessary third, for the second had reached its limit and could go no farther.

This third generation, speaking not according to time but according to work, found the field widening instead of narrowing, and that the power of individual effort had reached a halting place, hence they combined, the true successors of the first apostles of irrigation, new apostles upon whose shoulders falls the mantle of all the others who saw empire in water and soil and not in gold.

Individual effort waxed weaker in making an impression upon the surface of this great empire of the West, and so the states, the new stars, came to its aid and the desert began to bloom. But new questions arose, intricate questions. State lines were an impasse to their solution, and so there was a reaching out for something beyond, some outside power to aid and further the work of empire building. Then it was that the new irrigation apostles, the successors of the original Pacific and Intermountain pioneers, thought of the general government, and its hundreds of millions of fertile but waterless acres, and, to make a long story short, the National Irrigation Congress, the new pioneers, took up the problem. It required years of struggle against strong opposition before success appeared in sight, but success did come, and in 1902 Congress passed the National Irrigation law, and the Federal Government had put its shoulder to the wheel of empire building, and is in it to stay.

The sixteen states of the great arid and semi-arid empire of the West, are upon the threshold of a new problem, one greater than any that has ever before come up for solution. It means the continuation of the great work begun by the early users of the miner's inch the planters of the first field of corn, the men who set the Pacific and the Intermountain Empires on the road to greatness. The men who are to solve that problem are and must be pioneers, for it springs out of new conditions, covers a new field. To say that anybody else, any other organization than the National Irrigation Congress can go on with the work, is to destroy the efficacy of its members' work take from them the laurels that belong to them and to them alone, and turn back the process of continuous empire building to an incomplete past, a past in which others might have done as well as the man who first thought of using his miner's inch to raise corn, others beside Brigham Young who might have poured water on the ashy soil of the Intermountain empire, but in which no other did what they did, no other thought of it.

This work of irrigation is in its infancy, and every man who advocates it and fosters it for the good of the people, for the extension of the empire of the irrigated West, is a pioneer. He who has been half hearted in his interest, aimed to make use of it for his per-

sonal gain, or who has put aside the interests of the people, the home seekers, the real empire builders, is not a pioneer; he is an obstacle in the way of progress, a drag upon the proper solution of the problems that are bound to arise. His counsel is not beyond suspicion, his piety is a mere garment, familiar old clothes.

A very long time ago the Greeks and the Trojans were at war. The former were beseiging the capital city of Troy but did not make much headway in an open fight. so they thought of a plan to overcome the unsuspicious, confiding Trojans. They pretended to give up the fight as too arduous an undertaking, so they packed up their baggage and moved away apparently, and the Trojans rejoiced because they thought their enemies were defeated.

But the pious Greeks left behind them a nice gift for the Trojans, and, after quite a parley with the principal Greek land grabbers, the Trojans accepted the gift. It was a monster horse, in the belly of which was hid a strong force of armed men. When the horse had been dragged into the rejoicing city and night had fallen, the armed Greeks issued out of the belly of the horse, put the Trojans to death, and burned up their city. Ever since this historical event a similar attempt to beguile honesty and confiding simplicity by pious ejaculations and a great show of g o o d n e s s has attached to it the saying of a wise Trojan who objected to the acceptance of the monster horse, but whose wise counsel was unheeded: "I fear the Greeks bearing gifts."

BRIGHAM YOUNG, FOUNDER OF THE INTER-MOUNTAIN EMPIRE.

There need be no fear of anything happening adverse to the interests and rights of the actual homeseekers in the carrying out of the objects of the national irrigation law, if the pioneers of it, the National Irrigation Congress, that brought about that legislation, continue to keep guard over its cradle until it is weaned and has cut its eye teeth and can draw upon its own vitality. The danger that is already apprehended by those timid souls who seem to be anxious to wet nurse the infant, will surely happen if its own parent abandons it to the suspicious mercies of strangers.

Some indiivdual members of the Congress may be afflicted with an influenced dissatisfaction and withdraw their support, preferring to pay membership fees in other less high aimed, but perhaps more lucrative organizations, and if so, what of it? Their places will be quickly filled by others less finicky, and so will be obviated the fulfillment of the Scriptural fiat: "A house divided against itself shall surely fall." If there be any who take such action they will but make clear the line between the vanguard of the hardy pioneers and the mere camp followers.

We have reached the cross roads in the irrigation problem and the land question, where it must be decided whether the people of sixteen great states of overmastering productive powers, shall be the owners of their own soil, or become the eternal mortgagees of insatiable grasping schemers of the same ilk as those who have been squeezing them like sponges for so many years.

Never, since the Declaration of Independence was rung out to the world has there been so great and pressing a necessity for freedom—not that foreign enemies are crushing us, but our home Tories are more dangerous than open foes because they are more insinuating, and they are protected by certain business policies which discountenance their exposure, and they are garbed in robes of light by liberal applications of printer's ink.

The liberty to be rung out to the people of this nation and to the world, is the liberty of the homeseeker, the toiling builder of the western empire, to select his own home and the water to cultivate it, free from interference, and the liberty to possess and enjoy it in peace, comfort, and happiness in his own fashion, and to his own profit, without being disturbed by conflicting laws, or discriminating interpretations put upon them by grasping, envious outsiders, who see in a prosperous farmer good game to be plucked, hampered, harassed, and even ruined.

With these objects to be attained, who can aid in their attainment better than those who are imbued with the spirit of the pioneers, and who aim to further and perfect their work—the new apostles of irrigation—the successors of the old—the National Irrigation

DR. A. C. TRUE,
DIRECTOR OFFICE EXPERIMENT STATIONS,
U. S. DEPT. OF AGRICULTURE.

Congress? Let the others cease their machinations, stand aside until they have amply demonstrated the purity of the faith they profess with their lips:

"Why are you halting in the path of man?
Is it your shoulder bears the human load?
Do you draw down the rains of the sweet heaven,
And keep the green things growing?"

WHERE WE STAND.

The following letter from William E. Smythe, author of "The Conquest of Arid America," and founder of the "Irrigation Age," tells some home truths about us, which we purpose using to good advantage:

"D. H. Anderson, Esq., Chicago, Ill. My Dear Sir—I beg to acknowledge receipt of your favors of July 14th and 27th, the latter including pamphlet (Influences in the National Irrigation Program).

"In your account of the beginnings of national irrigation you deprive your own magazine of the credit to which it is entitled. 'The Irrigation Age' was the instrument of those who founded the organized irrigation movement, stood by its cradle, fought its battles, established it as a force in the life of our times,—and all without money and without price. We had an idea. We believed it was big and righteous. We fought for it for all we were worth.

"WM. E. SMYTHE."

(Father of the National Irrigation Congress, and one of its first presidents.)

One dollar and fifty cents will secure for you one year's subscription to THE IRRIGATION AGE and a finely bound volume of the Primer of Irrigation which will be sent postpaid in a few months, when volume is completed. The Primer of Irrigation will be finely illustrated and will contain about 300 pages. Send post office or express money order for $1.50 and secure copy of first edition.

We have received a long article on the subject of "Irrigation on the Planet Mars," which we are averse to publish lest some one start an organization and collect subscriptions for the benefit of the Martian sufferers from land grabbing and water barons.

THE PRIMER OF IRRIGATION.

BY D. H. ANDERSON.

CHAPTER VI.

PLANT FOODS — THEIR NATURE — DISTRIBUTION AND EFFECTS IN GENERAL.

There are four substances which are essential to all plant food; without them few plants could live, and what is surprising, they form a very large portion of every plant in one form or another. These substances are: Carbon, Oxygen, Hydrogen and Nitrogen. We shall take them up in rotation and briefly explain their origin, nature and action.

CARBON.

Carbon is generally known under the form of coal, any kind of coal, but for experimental purposes it is usually wood charcoal that is considered the nearest approach to pure carbon, there being none except the diamond which can be called actually pure or crystallized carbon. As wood charcoal, it is derived from willow, pine, box, and several other woods, burned under cover so as to prevent free access of air, and its manufacture is of great commercial importance. kilns for its creation existing in thousands of places throughout the United States, where forests abound and wood is in plenty. It should be borne in mind that this carbon, or wood charcoal, is an essential element of the plant, inasmuch as it comes out of it by burning. Moreover it is all manufactured in the plant, extracted as part of its food from the soil, or the air.

Heated in air, charcoal, or carbon, as we shall call it hereafter, burns with little flame, and is slowly

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CHIEF OF IRRIGATION INVESTIGATIONS U. S. DEPT. OF AGRICULTURE.

HON. ANGUS M. CARMEN,
SALT LAKE CITY, (FATHER UTAH LAKE PROJECT.)

consumed, leaving only a white ash, the rest of the carbon disappearing in the air. It is not lost, however, for by the burning it is converted into a gas which goes by the name of "carbonic acid," which ascends and mingles with the atmosphere, to be again absorbed by plants to manufacture more carbon, or rather a fresh supply of charcoal. This carbonic acid gas is deadly, speedily causing death if breathed.

Carbon is light and porous and floats on water, but plumbago, or black lead, and the diamond, which are only other forms of carbon, are heavy and dense. Both black lead and the diamond when burned in the air at a high temperature, leave only a very little white ash, the rest being converted into carbonic acid and disappearing in the air like the common charcoal.

Of this carbon, all vegetable substances contain a very large proportion. It forms from 40 to 50 per centum by weight of all parts of dried plants cultivated for the food of animals or man, and the part it performs in the economy of nature is therefore very important.

Light, porous charcoals possess several notable properties in plant culture:

First—they absorb into their pores large quantities of gaseous substances and vapors which exist in the atmosphere. Thus: They absorb over ninety times their bulk of ammonia; fifty-five times their bulk of sulphuretted hydrogen; nine times their bulk of oxygen; nearly twice their bulk of hydrogen, and absorb sufficient aqueous vapor to increase their weight from ten to twenty per centum.

Second—They separate from water, decayed animal matters and coloring substances which it may hold in solution. In the soil they absorb from rain, or flowing water, organized matters of various kinds, and yield them up to the plants growing near to contribute to their growth.

Third—They absorb disagreeable odors and keep animal and vegetable matter sweet when in contact with it. For which reason vegetable substances containing much water, like potatoes, turnips, etc., are better preserved by the aid of a quantity of charcoal.

Fourth—They extract from water a portion of the saline substances, or salts, it may happen to have in solution, and allow it to escape in a less impure form. The decayed (half carbonized) roots of grass, which have been long subjected to irrigation, may act in one or all of these ways, on the more or less impure water with which they are irrigated, and thus gradually arrest and collect the materials fitted to promote the growth of the coming crop.

OXYGEN.

We know oxygen only in its gaseous or aeriform state, although it may be liquefied, and even converted into a solid form under the name of "liquid air." As a gas it is invisible and possesses neither color, taste, nor smell. When inhaled in a pure state it is stimulating and exciting to the vital functions, but used in excess it causes death. Plants refuse to grow in pure oxygen gas and speedily perish.

It exists in the atmosphere in the proportion of 21 per centum of the bulk of the latter, and in this state and proportion it is necessary to the existence of animals and plants, and to permit combustion everywhere on the globe. The amount of it in water will surprise many readers, for every nine pounds of water contains eight pounds of oxygen. A knowledge of this fact will cause the full value of water as an essential to plant growth to be appreciated; moreover, water possesses the power of absorbing still more oxygen from the atmosphere than it contains naturally. Thus, water will absorb from three and one-half to six and one-half parts of oxygen to one hundred parts of water. Rain, spring and river waters always contain an additional proportion of oxygen which they have absorbed from the atmosphere. This is taken up in the soil, for, as the

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water trickles through the soil it surrenders the oxygen to the plants with which it comes in contact, and ministers to their growth and nourishment in various ways to be hereafter explained.

But the quantitiy of oxygen stored in solid rocks is still more remarkable. Nearly one-half of the rocks which compose the crust of the earth, of every solid substance we see around us, of the soils which are daily cultivated, and much more than one-half of the weight of living plants and animals, consist of this elementary body, oxygen, known to us only as an invisible, imponderable, unperceivable gas.

HYDROGEN.

Hydrogen is also known to us in the state of gas, and like oxygen is without color, taste, or smell. It is unknown in a free or simple state, although chemists have succeeded in obtaining it in small quantities, and is not so abundant as either carbon or oxygen. It forms a small percentage of the weight of animal and vegetable substances, and constitutes only one-ninth of the weight of water. With the exception of coal and mineral oils known as "hydro-carbons," it is not a constituent of any of the large mineral masses of the globe.

It does not support life, and animals and plants introduced into it speedily die. It is the lightest of all known substances, being fourteen and one-half times lighter than air. Water absorbs it in very small quantities, one hundred gallons of water taking up no more than one and one-half gallons of it.

NITROGEN.

This substance is likewise known only in a state of gas. It exists in the atmosphere in the proportion of seventy-nine per centum of its entire bulk, and is without color, taste, or smell. It is lighter than atmospheric air in the proportion of ninety-seven and one-half to one hundred, and is deadly in its pure state to both animals and plants. It is essential in the atmosphere we breathe, moderating the combustion which would ensue if the air were pure oxygen, and forms a part of many animal and some vegetable substances, but does not enter, except in small proportions, into mineral masses. It is less abundant than any of the so-called organic elements, but it performs certain most important functions in reference to the growth of plants. Spring and rain water absorb it as they do oxygen, from the atmosphere, and bear it in solution to the roots of plants, one hundred parts of water

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HON. JOHN HENRY SMITH, SALT LAKE CITY.

dissolving about one and one-half to four per centum of the gas.

PROPORTIONS OF THE FOREGOING ELEMENTS IN PLANTS.

Although the substances of plants are composed mainly of the above organic elements, they exist in very different proportions. This will appear from the following table of "dried" plants, taking one thousand parts by weight as the standard:

	Oats.	Clover seed.	Grass, hay.	Peas.	Wheat.	Potatoes.
Carbon	507	494	458	465	455	441
Hydrogen ...	64	58	50	61	57	58
Oxygen	367	350	387	401	431	439
Nitrogen	22	70	15	42	34	12
Ash	40	28	90	31	23	50
	1,000	1,000	1,000	1,000	1,000	1,000

The above proportions are slightly variable, but the figures given represent nearly the relative weights in which these elementary elements enter into forms of vegetable matter. Herbaceous plants generally leave more ash, that is, inorganic matter, the wood of trees and the different parts of plants yielding unequal quantities.

HOW ORGANIC ELEMENTS COMBINE TO FORM PLANT FOODS.

Carbon being a solid, and insoluble in water, can not be taken up through the pores of the roots of plants, the only parts with which it can come in con-

HON. FRED KIESEL, CHAIRMAN EX. COMMITTEE
11th NATIONAL IRRIGATION CONGRESS, OGDEN, UTAH.

tact. Hydrogen, in its simple state, forms no part of the food of plants because it does not exist in the atmosphere or in the soil in any appreciable quantities. Oxygen exists in the atmosphere in the gaseous state and may be inhaled by the leaves of plants. Nitrogen may be absorbed by the leaves of living plants, but in a quantity so small as to escape detection. Horeover, oxygen and nitrogen being soluble in water to a slight degree, may also be absorbed in small quantities along with the water taken in through the pores of the roots.

But this absorption by the plant is insufficient to maintain its life and growth. It must have a liberal supply of food in which the four elements specified form a large percentage. Now, this food can only be obtained, or manufactured, by the four organic elements entering into mutual combinations to form what are known as "chemical compounds." It is these chemical compounds which find their way into the interior of the plant, into its very substance, and then the plant grows and reaches maturity, provided these chemical combinations are continued during its period of existence.

It must be borne in mind that the atmosphere diffuses itself everywhere. It makes its way into every pore of the soil, carrying with it its oxygen, carbonic acid and other substances it may be charged with. to the dead vegetable matter and to every living root. Its action is double: Playing among the leaves and branches, and fondling the roots by mingling with the soil. It is the workman, and its tools are its gases, and with them it manufactures out of the raw material it finds in the soil—that is, the silica, the sulphur, and other inorganic substances, and the decayed organic matter—chemical combinations which the plant seizes, appropriates and digests.

CHEMICAL COMBINATIONS.

When common table salt and water are mixed the salt dissolves and disappears. By evaporating the water it is possible to recover the salt in the same form and condition as it was at first. This is called a "mechanical combination," with which chemistry has nothing to do, and which would not, in the economy of nature, be sufficient as a plant food, although such combinations and solutions are absorbed by the plant—they do not feed it!

But when limestone is put into a kiln and burned it is changed into an entirely different substance, which is called "quicklime." The limestone is decomposed by the burning, the carbonic acid mixed with lime is driven off by the heat, and lime remains.

So when sulphur is burned in the air it is all converted into a white vapor of an unpleasant odor, which is finally absorbed by the atmosphere and disappears. This is also a chemical decomposition, in which the sulphur is combined with the oxygen of the atmosphere.

To cite another illustration, it may be said that water itself is a chemical compound of the two elementary bodies, oxygen and hydrogen.

None of these latter are mixtures like the mixture of salt and water, but elementary bodies united to form new substances, which, as has been said, are called "chemical compounds," and it is through these chemical combinations that all plants and fruits possess their various peculiarities.

The number of compounds which the four organic elements form with each other is practically unlimited, but of them, a very few only minister to the growth and nourishment of plants. Of these water,

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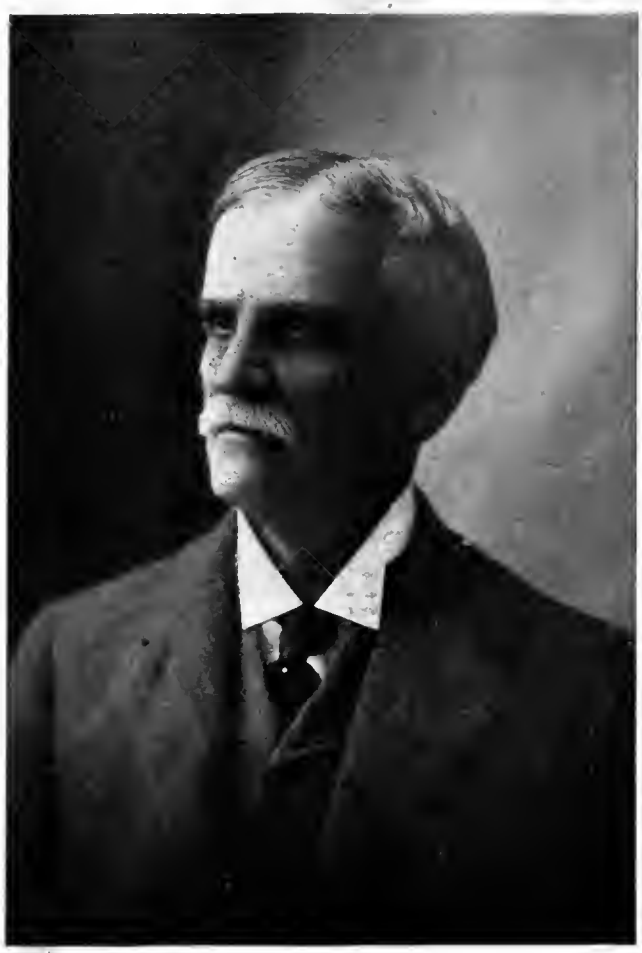

HON. JOHN E. FROST, TOPEKA, KANSAS.

carbonic acid, ammonia, and nitric acid are the most important. These compounds we shall take up in their order, a knowledge of all of them being of essential importance in agriculture.

WATER.

The following are the three qualities of water important to plant life:

First—A solvent power.

Second—An affinity for certain solid substances.

Third—An affinity for its own elements.

First—Water possesses the power of absorbing the several gases of which the atmosphere is composed, and carries them to the roots of plants whence they are taken into the circulation.

It dissolves many solid inorganic substances, earthy and saline, and conveys them in a fluid form to the roots of plants, which enables them to ascend with the sap. It also takes up substances of organic origin, such as portions of decayed animal and vegetable matter, and likewise brings them within reach of the roots.

When warm the solvent powers of water over solid substances is very much increased, a fact which accounts for the luxuriant vegetation in the tropical and semi-tropical regions, and in what are known as "warm soils."

Second—Water exhibits a remarkable affinity for solid substances. A familiar instance is mixing water with quick lime. The lime heats, cracks, swells, and finally becomes a white powder. This is familiarly known as "slaking" lime. When thoroughly slaked, the lime will be found to be one-third heavier than before. Every three tons of lime, therefore, absorb one ton of water; hence, if four tons of slaked lime is put upon land one ton of water is also mixed in the soil.

Water has an affinity for clay, the hottest summer seldom robbing the clay of its water enough being retained to keep wheat green and flourishing when plants on lighter soils are drooping and burning up.

An affinity for water causes vegetable matter to combine chemically with it, but in the case of a porous soil the water is merely "drunk in" mechanically and it is retained unchanged in the pores of the soil, whence it may be evaporated out, as related in the last chapter, but not where there has been a chemical transformation. This is a fact that should be remembered in applying mixtures of vegetable matter to the soil by way of fertilization. A mere mechanical mixture is of little effect; there must be a chemical transformation provided for. And it should also not be forgotten that water itself is capable of a chemical change whereby its qualities are preserved and retained much longer, indeed, than if merely poured upon the soil as a mechanical attempt to assist plant growth.

Third—Water possesses an affinity for its own elements, and this fact exercises a material influence on the growth and production of all vegetable substances. In the interior of plants, as in animals, water undergoes

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continual decomposition and re-composition. In its fluid state it finds its way into every vessel and every tissue. In this situation the water yields its oxygen to one portion of the plant and its hydrogen to another portion, wherever either is needed, and, in like manner, the oxygen and the hydrogen resume their combination as water and cling together until a new chemical change is needed. To comprehend this better the reader has only to observe the effects of water on his own system, for, as between plants and animals, the transmutations of oxygen and hydrogen, conveyed into the system by means of water, are practically identical.

We shall have more to say upon this subject in the chapter on the advantages of irrigation.

CARBONIC ACID.

Carbonic acid, as has been said, is the gas from burned charcoal, or carbon. It has an acid taste and smell, is soluble in water, and reddens vegetable blues. Water dissolves more than its own bulk of this gas. It is one-half heavier than atmospheric air, and is deadly in its effects. Yet it is the principal food of plants, being absorbed by the leaves and roots in large quantities, hence its presence in the atmosphere is necessary to plant growth, though the proportion is small.

Carbonic acid unites with potash, soda and lime, forming compounds known as "carbonates." Thus pearlash is carbonate of potash; the common soda of the shops is carbonate of soda, and limestone, or chalk, is carbonate of lime. The common carbonate of lime, in its various forms of chalk, limestone, or marble, is insoluble in pure water, but it dissolves readily in water containing carbonic acid. We know that water absorbs a quantity of carbonic acid from the atmosphere, and hence as it trickles through the soils containing limestone, etc., it dissolves a portion of the earth and carries it in its progress to the roots of the plants, where the earthy solution is used directly or indirectly to promote vegetable growth.

As to its absorption by water, a reference to a common glass of soda water will be sufficient to make this clear.

Some plants manufacture their own acids out of the carbonic acid—distinctive acids—for instance, oxalic acid, which is found in the leaves and stems of the common sorrel (oxalis). It is an acid not found in the soil and may be obtained from sugar, starch and even from wood by various chemical processes, principally by the use of nitric acid. To detail all the uses to which carbonic acid may be put would be going deep into chemistry, which is beyond the scope of this book. However, vegetable acids will be referred to in the next chapter.

AMMONIA.

Ammonia is a compound of hydrogen and nitrogen, and performs a very important part in the process of vegetation. It promotes not only the rapidity and luxuriance of vegetation, but exercises a powerful control over the functions of vegetable life. It possesses several special properties which bear upon the preparation of plant food.

First—It has a powerful affinity for acid substances, and unites with them in the soil, forming saline compounds or "salts," which are more or less essential to vegetable life.

Second—It possesses a very strong affinity for

RODNEY H. YALE, BEATRICE, NEB.

the acids of potash, soda, lime and magnesia. When mixed with these acids the acid in the salt of ammonia (sal ammoniac) for instance, is taken up by the potash, etc., and the ammonia is set free in a gaseous state. This is the effect of lime dressing on a soil rich in animal and vegetable matter; it decomposes the salts, particularly those of ammonia.

Third—The salts which ammonia forms with the acids are all very soluble in water, and thus ammonia is brought down to the roots of plants for their use.

Fourth.—In the state of carbonate it decomposes gypsum, forming carbonate of lime (chalk) and sulphate of ammonia, both of which are peculiarly favorable to vegetation.

Fifth—The presence of ammonia in a soil containing animal and vegetable matter in a decaying state causes this matter to attract oxygen from the air with great rapidity and in abundance, the result being that organic acid compounds are formed which combine with the ammonia to form ammoniacal salts. On the decomposition of these latter salts by the action of lime or other of the affinities above mentioned, the organic acids separated from them are always further advanced toward the state in which they become fit for plant foods.

Sixth—The most important property of ammonia is the ease with which its salts undergo decomposition,

HON. JOSEPH M. CAREY, CHEYENNE, WYOMING.

either in the air, in the soil, or in the interior of plants, a peculiarity which is possessed by water, as has been said. In the interior of the plant ammonia separates into its constituent elements as freely as water. The hydrogen it contains in so large a quantity is always ready to separate itself from the nitrogen, and so, in concert with the other organic elements introdueed into the plant through the roots or the leaves, it aids in producing the different solid bodies of which the several parts of the plant are made up. The nitrogen also becomes fixed, that is "permanent" in the colored petals of the flowers, in the seeds, and in other parts of the plant it passes off in the form of new compounds, in the insensible form of perspiration, or in perfumed exhalations of the plant.

NITRIC ACID.

This acid consists of nitrogen combined with oxygen, and never occurs in nature in a free state, but is found in many semi-tropieal regions in combination with potash, soda and lime, in what are known as "nitrates." They are all, like the salts of ammonia, very soluble in water, those of soda, lime and magnesia attracting moisture from the air, and in a damp atmosphere gradually assume a liquid form. Saltpeter is a compound of nitric acid with potash (nitrate of potash), and it may sometimes be used as an influential agent in promoting vegetation. Like the acid itself, these nitrates, when present in large quantities, are destructive of vegetation, and are frequently the eause, in arid and semi-arid regions, of utter barrenness, the nitrous incrustations aeeumulating upon the surface of the soil. In small quantities, however, they exercise an important and salutary influence on the rapidity of growth.

An Apology.

Owing to lack of space in preparing for the all important session of the Eleventh National Irrigation Congress, we have been eompelled to omit from the August and September numbers of THE IRRIGATION AGE the seeond ehapter of Hon. Thomas F. Weedin's revelations entitled, "The San Carlos vs. The Tonto Reservoir." The matter is too important to be lost to the public, and it will appear in the October number without fail.

SAN SABA VALLEY, TEXAS.

Arrangements have been completed for the construction of the contemplated big irrigation works on the San Saba river. The plant will include two large storage reservoirs and 176 miles of eanals and laterals. This will water about 40,000 aeres in the valley. By and by "San Saba" will be the legend on numerous boxes and crates in our great markets of the North.

UTAH DELEGATION, 10th NATIONAL IRRIGATION CONGRESS, COLORADO SPRINGS, COLO.

THE IRRIGATION AGE has the utmost confidence in the delegates to this great and important Congress; it does not believe that any one man, or set of men, ean or will manage it for personal interests, and that if they, or any of them dare to attempt it, they will quickly disappear and be heard of no more.

DELEGATES TO 10th NATIONAL IRRIGATION CONGRESS.

THE DRAINAGE JOURNAL DEPARTMENT.

The Flow of Water Through Pipes.

SOME FACTS ABOUT LAYING TILES.

BY J. ARNETT,
Surveyor and Civil Engineer.

All rules for the formation of tables to show the cubic feet per second of the flow of water through pipes of various diameters and cross section areas are arbitrary. If the reader does not already know that, he will soon see why when he considers that in open ditches, creeks and rivers the water flow on the surface at the center where there is no friction, is much faster than in the bed and sides of ditch, creek or river. The same holds good in tile drains. The greatest velocity is at the center of the tile, and the friction at its circumference surface. This circumference surface friction depends upon whether the tile are smooth inside, of equal internal diameter, laid on firm surface, without horizontal or vertical shouldering. Reader, you know that the practical work of burning and laying tile, forbid us to expect these last conditions. Hence any rule is a mere approximation and approaches the *truth,* as the last conditions and others not mentioned, approach perfection.

J. ARNETT, C. E., LONDON, OHIO.

The writer will give two formulas, taken from John C. Troutwine's Engineers Pocketbook, for the velocity in feet per second of the flow of water in tile drains, and the cubic feet of water discharge per second.

Now what is a *formula?*

If you will permit the writer to coin a definition, permit him to say that it is a *rule* tied in a *double bow knot,* and when this double bow knot is untied by expanding it into words, it becomes a rule. Here are the formulae and their rules.

The velocity of flow in feet per second:

$$\text{Velocity in ft. per sec.} = 48\sqrt{\frac{\text{diameter in ft.} \times \text{total head in ft.}}{\text{total length in ft.} + 54 \text{ diameter in ft.}}}$$

Now for the rule: Multiply the diameter of the tile in feet (the diameters of all tile less than a foot would be the fraction of a foot) by the total head in feet; the product is the numerator of a fraction, for denominator of which, to the total length of the tile drain in feet add 54 times the diameter of the tile in feet. Divide the numerator by its denominator and extract the square root of the quotient, and multiply by the square root thus found by the coefficient or constant, 48.

Let us apply this rule: Suppose we have a 6-inch tile drain a half mile or 2,640 feet long, with a total head (or fall) of 12 feet, what is the velocity in feet per second of the flow of water in the tile? In our drain the tile is 6 inches—half a foot. This multiplied by total head, 12 feet, gives a product of 6 feet for the numerator of our fraction, and to get the denominator of our fraction to the length of the drain 2,640 feet, we must add 54 times the diameter of the 6-inch tile, which is 27 feet. This added to 2,640 feet give 2,667 feet for the denominator of our fraction, and we now write it thus:

$$\text{The flow in feet per second} = 48\sqrt{\frac{6}{2667}}$$

2,667 will go into 6, 0.0022497187 of a time. Pointing this last quantity off into periods of two figures each thus: 0.00'22'49'71'87' and extracting the square root gives us 0.04743, and this multiplied by the co-efficient or constant, 48, gives 2.27664 feet for the velocity of flow in feet per second.

Now for the discharge of our 6-inch drain in cubic feet per second. Our formula is

$$\text{Discharge in cub. ft. per sec.} = 37.6\sqrt{\frac{\text{5th power of head.} \times \text{diameter in ft.} \times \text{in ft.}}{\text{length in ft.} + 54 \text{ diam. in ft.}}}$$

The fifth power of our 6-inch drain=0.5×0.5×0.5×0.5×0.5=0.03125 of a foot and this multiplied by 12, the head in feet, gives 0.37500 for the numerator of our fraction, and to get the denominator of our fraction we must add to 2,640 feet, the length of our drain, 54 times the diameter of the 6-inch tile in feet. which is 27 feet, giving us for the denominator of our fraction 2,667 feet, and we can now write our formula thus:

$$\text{Discharge in cubic ft. per second} = 37.6\sqrt{\frac{0.37500}{2667}}$$

Dividing 0.37500 of a foot by 2,667 gives us for a quotient 0.00014060742 of a foot and we can now write our formula in this shape: The discharge of our 6-inch tile in cubic feet of water per second=37.6 $\sqrt{0.00014060742}$=the square root of the quantity under the radical multiplied by the coefficient of constant 37.6. The square root of 0.00014060742 is 0.011859 of a cubic foot and this multiplied by the coefficient 37.6 give 0.4458984 of a cubic foot discharge per second for our 6-inch tile drain=$\frac{26.75}{1605.25}$ cubic ft. per min. " " " hr.

The algebraist can see through and apply the foregoing formulas instantly, and all farmers and others interested, familiar with the principles of arithmetic and who are in possession of two grains of common, kinetic, working sense can compute by the foregoing rules whatever he wants. Any one desiring to examine the subject further the writer refers him to the subject "Hydraulics," in John C. Trautwine's engineer's pocket book, page 538 of issue of 1876, and page 236 of issue of 1888. There he will find formulae, rules and tables to his heart's content. The writer feels that he should not cease this squib without referring to an important matter in the construction of tile drains. If you want a doctor, get one. If you need a carpenter, get one. If you desire a tile drain laid to a uniform gradient, get a competent engineer to level it and give you the cuttings every 100 feet or oftener, measured from the tops of the stakes driven even with the surface of ground.

Then you take charge of the work and see to it that the trench is cut to the gradient, made smooth and even in the bottom, tile laid true without shouldering, turning tile this or that way to make the closest joint possible, and in refilling trench hold tile in place until earth is compacted on both sides to half their height so that there may be no danger of bad shouldering by the ends of the tile being pushed this way and that way, or by the unequal settling of loose earth. The cost of the drain will be more but remember you are doing work not for today only, but for all coming time.

A tile drain should be of sufficient capacity to carry away one-half of an ordinary rainfall, the soil being supposed to absorb the other half. No land holder can afford to tile drain against a cloud burst or down pour of rain of two or more inches of water per hour. Whatever mistakes you may make, do not let the putting in of tile too small to do the work be one of them. Our mothers used to sweeten gooseberry pies by putting in sugar, pound for pound, then shut their eyes and put in more sugar to be sure to have pies sweet. Be liberal in determining the size of tile for any drain, and then add an inch or two to the diameter to be sure to have the tile large enough to do the work expected of it. The writer began in 1858 to level for box drains to carry the water of the historic gopher ditcher to an outlet; then leveled for box drains in their own right, then he leveled for crude, high priced tile with the apathy of the farmer against him. It is enough to say that the writer, on account of the high price of tile and poor at that, the apathy and ignorance of the farmer of the utility of tile drainage, and other troubles over which he had no control, looks back to county ditches, the construction of which he superintended, where the tile should have been once and a half or twice as large. Today tile are every way better made, much larger sizes, from three to forty-two inches internal diameters, of two, two and a half and three feet lengths. This being so, the farmers are taking up about all the tile in some of my first ditches, moving the tile up the ditch to points where the capacity of tile can do the work, and putting in larger tile in its stead. Say a 15 or 18-inch instead of a 12-inch. You can get splendid 15-inch tile now for $1.90 per rod. At first we paid $2.00, $2.25 and $2.50 for 12-inch tile of foot lengths, of every mathematical shape of cross section, and some shapes that mathematics knows nothing of.

Put in tile large enough and you will not regret it. Any one desiring to supply himself with an exhaustless store of information to draw upon, let him make John C. Trautwine's engineer's pocket book a member of his library.

Once more—while laying tile lay it deep, *deep*. All costs are the same except deeper digging and more back filling. Remember, if you put your tile down two and a half feet you have your field drained to a certain extent, but if you put it down five feet deep you drain another field underlying the first, so the roots and rootlets of your crops have two fields, one above the other, from which to elaborate their plant food.

An exchange says: "All the human race is yet in the rudimentary stage of moral development." How that can be when the editor has advanced far enough to find it out is one of our social mysteries.

IN MEMORIAM.

Fred Bond, state engineer of Wyoming, departed this life on August 14, last, after an illness of seven weeks of typhoid fever, at his home in Cheyenne.

Mr. Bond's death came as a public calamity, and in the words of the governor of Wyoming, "his loss will be felt by the entire state, and it will be difficult, indeed, to replace him."

Quiet and unassuming, he possessed those unusual qualities which endear one to hearts of all, and he was one of the most generally beloved men in the entire state. Kind and indulgent, courteous, and, withal, a

FRED BOND, LATE STATE ENGINEER, CHEYENNE, WYO.

true gentleman, he counted his friends by scores and had no enemies. To meet him was to be his friend, and his death will be mourned throughout the length and breadth of the commonwealth.

The deceased leaves a widow and three children, Warwick, Kenneth and Fred Bond, Jr. His brothers, Frank and H. L. Bond, are here. A mother is still living at Iowa City, Iowa.

We knew Mr. Bond personally and well, and join with his friends in deploring his loss and extending sympathy to his family.

Mr. Clarence T. Johnston, recently assistant chief irrigation investigations, United States Department of Agriculture, has just been appointed state engineer of Wyoming, to fill the position made vacant by the demise of Mr. Fred Bond.

We notice in some of our agricultural exchanges that "apples" are recommended in the manufacture of cider. It is believed that this fruit will add "body" to the usual pine wood shavings, liquorice, and pond water decoction commonly sold under the name of "cider."

MR. SILAS THORNAPPLE'S OPINIONS CONSARNIN' IRRIGATION.

'Taint because thar ain't water enough on this airth to go around thet thar is so much difficulty in gittin' any when it is wanted the wust, thar bein' a sufficient quantity uv it to oblege the large part uv the inhabitants to go into the ark-buildin' occupation to save themselves gittin' drowned ef it sh'd all come onto them to oncet—but it is because thar is so many obstacles in the way uv gittin' it.

Lookin' at the situation from a birdseye pint uv view, I calkerlate thet it would take the sarvices uv a arbitration tribunal composed uv Solomons to make any satisfactory impressions on the difficulties, an' then the arbitrators would hev to be encased in suits uv boiler plate while attendin' thar meetin's, on accounnt uv the strennous pressure thet would be brought to bear on them by the army of contractors, water barons, land sharks, an' other friends uv humanity anxious to procure homes for the sufferin', pervided them ez suffer hev the cash to back up thar aspirations. The others don't git any homes wuth mentionin'.

On the surface, thet is, on the side turned to the ardent gaze uv the public, this irrigation business 'pears to me to be in the follerin' condition: It is divided into two classes, each one uv which is a holdin' on to the end uv a rope an' a-pullin' fur all they're wuth in contrary directions. So fur ez the surface looks, neither uv 'em hain't got a hair weight uv unanimity or surrender, but I guess I know a few things an' I don't hev to pry my opinions out with a boot jack.

One side hez all the land, or it hez made contracts to git all thet's wuth surveyin', or pourin' water on, an' the other side hez all the water which hez not been set aside fur drinkin' purposes in the State uv Kentucky, or hez contracted to git it.

I wuz talkin' to Priscilly—thet's my wife—about the condition uv the irrigating problem, an' I allowed a few rays uv light to be shed onto the idee I hev jest suggested.

"Wall," says she nateral like, "I sh'd think them ez hez all the land, an' the fellers ez hez all the water would git together, as Deacon Plum wants everybody to do, an' then they could git along without so much rampagin' about an' squealin' like pigs under a gate."

"Sh-h-h," says I, peerin' about keerfully, fur the very walls hev ears when the irrigation question is teched, an' approachin' nigher to Priscilly, "thet's what they are a doin' now, an' they don't want anybody to know it; thet's why thar is so much tarnal squealin' to make folks think thar's somethin' else ails 'em."

"I don't keer what they do," remarked Prlscilly, resumin' her knittin'. "so long ez they leave me enough water to bring the milk up to the standard required by them knolledgeous scientific fellers ez don't know the difference between fresh milk an' a pail uv whitewash."

"Priscilly," says I, laughin' in my sleeve, "you hev hit the whole batch in the solarum plexum without meanin' to do it."

"Whar might thet be?" asked Priscilly, in her simple innocence.

"Tain't wuth while explainin," says I, "so long ez it is did." Then addin' by way uv explanation: "The fellers ez hev charge uv the irrigating cow are gittin' milk out uv her from her horns to her tail, an' they are a-skimmin' off the cream an' a-waterin' the milk up to a standard ez high ez the sky. Thet's what they keep the cow fur, an' it's the consumers ez git bilious when they pay cream prices fur skim milk an' water."

"I sh'd think the unfort'nit' consumers would not like that," pursued Priscilly, in a sympathetic tone uv voice.

"They don't know anything about it," says I. "They only hev their suspicions, so they swaller their milk an' water jest like spring lambs. It's a case uv the people be gol darned."

"Silas!" exclaimed Priscilly, reproachingly, "you're swearin' again."

"Thet ain't swearin'," explained I; "thet's the business motto ez hez took the place uv 'God bless our home' in the syndicated homes uv the farmers uv the irrigated west."

Allus irrigate immediately previous to a rain storm. It saves water fur the combine, an' enables him to charge you jest ez if you had used the whole allowance—thet is if you stop when the rain comes down hard. Somebody hez to pay fur the water an' why not you?

Allus git your land cheap and then agitate the government to put in waterworks cluss by. You will then git a good price fur your land without any expense. N. B.—Buy all the land you can, but git it any how.

Some uv our water canals hev been dammed so often thet there is a projec' on foot to concentrate all the dams in the Tonto deestrick. It begins to look ez if they hed already begun the work.

In buildin' a reservoir, it don't make no difference if thar aint no water to fill it or not. The main thing is to git the reservoir. Let the other fellers worry about the water.

Thar are certain deestricks in the bloomin' West whar, ef you can't take your ditches in over night you hed better nail them down.

A great number uv people raise fine crops by usin' the watered stock uv the irrigation combines without actually usin' a drop uv the real water. They are gen-'rally the promoters.

Some folks insist thet water allus runs up hill. But tain't so. I've seen it run up out uv a pump many a time, and I hev seen times when it wouldn't run at all.

Thar is allus more money made by a contractor out uv a job than the feller who pays for the job ever receives out uv the profits. The truth of this surprisin' fac' will appear later on if irrigation is carried on accordin' to the ideas uv some folks.

A scientific investigator comes forward with the statement that "cow peas" are not peas but beans. Aside from the fact that a rose by any other name will smell as sweet, we are reminded of the poem:

"Tell me not in mournful numbers
Life is but a mournful dream,
For the soul is dead that slumbers
And things are not what they seem."

PRACTICAL IRRIGATION.

JNO. G. HALL, GREELEY, COLO.

In treating various subjects under the head of practical irrigation, I am requested to speak of the failures as well as the successes of our Greeley farmers, as failures teach success as well as success itself, so I will take for my subject, "Growing of Trees."

Thirty-three years ago, when the colony was first established by Horace Greeley, and the first ditches were taken out, and irrigation beginning to prove a success, thought and energy were of course turned to the planting of trees. This in a measure is all right, especially around dwellings and out-buildings, and there they are a necessity for comfort and ornamentation.

C. G. ELLIOTT, C. E.,
EXPERT IN DRAINAGE INVESTIGATIONS.
U: S. DEPT. OF AGRICULTURE.

Land was then cheap and water plenty. Very few ditches and plenty of snow to furnish late water. Trees were planted on both sides of laterals, running through farms and along fences, the cottonwood variety being in the majority of cases planted. Thirty years passed and these twigs or cuttings stand today from fifty to one hundred feet high, rendering unproductive on each side of them the ground equal to the height of the trees.

Now that the land becomes so valuable by the aid of artificial watering, ranging in price from fifty to two hundred and fifty, the trees become an expensive luxury, and farmers are cutting them out as fast as possible to render the land productive, as a single row of trees will render unproductive a tract equal to eighty acres, that would produce from $100 to $200.

When a new canal is taken out it is generally suggested that trees be planted on the banks to beautify and be self-watering. This is a mistaken idea, as trees along canal banks as well as laterals are a very expensive luxury, because there must be labor done on canal banks as well as laterals, and it is slow, expensive work chopping through and dealing with green trees along your ditches. So in an irrigated country plant trees around your buildings only for best results.

CONTRIBUTIONS THANKFULLY RECEIVED.

A friend of THE IRRIGATION AGE who received the following letter permits us to publish a copy. We do so without comment:

GEORGE H. MAXWELL,
Executive Chairman
The National Irrigation Association,
1707 Fisher Bldg., Chicago.

August 18th, 1903.

DEAR SIRS: Last month I sent you a reprint from the Arizona *Republican* giving account of our final success in the organization of the Salt River Water Users' Association, thus adjusting local complications enabling the Government to build the great *Tonto Basin Reservoir.*

That work done I have returned east to take up the campaign for the repeal of the Desert Land Act, the commutation clause of the Homestead Act and the Timber and Stone Act, under which the public lands are being absorbed by speculators, to the exclusion of actual settlers, at the rate of over *25,000,000 acres a year.*

Funds are urgently needed for our correspondence and press bureau in this campaign. Public sentiment must be awakened. The commercial interests of the country who want a dense *population* in the West can not afford to be apathetic. May we not have prompt remittance of your dues? Yours very truly,

GEORGE H. MAXWELL,
Executive Chairman.

HENRY W. PEABODY & CO.,
SHIPPING AND EXPORT COMMISSION MERCHANTS.
NEW YORK, Aug. 19, 1903.

THE IRRIGATION AGE AND DRAINAGE JOURNAL:

Gentlemen—Some of our South African friends have recently formed a land syndicate and propose adopting on a large scale the best irrigation methods now in vogue. They are anxious to have full detail as to the method practiced in this country and have requested that we furnish them with catalogues, text books and full information on the subject. We will be glad to have a sample copy of your publication and also any information with which you can furnish us relative to the best manufacturers of machinery now in use.

Any detail you can give us under this heading will be appreciated.

Yours very truly,
HENRY W. PEABODY & CO.

Mark your reply: For South African Department.

LADYSMITH, WIS., Aug. 2, 1903.

D. H. ANDERSON PUB. CO., CHICAGO, ILL.:

Gentlemen—Please send me a sample copy of THE IRRIGATION AGE AND DRAINAGE JOURNAL, as I want to buy a brick and tile machine and would like to get the ad. of some responsible company.

Yours truly,
GEO. B. GOOTHER.

MEADOW VALLEY, WIS., Aug. 14, 1903.

THE IRRIGATION AGE AND DRAINAGE JOURNAL:

Dear Sir—I write to ask if you know whether there is such a thing as a sand tile manufactured. I understand it is made somewhere in northwestern Illinois. It is the common tile with a collar tile about eight inches long that is made to fit and slip over the joint of the common tile. Please write me. Would like to get them as near the central part of Wisconsin as possible. Any information in regard to the above will be greatly appreciated.

Thanking you in advance, I remain,

Yours respectfully,
XAVIER F. GEHANT.

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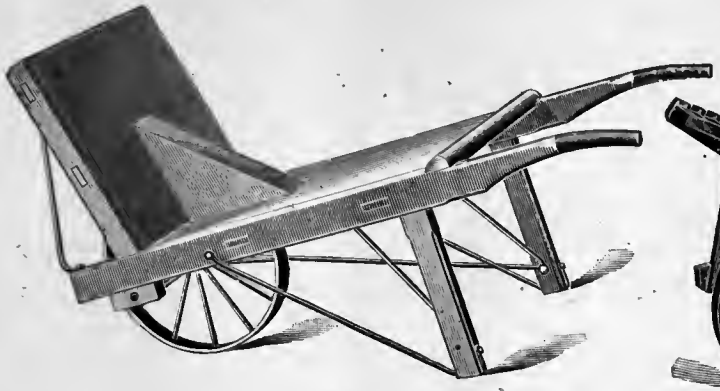

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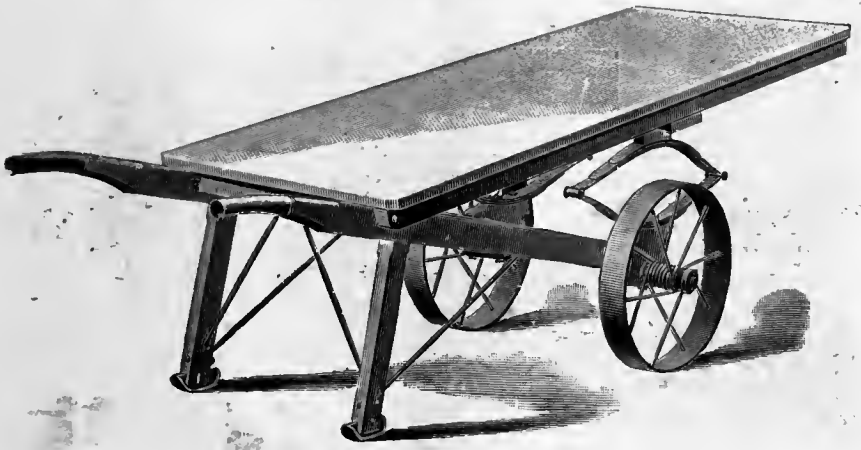

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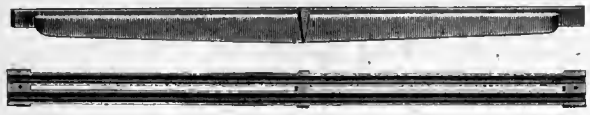

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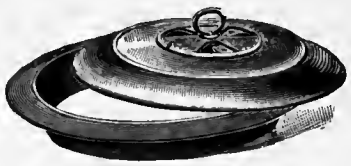

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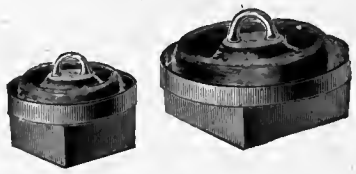

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THE IRRIGATION AGE

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A monthly illustrated magazine recognized throughout the world as the exponent of Irrigation and its kindred industries. It is the pioneer journal of its kind in the world, and has no rival in half a continent. It advocates the mineral development and the industrial growth of the West.

D. H. Anderson of the IRRIGATION AGE has purchased a half interest in *Modern Irrigation*, Denver, Colo.

EDITORIAL

The Schemes Behind the Opponents of Repeal.

Congressman Reeder, of Kansas, speaking in favor of the Maxwell scheme to aid the dear people by taking all the public land away from them for fear it will be stolen, said before the Ogden Congress with marked bitterness: "The foes of repeal must have some private schemes to further or they would not be angered over the prospect of doing away with these laws."

They did have private schemes, one of which was to prevent the destruction of homes by the repeal of the land laws. Another scheme was to defeat the design of turning over 100,000,000 acres of public lands to syndicates and land grabbers, sooners, squatters, and bogus entry men, who would have the homeseekers at their mercy. If under the present land laws these gentlemen can steal 25,000,000 acres of public land per annum, as is charged by Mr. George H. Maxwell, how much would they steal if there was nothing to hinder them?

The opponents of repeal were not only angry, they were mad all the way through to think that such a bare faced proposition could be broached by apparently intelligent men. When Congressman Reeder and the others can show that they are in this thing for the sake of humanity and not for a fee, their vituperations may be entitled to more respect.

Something of a Nightmare.

The party holding down the safety valve of the Arizona *Republican*, fell off the other day and let the "thing blow off." Either that, or, afflicted with a nightmare through over cramming on Maxwell delicatessen, he imagined the editor of THE IRRIGATION AGE camping on his epigastrium. He was so mad he slapped his wrist to think that we contemplated running the Ogden congress all by ourself. Well, we might have done better than his friend Maxwell with one hand tied behind our back.

Valuable Matter to Come.

We have a collection of interesting valuable, practical and scientific articles on the subjects of Drainage and Irrigation for the columns of THE IRRIGATION AGE during the coming year. They have been specially prepared for our columns by the greatest living experts and practical men of the age in all countries. On account of the pressure of matter connected with the Eleventh Irrigation Congress, they have been necessarily omitted, but they will appear from now on. Our readers can scarcely attribute their omission as a fault if they will stop to consider the importance of the Congress held last month at Ogden. The latter has reiterated its intention to preserve the homes of the irrigation farmers of sixteen states and territories, and with that established as a fact, THE IRRIGATION AGE feels at liberty to devote more space to the manner of utilizing and making those homes productive and profitable.

Broad Scope of the Congress.

The National Irrigation Congress is not alone concerned about the reclamation of arid lands in certain states enumerated in the national irrigation law. To limit its objects to sixteen states and territories and to public lands, is to make it at every session the battlefield of corporation lawyers from Chicago and elsewhere. Its scope and objects are broad enough to cover the whole nation; they are of more importance than battleships, river and harbor bills; they are vast enough to become a political issue whether local or national; they pertain to the preservation of the home, the creation and maintenance of a vast productive empire, the very idea of which has succeeded in building up a great nation, a world power, in spite of the drawbacks and obstacles thrown in its way by land grabbers. They extend to the guardianship of the millions in the reclamation fund which the rats and the mice of schemers are already busily preparing to gnaw into for the benefit of their own pockets. Its selection of El Paso, Tex., outside the reclamation area, is proof of the genuineness of its diversified objects and its determination to carry them out.

El Paso as an Object Lesson.

The wisdom of selecting El Paso, Tex., as the place for holding the Twelfth National Irrigation Congress, can not be questioned. The location is an object lesson on the subject of irrigation. Could the Congress be transported to the ancient irrigating works of the Euphrates and the Tigris, visit the Nile valley to study the stupendous cause of its fertility and the gigantic engineering plans that are near completion, or travel through the irrigated portions of India and see the productive character of soil that has been irrigated for unknown ages, every one would admit the value of the information to be gathered and its usefulness as an object lesson for us who are practically babes on the subject.

The equivalent of these foreign lands we have at El Paso, and the lessons to be learned by the delegates, and through them imparted to the irrigation farmers of the country, will prove equally as valuable. There, the beardless irrigator from the new lands of the North and West may look upon and over 300 years of an irrigation system as perfect and productive now as when it was first inaugurated. He will see 150,000 square miles of irrigable land, 96,000,000 of fertile acres ready to be converted into a productive empire on the application of water. He will see the reasons for many failures, the causes that will insure success, and he will return home and apply the lesson to his own home ranch and realize success where otherwise he would be working in the dark and experimenting all his life.

El Paso was an inspiration.

The Crocodile Syndicate.

A Crocodile whose recent meal of an unwary traveler had disagreed with his refined stomach, thus addressed a crowd of fat, juicy children who stood on the river bank watching his writhing, while the big tears were coursing down his cheeks:

"Dear children, I weep because I feel sorry for you. It has come to my knowledge that you are to meet with a horrible fate unless you let me save you. There are a lot of wicked crocodiles that want you badly. You can see their villainous eyes bulging out of the surface of the water all around. They are waiting to gobble you up, but I will save you, dear children. Come up close and I will tell you how I am going to do it."

Just as the guileless infants with one accord were about to gather around the weeping crocodile, one of their number with more sense than the rest, and less confidence in crocodiles generally, leaped in front and waved them back vehemently.

"Keek back, fellow boys, if you value your lives and your belongings. Do not be deceived by the tears of this fellow. He is fooling you. He is the head of the Crocodile Syndicate, he is the Corporation Lawyer of the whole bunch, and if he gets you in his power, the whole crowd will jump on you and gobble you all up without leaving so much as a brass button by which your sorrowing friends can identify you."

Then the children ran away home and remained there safe, while the angry crocodiles of the syndicate chewed off the tail of their weeping corporation lawyer and refused to divide up their spoils with him any longer.

Investigate the Land Stealing.

It was declared positively upon the floor of the Ogden Congress, that the Government of the United States is losing 25,000,000 acres of land per annum through fraudulent entries, and by various methods of stealing. This matter should be investigated, for THE IRRIGATION AGE does not believe that Theodore Roosevelt, in view of his repeated public utterances to the effect that the public lands are intended for the homes of the American people, ought to rest under the suspicion that the acts of his officials belie his words.

If anybody steals a postage stamp from the Government he is speedily put where he will do so no more. Why, or how, men can steal 25,000,000 of acres of land every year, or one acre and the Government look on with apathy, is something every citizen would like to know. There was a call for proofs made at the convention, but the attempt to repeal all the land laws to enable the public domain to be grabbed by wholesale, obscured the retail stealing going on at the above rate per annum. The question demands an investigation and THE IRRIGATION AGE re-

quests those who have any evidence or information leading to the exposure of such frauds, to prepare it, ready to present to the Twelfth Congress at El Paso, where the matter will be inquired into seriously unless the corporation lawyers run the Congress, which borders on insult even to intimate, but they have been defying the power and authority of the Government itself so long and to such a monstrous extent, that it is difficult to say what they will not do or attempt to do with a voluntary organization.

Drainage and Irrigation.

We have received a letter from a distinguished surveyor and civil engineer, Mr. J. Arnett, of London, Ohio, whose able article on "Laying Drain Tiles" appeared in the September issue of THE IRRIGATION AGE AND DRAINAGE JOURNAL, intimating that we had sounded the death knell of the DRAINAGE JOURNAL by attaching so much importance to the subject of irrigation. Mr. Arnett says among other things:

"In some of their bearings the AGE AND JOURNAL are identical. They both deal with water. They both must have canals, ditches and laterals. But the *use* made of the water by the two systems differ diametrically. Irrigation wants to carry water into the soil; drainage wants to carry the superabundant water out of the soil. Barren, arid land will not produce without irrigation, neither will flooded land produce without drainage.

"The perusal of THE AGE shows that its editor is a pioneer and at home in its field. But where, O where, is the champion for drainage?"

THE IRRIGATION AGE does not deserve this imputation, and it has spoken very little to the purpose if its readers fail to understand that it is the pioneer and champion of both drainage and irrigation. Both are essential to advanced, scientific agriculture, not as mere temporary makeshifts, but combined mechanical essentials whether on flooded lands or on arid lands. There are times of drought in the humid regions when irrigation is essential, and it is now extensively practiced in Illinois and elsewhere, and it is also of vital importance in the arid regions where the land will not produce without irrigation, that there must be a perfect system of drainage to produce any sort of a crop.

Professor Arnett himself solves the whole problem when he confesses "that drainage wants to carry off the superabundant water out of the soil," a fact we admit without reservation, and that "barren, arid land will not produce without irrigation," a fact which is also admitted. Experience has demonstrated with costly emphasis that the arid lands must possess as perfect a system of drainage as flooded lands, for the constant pouring of water "into the soil" without drainage is as detrimental to the growth of plants as flooded lands in the humid regions without drainage. There is always "superabundant water" to be got rid of, and it makes no difference whether that superabundant water comes from the rains of heaven or an irrigation ditch. Every housewife who keeps growing her pots of flowers in the winter time understands that the pots must be perforated at the bottom to carry off the surplus water she sprinkles on the top.

It is time for the advocates of drainage and those of irrigation to join hands in the common cause of scientific agriculture. Both have been practiced since the flourishing days of Babylon the Great, and the combination of the two systems is as old as the Nile of Egypt. In the Primer of Irrigation, in course of preparation by the editor of this journal, the whole subject is treated fully and at large, and the cause of its preparation was the demand for a combined system of drainage and irrigation. We maintain that this journal is a true journl of drainage and irrigation, the only one in the country, and from our correspondents and subscribers in India, Australia and South America, we feel at liberty to claim that it is the only one in the world. To separate the subjects would be impracticable, unwise, unscientific, and to repudiate all our progress in the art of agriculture.

The Ogden Congress.

The National Irrigation Congress that ended its eleventh annual session at Ogden, Utah, on the 18th of September, demonstrated that it is a living, working actuality, and announced to the world that it is not and will not be the mere personal instrument of any schemer or combination of schemers for personal gain. The effort to destroy it ignobly failed, and if there is a grain of intelligence left to those who hope to transform it into a private land syndicate, they will cease their efforts from now on and either join with it in its great aim to benefit the public, or step out of it and employ their own agencies to accomplish their underhand work. If they refuse to do either, then they must expect to receive liberal doses of purgative medicines during the coming year, so that the Twelfth Congress to be held at El Paso will be free from their pernicious influences. They are hereby notified that the doses administered them will not be gentle triturations, but in good, old fashioned Allopathic quantities.

The National Irrigation Congress peremptorily refused to turn over its prerogatives to any man or set of men, and when that certain man who attempted to compel them to surrender their objects to him says: "I am too busy attending to irrigation matters to run for the Vice-Presidency," we wonder *whose* irrigation matters he is attending to?

Begin to prepare now for the Twelfth National Irrigation Congress.

ELEVENTH NATIONAL IRRIGATION CONGRESS.

Inauguration of an Empire of Productiveness—The Man Behind the Irrigation Ditch will Rule the World—The Deserts Made to Bloom as a Rose Garden, and a Phoenix of Fruit and Grain Springs from the Barren Ashes of Ages of Desolation—Hope for the Future through the Downfall of Scheming Home-Destroyers—The Canker Worm of Land Stealing Crushed, and the Hypocritical Coddling Moth Scattering its Pernicious Germs in the Heart of a Fair Domain, Asphyxiated.

For twelve years a body of energetic men, patriotic, wise, intelligent and insistent, have been endeavoring to interest the world in the wealth of soil within the boundaries of the United States west of the 100th degree of longitude. "Pooh! you have nothing but a barren desert," was the sneering reply of the humid and swamp land man of the East. "You can't compete with the God's country of the rising sun." "Come and see." quoth the Irrigator. And they did come, dribbled in; they were dragged in, figuratively speaking, until, the fame of the great western empire spreading, they came of their own accord—nay, rushed in—an army of them to see what the Ogden Congress had to show in the way of wealth. Well, they found that the loud trumpetings of the man behind the irrigation ditch, his boasts and hilarity over the success he had reached were not idle vapor, not dreams, but stupendous realities, and the men who came and saw were conquered, and they wanted some of the wealth. They shall have some of it, for there is abundance to spare, but they shall not have all of it.

U. S. SENATOR WM. A. CLARK.
President 12th National rrigation Congress.

When successful endeavor appeared in sight, the influences that had been steadily at work to destroy, by undermining, the efforts of the pioneers of irrigation and reclamation, the land gophers gnawing at the root of every growing plant, the coddling moths boring into the heart of the fair and noble fruit, the canker worms eating out its soul and vitality; when national irrigation became an accomplished fact in spite of their efforts to prevent it, when there appeared millions of money in the reclamation fund and more millions in sight, all these destructive agents threw up their hats with a "Whoop! Hurrah!" and boldly announced themselves as the only, the true apostles of irrigation. And they said: "You have done well, you are indeed brave men, but your work is done; you have reached a point where you can no longer continue your work. We will come in and manage this good thing hereafter, we know how to do it and you do not. The money in the reclamation fund must be carefully watched lest it be misapplied. We are the fellows who know how to handle the people's money; you are letting dishonest men steal millions of acres per annum; the government can not stop them, neither can you, but we can."

But the Ogden Congress laughed; they knew what was beneath these crocodile professions, this Uriah Heap anxiety, and they took the mourners, the calamity howlers, the self-constituted apostles of everything that displayed a dollar or a rich acre of ground in sight—took them at their word, we say, and said to them in so many words: "Inasmuch as you claim that land stealing has grown into such monstrous proportions and you also claim that you have had charge of this entire business for years, that you are the apostles of it we deem you unfaithful to your principles, recreant to your duty, and we sincerely believe that with you in control the public domain and the reclamation fund will have a poor prospect of fulfilling the prophecies, accomplishing the desires and aims of our great and good president, Theodore Roosevelt, with whom you insultingly profess to be hand and glove, and we will turn you down hard, so hard that the bump of your coming down will be heard in Washington, and mildly intimate to the powers that are so anxious to preserve the public domain for the people, that you are the cause why it is diverted from that great object. It is time to remove your tin halo and put you under guard in a soli-

WASHINGTON NEWSPAPER CORRESPONDENTS.

tary cell, where you can meditate upon the fact that you can not fool all of the people all of the time."

So the foes of honest irrigators, the obstacles in the way of homes for the people, the friends of land syndicates, the corporation lawyers with fat fees to secure control of western progress or ruin it, the little would-be Napoleons who saw a revolution and attempted to ride it into imperial power, were all routed, thrown off from the periphery of the great wheel of progress, flattened, smashed, and it is to be hoped that they will understand that they are a detriment and not a benefit to the cause of irrigation and reclamation.

This much was, of itself, a great master stroke, and the Ogden Congress is to be congratulated that it stood so sturdily against the land greedy, who fancied they could transform it into a personal graft. It was too big, its aims too grand, and the results it had accomplished against all obstacles too important to be thrown away out of sympathy for the tears shed by those who were well paid to shed them. It went on, however, and did more; what that more is will appear from the following necessarily concise account of its proceedings:

At 10:50 o'clock a. m., the gavel of Senator William A. Clark, its president, came down sharply, and the Eleventh National Irrigation Congress fell into line for the business before it amid great enthusiasm and surrounded by unique decorations representing desert and irrigated land. Hon. Heber M. Wells, governor of Utah, welcomed the delegates to the state, and Mayor Glasmann, of Ogden, turned over to them the keys of the city. Mayor Glasmann sounded the keynote of the deliberations which were to follow. His language is here reproduced to enable the reader to comprehend the situation, and to explain many things that have only been hinted at in this issue of THE IRRIGATION AGE. Said he:

"A prominent eastern newspaper has asked the question, what is the need of any more irrigation congresses now that the government has set aside the receipts of the public lands for the reclamation of the arid West? I want to say there is more need for an irrigation congress today and in the future than there ever was. True, you have the money appropriated by the government, but it will be the privilege and the duty of this congress to see that this money is properly used and not misapplied or wasted. You have a greater work before you at this session than at any time during the eleven years' history of the irrigation congress. You must be able to provide a plan for the expenditure of the millions of dollars set aside for our cause, which must meet the approval of the Secretary of the Interior and the National Congress. It will be your privilege to adopt a system for the sale of reclaimed lands that will meet the approval of the American people, a system that will be a blessing to the genuine settlers. It must

SOME OF DELEGATES ON SITE OF PROPOSED RESERVOIR.

PROF. DOREMUS LECTURING TO DELEGATES

be as meritorious, if not excel, the famous homestead law signed by that greatest of modern Americans, Abraham Lincoln."

President Clark, in response to the address of welcome, reviewed the work that had been accomplished by the National Congress, prophesied an illimitable future for the western irrigated empire, and concluded as follows:

"I share with you the inexpressible enjoyment of the cordial hospitality of the good people of Ogden, as well as the pleasure of participation in the discussion of the fascinating subject which we are all striving to promote. From the very inception of the movement, it has invoked the noblest impulses and the highest aspirations of all who desire to make the earth more fruitful and enjoyable and the people who dwell thereon better and more happy. Its fulfillment is the goal to which we will devote our best energies, and which shall be the inspiration of our fondest hopes for the welfare of the generations that are to follow."

After which came the reading of a telegram from President Roosevelt, in the words following:

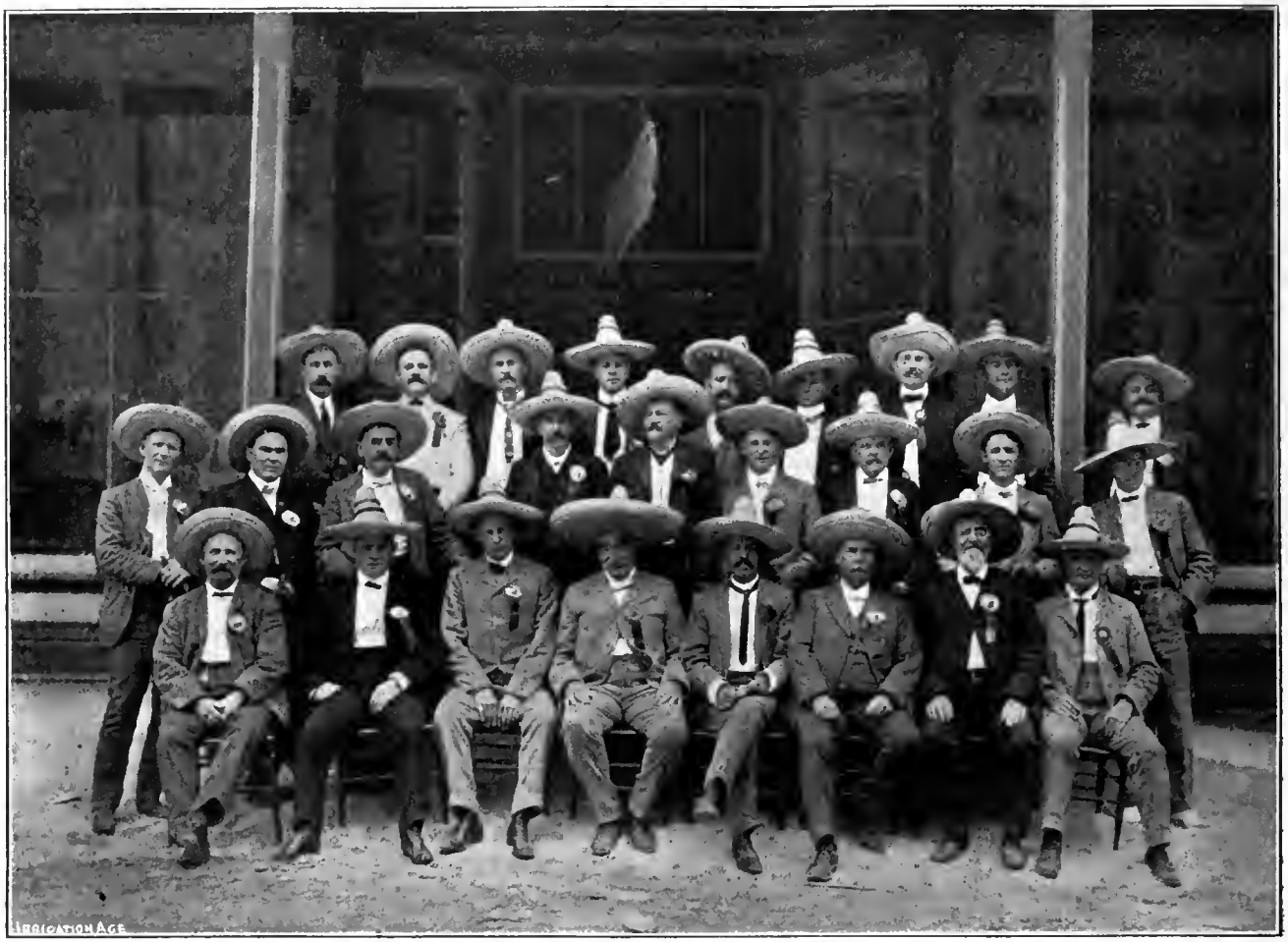
"MR. FRED J. KIESEL, Chairman Executive Committee, the National Irrigation Congress, Ogden, Utah:

"My Dear Sir—Permit me to express through you to the irrigation congress my hearty congratulations upon what has been accomplished in the year that has just passed, especially because I regard this as opening a new era in the treatment of irrigation from the national standpoint. None of our internal policies will be more consequent to the future of the country during the next few decades than this matter of irrigation. It is of vital consequence to the intermountain states and to the entire semi-arid region, and what is of vital consequence to one portion of the country is of vital consequence to the whole country."

(Signed) THEODORE ROOSEVELT.

A telegram of greeting from Secretary Hitchcock was also read, and after the singing of the Irrigation Ode, expressly written for the congress, an adjournment was had until 2 p. m., at which time the congress expected to get down to business.

The afternoon session of the 15th was taken up largely with the settlement of the number of delegates entitled to vote. While the constitution of the congress in express terms limited the number of delegates to twenty from each of the United States, it happened that through an error this membership was nearly trebled, and there were 583 delegates more than the constitution allowed. The congress, however, upheld



EL PASO, TEXAS, DELEGATES TO 11TH NATIONAL IRRIGATION CONGRESS, OGDEN, SEPTEMBER 15 18, 1903.

Read from left to right.

FIRST ROW, TOP—1, John W. Fisher; 2 H. G. Crowe; 3, John P. Ramsey; 4, H. D. Slater, Editor Herald; 5, Thomas Powers; 6, W. O. Millican; 7, John S. Aikin; 8, C. E. Kellogg; 9, Juan S. Hart, Editor Times.

SECOND ROW—1, C. E. Kelly; 2, Bert Orndorff; 3, W. A. Gifford; 4, P. M. Millspaugh; 5, Francisco Mallen, Mexican Consul; 6. John L. Dyer; 7, E. C Pew; 8, W. Grandover; 9, J F. Williams.

THIRD ROW—1, Park W. Pittman; 2. Judge James Harper; 3, J. A. Smith, Chairman Delegation; 4, Felix Martinez, Editor News; 5, A. Courschene; 6, W. H. Winn; 7, J. J. Mundy.

the constitution and almost unanimously reduced the number of voting delegates to 363. Then came the naming of committees, which consumed the rest of the time of the first session, but the work was finally completed and the congress adjourned until Wednesday, and the delegates prepared for the issues likely to arise.

The first act of the organized Eleventh National Irrigation Congress was the practically unanimous refusal to merge with any other organization. The National Irrigation Association, run by George H. Maxwell, and the Trans-Mississippi Congress had both been flirting with the merger idea, and had set at work every possible influence possessed by them and their backers to force a merger at the tenth congress, held in 1902 at Colorado Springs, Colo. The question was referred to a committee to report to the eleventh congress, to be held at Ogden in 1903, and upon that report, which was adverse to any merger on the ground principally that the National Irrigation Congress was a distinctive movement for certain specified purposes, the congress maintained its autonomy, declining to become the tool of any private association.

In spite of this warning of the temper of the

EL PASO-MEXICAN BAND.

congress to maintain the objects for which it was originally organized there followed upon it almost immediately an attempt to force through a resolution favoring a repeal of the timber and stone act, the desert land law and the commutation clause of the homestead law. The scheme of the resolution originated with George H. Maxwell, a delegate hailing from California, with a residence in Chicago and a home in Arizona, and a man who, it is alleged, is working in the interests of himself and land-grabbing corporations.

It will appear strange to the reader that the committee to whom the Maxwell resolution was referred, after much discussion, reported in its favor, twelve to nine, and yet the resolution was thrown out by the great body of the congress. Mr. Maxwell was so confident that he went around and boasted of victory. Said he: "I have assurances from the delegates that the resolution in favor of repealing the desert land law will be adopted, and I believe similar action will be taken regarding the timber and stone act."

But the congress entirely ignored the Maxwell resolution, leaving that gentleman up in the clouds with nothing to stand on. Instead, the congress passed a resolution, offered by Congressman J. C. Needham, of Modesto, Cal., calling upon Congress to modify the land laws so as to save the remaining public lands for actual settlers, who will found homes and live upon said lands. It is reported that Maxwell declined to vote on this resolution.

OGDEN TABERNACLE—EXTERIOR.

There are some who insist that the design in securing several hundred more delegates than the constitution permitted was calculated to help Maxwell "pack" the congress. This idea is intensified by the bitter accusations hurled at the friends of the people who opposed the designs of land grabbers to repeal all the land laws and seize upon the whole public domain. These denunciations came principally from the allies and co-workers with Maxwell, Congressman Reeder, of Kansas, and Attorney-General Donovan, of Montana. Even the president, Senator Clark, was deceived by their specious presentations of the case and fancied them to be real friends of the homeless instead of mere corporation lawyers, as G. L. Miller, of Kansas, designated Maxwell.

OGDEN TABERNACLE—INTERIOR.

Be that as it may, if Maxwell undertook the job of packing the congress, it was too much for him, and he was hoist by his own petard.

The last official act of the congress on Friday, September 18, was the selection of El Paso, Tex., as the place of holding the Twelfth National Congress, in

1904. This selection was made unanimous after the claims of Idaho and other states were duly considered, the fact being that the opportunity of showing the world the various systems of ancient and modern irrigation was too valuable, too much of an object lesson to be neglected.

one of colonization of the arid and semi-arid lands, were discussed by the most expert men in the world, and their views either presented to the congress orally or specially prepared to be inserted in the official report and given to the world as a text-book well worth the careful study of every farmer, whether he practices irri-

BIRDS-EYE VIEW—PART OF OGDEN CITY.

In all there were eight sessions of the congress, two—a morning and afternoon—on each of the four days of its deliberations. The meager results of these sessions, so far as official action is concerned, should

gation or not. Limited space forbids us to give even a list of the valuable papers read and offered the congress, or to supply at this time a list of the names of the authors, but it is the intention of THE IRRIGATION

VIEW IN OGDEN CANYON SHOWING OGDEN RIVER.
Its waters have redeemed a desert area as large as Rhode Island; also furnish electric power for Salt Lake and Ogden.

not be regarded as all the work done by this congress. Whatever there is of new, advanced thought on the subjects of irrigation, forestry, and their cognate subjects of water storage, reclamation of desert lands, tree culture and crop raising, together with the important

AGE to print in its columns during the coming year the greater part of the matter that was laid before the congress.

There are some—their number is few, but they are noisy—who contend that this Eleventh National Irri-

gation Congress failed to accomplish anything of permanent value or importance. But THE IRRIGATION AGE, while far from agreeing with such a proposition, feels in duty bound to say that there should have been regular committees appointed to investigate the various questions connected with irrigation, the operation of the national irrigation law, frauds upon the public land laws generally, the location of reservoirs, well and water storage basins, forestry and the renewal of forests and maintenance of watersheds. Moreover, a committee to inquire into profitable irrigation, the most productive crops, systems of irrigation and the unification or codification of our diverse laws upon the ownership, appropriation and use of water. A committee on colonization would have proved of incalculable value, for we are upon the border of a great era of small farms.

All these details are within the power and scope of the objects of the National Irrigation Congress, for we do not consider that when it adjourned on Friday, September 18, that adjournment was final, sine die, but its members remained a living force, an influential organization until the twelfth congress at El Paso in 1904 should be regularly organized, ready to receive the report of the committees appointed by the eleventh congress. THE IRRIGATION AGE can not accept the proposition that the only thing accomplished officially by the eleventh congress at Ogden was the selection of an executive board of management, who have full power and authority to arrange a twelfth congress without let or hindrance, and who may or may not re-

"AS IT WAS IN THE BEGINNING."
Vast tracts of such land, growing sage brush, cactus and grease wood, still exist all over the West.

AS IT IS NOW.
Transformation from desert shown above wrought by irrigation.

pudiate whatever counsel shall be given them by those who are so deeply interested in its vigorous action as the irrigators of the country.

The National Irrigation Congress is something more than a mere name, and it has reached its present condition by hard struggling against the obstacles

gress will assume its proper place as a perfected working organization; if not, then there must be one ready that will.

IRRIGATION AND THE NEWSPAPER MEN.

The most far-reaching consequence of the Ogden congress, one that will leave its impress for all time

LOGAN UTAH.
PROPHECY FULFILLED: "The wilderness and the solitary place shall be glad for them, and the desert shall rejoice, and blossom as the rose."—Isaiah 35: 1.

thrown in the way of its very existence. It has been menaced, browbeaten and wheedled by those within its own organization; it has been obliged to fight against the attempts to transform it into a private land scheme by land grabbers and by those who have a greedy eye on

on the minds of the people of the country, was its attractive power to draw from the capital of the nation, Washington, about a score of men, the brightest and best material representing the greatest and most influential newspapers of the nation.

"THEY WERE FED ON GOOD ALFALFA."
Work Horses about to be shipped to Southern Utah for Construction Work on Irrigation Canals.

the millions in the reclamation fund. All of these it has had to combat, and it has now defeated them, but has not yet rooted them out, perhaps "smoked out" would better express the idea, but at El Paso the con-

Said Major Carson, of the New York *Times*, the dean of the Washington newspaper corps, in a speech before the Eleventh National Irrigation Congress, alluding to this trip: "We were offered an opportunity to

see a large portion of the arid lands of the West, to see what was being done and what has been already accomplished through the agency of irrigation in the work of irrigation. * * * The money value of the results has reached figures that would stagger persons who have not given this subject study and investigation."

Coming from men accustomed to deal with hard facts, divested of all sentiment, the opinions of these newspaper men possess an intrinsic value no other set of men could give the question of irrigation. The subject was somewhat cloudy to them, but seeing with their own eyes the magnificence of the great West, their pen-

READY FOR THE REAPER.
Wheat field near Salt Lake City, Utah.

Evidences multiplied as the newspaper men advanced into the arid and reclaimed region, until Major Carson, speaking for his brethren, declared, referring to the national irrigation act: "In my judgment no act has ever been passed by Congress that will be so far-reaching in its results, so beneficial to the nation and which will do more to increase the astonishment of the world at the power, the greatness and the resourcefulness of the American people."

eils moved with a common impulse to impart the truth to the world, and it will be many days before their amazement and admiration will be spent. They discovered a new world, a vast fruitful empire, and they never tire of depicting its glories. They are advertising land schemes, for their impulses are patriotic, and they rejoice at having seen the marvelous greatness of a hitherto undreamed of empire, one unknown hitherto to the people of the East.

"AND THE TASSELS ON THE CORN."
Snap shot near Agricultural College, Cache Valley, Utah.

PRACTICAL SIDE OF THE CONGRESS.

It will be a long time before the smoke of the Eleventh National Irrigation Congress, held at Ogden, Utah, in the year 1903, shall have been sufficiently cleared away to perceive the real work that was done by it. Its direct benefit is not small, but its indirect service to the cause of irrigation will prove incalculable. It was earnest enough to preserve the integrity of its organization, strong enough to draw from the great center of the nation's government the most enlightened men of the country who could not resist the desire to personally see what all "this palaver is about," and it added to its work a practical illustration of the value and profit of irrigation, and the enormous possibilities of reclaimed desert lands.

It was the fruit and produce exhibit of the Eleventh National Irrigation Congress which constitutes the cap sheaf of its wise forethought in making a showing that would express more than volumes of talk and print. The display was one that the world entire can not rival and to the stranger to the irrigated manor born it was small wonder that he stood amazed at the sight of produces that are never seen outside of the domain of the farmer of reclaimed desert land. Words were inadequate to express his astonishment, exclamations only relieving him from the idea that he was dreaming. The wonderful showing demonstrates without need of further argument the enormous and unlimited resources of the arid West, when reclaimed by irrigation, and it does it in a more convincing and

READY FOR THE MARKET.
A bunch of spring lambs, on the way to the stock yards.

A CORNER IN SUGAR.
Small section of beet sheds at one of the Western sugar factories.

forcible manner than oratory or statistics. The impressions made are ineffaceable, and those who saw will never tire of relating their experiences.

There were four loving cups, valued at $500 each, offered as grand prizes. That offered by Senator W. A. Clark, of Montana, for the best general collection of fresh fruits, open to all, was won by the state of Idaho. A cup of similar kind and value, offered by H. C. Havemeyer on behalf of the American Sugar Refining Company for the best sugar beets grown under irrigation, was awarded to Mr. A. Rhodes, a farmer of Garland, Box Elder county, Utah, whose samples averaged 93. The similar kind of cup offered by the Pabst Brewing Company, of Milwaukee, for the best barley exhibit from irrigated lands, was awarded to the Manhattan Malting Company, of Manhattan, Mont. The similar prize cup offered by the Anheuser Brewing Company, of St. Louis, for the best hops exhibit, was awarded to McNeff Bros., of North Yakima, Wash. Other prizes in the shape of gold medals and cash were offered for individuals and firms, and one of a gold medal and fifty dollars in cash for the best display of commercially packed fruits. All of these prizes, when awarded, received the applause of those who were disappointed, the merits of the award being fully and heartily recognized. THE IRRIGATION AGE will take pleasure in referring to them specially when space permits. All of the arid and semi-arid states covered by the national irrigation law, and some that are not, vied with one another to make this exhibition of fruit and produce from whilom desert lands, the greatest and most remarkable ever held in the world.

STATES REPRESENTED AT THE CONGRESS.

The following is a list, as near as can be determined without an official report, which will appear in a short time of the states represented and the voting strength, limiting the representation to twenty for each state, as provided in the constitution:

Alabama	1	New Mexico	14
Arizona	20	New York	2
Arkansas	4	North Dakota	6
California	20	Oklahoma	4
Colorado	20	Oregon	20
District of Columbia	2	Pennsylvania	1
Idaho	20	South Dakota	10
Illinois	14	Texas	20
Iowa	9	Utah	20
Kansas	20	Virginia	2
Michigan	1	Washington	20
Minnesota	20	Wisconsin	8
Missouri	4	Wyoming	20
Montana	20		
Nebraska	20	Total	362
Nevada	19		

To this list should be added the state of Vermont, which came in after the report of the committee was presented. It will appear from this list that thirty of the United States are interested in the question of irrigation, and it may fairly be predicted that every state in the Union will be represented at El Paso in 1904, when the Twelfth National Irrigation Congress meets.

NEW OFFICERS CHOSEN.

The following is a list of the new officers of the Twelfth National Irrigation Congress to meet at El Paso in 1904:

President—Senator W. A. Clark, Montana.
First Vice-President—L. W. Shurtliff, Utah.
Second Vice-President—W. C. Johnson, Colorado.
Third Vice-President—John Hall, Texas.
Secretary—H. B. Maxson, Nevada.

State Vice-Presidents—Arizona, A. J. Chandler; Arkansas, William S. Mitchell; California, Scipio Craig; Colorado, B. F. Rockafellow; Iowa, W. C. Howell; Idaho, J. H. Brady; Illinois, W. A. Marrifield; Louisiana, W. W. Doson; Kansas, J. C. Starr; Minnesota, Jesse E. Northrup; Missouri, Thomas Knight; Montana, Henry Altenbrand; Nevada, J. E. Stubbs; Nebraska; T. C. Paterson; New Mexico, L. Bradford Prince; New York, Wilber F. Wakeman; North Dakota, N. G. Larrimore; Oklahoma, W. T. Little; Oregon, Thomas G. Hailey; Pennsylvania, J. H. Kurtz; South Dakota, A. W. Ewart; Texas, John B. Goodhue; Utah, John Henry Smith; Virginia, H. B. Chermside; Washington, W. L. Benham; Wisconsin, Delbert Utter; Wyoming, Fenimore Chatterton.

Executive Committee — Arizona, D. A. Fowler; Arkansas, J. A. Van Etten; California, C. B. Booth; Colorado, C. E. Wantland; Idaho, F. R. Reed; Illinois, F. C. Tapping; Iowa, H. C. Wallace; Louisiana, Tom Richardson; Kansas, C. A. Schneider; Minnesota, Thomas Shaw; Missouri, J. W. Gregory; Montana, Herbert Strain; Nevada, P. A. McCarren; Nebraska, F. V. Meagley; New York, Freeman G. Palmer; New Mexico, G. A. Richardson; North Dakota, D. E. Willard; Oregon, Malcolm A. Moody; Oklahoma, Joseph B. Thoburn; Pennsylvania, James M. Lightner; South Dakota, Wesley A. Stewart; Texas, J. A. Smith; Utah, Fred J. Kiesel; Virginia, W. H. Beal; Washington, O. A. Fletcher; Wisconsin, Clark Gapen; Wyoming, Clarence T. Johnston.

CONVENTION OF ENGINEERS.

The meeting of the engineers of the reclamation service of the United States government was simultaneous with the meeting of the Eleventh National Irrigation Congress, of which body the engineers are members and enthusiastic delegates. Their meetings were held early and late, so as to enable the members to attend the congress, and their work was highly practical, being the comparison and discussion of actual results in the field, and the working of the national irrigation law.

There were gathered in Ogden twenty-nine of the leading men in the department who met to compile the results of their labors for report to the government and for an interchange of ideas. It is customary for the members of the corps to report singly to the department at Washington, but on account of the importance of the National Irrigation Congress they were ordered to attend. This meeting was of all the greater importance, as it was the first time the government engineers have had an opportunity for a joint meeting and a general presentation of their work.

Their discussions extended over every possible detail of the working of the national irrigation law, the reclamation of desert lands, the preservation and utilization of forests, artesian wells, reservoirs, methods of storing and saving water, and all these discussions were illustrated by practical experiences, a resumé of which could not be given here with justice to the subjects, but it is the design of THE IRRIGATION AGE to give them to its readers at the earliest possible opportunity, as practical information of the highest value to irrigators. The meeting of these most prominent engineers in the service of the government was well-timed, and it brought the government of Washington in direct contact with the mass of western irrigators; indeed, the engineers invited the co-operation of the irrigators.

REMINISCENCES OF THE XIth CONGRESS.

THE CODDLING MOTH AND THE PRONOUN "I."

The Coddling Moth is a dangerous bird,
He's as bad as the pronoun "I";
And the outside of the home he steals
Is fair, but inside—Oh, my!
Beware of the Coddling Moth in the heart
Of the outside fair-looking fruit;
Beware of the pronoun "I" that takes
The heart and the home to boot.
Spray both of them well with killing stuff,
Asphyxiate them both till they die,
For nothing destroys the farms of the West
So quick as that moth and that "I."

The only irrigation some of the eastern delegates knew anything about was that procured at the bar.

Last words of the president of the Congress: "Let's irrigate." Resolution unanimously adopted.

"What's a sombrero?" asked a Dakota delegate of an El Paso man. "It means next Congress at El Paso," was all the answer he could make.

Definition—What is an apostle of irrigation? Answer—The man who was opposed to national irrigation but now finds money in changing his religion.

The delegate who offered a resolution denouncing the outrages in Bulgaria was appointed a committee of one to go there and stop them.

California is keeping mum, but one of the Fresno delegates let out the fact that they were going to beat Utah or bust.

The new officers of the National Irrigation Congress were elected by acclamation. President Clark and Secretary Maxon being re-elected.

The Dawson county (Neb.) delegation was a good one and Brother Meagley is entitled to credit for his work in inducing so many to come.

Secretary Maxson's duties heretofore were performed to the satisfaction of every delegate, and, although arduous and many, he never faltered.

The only fault found with the Model Irrigation Farm was, it wasn't big enough for all the delegates to send for their families and settle down on it.

Eleven carloads of delegates and visitors visited the granary of Utah, the great Cache valley, and took notes of the amazing productiveness they did not believe possible until they saw it under their own eyes.

Judge L. W. Shurtliff, first vice-president, is known to every one as a man of the most sterling ability and enthusiasm in the cause of irrigation, and brings to his office that experience which will lend success to the twelfth congress.

Query—If there were no money in the reclamation fund, would the corporation lawyers labor so hard to have the land laws repealed?

Answer—Well, sixteen millions now and more to come are worth trying to get—not?

Mr. John Hall, third vice-president, formerly of Syracuse, Kans., but now of Lampasas, Tex., was a happy choice and brings to his office experience and ability. Moreover, he is from Texas, which means much, the congress to be held at El Paso.

Dr. T. S. Wadsworth, of Morgan City, Utah, was the oldest delegate. He confesses to eighty-three years, but looks to be only sixty, and can jump nine feet from a standing start. One of the results of irrigation, so he says.

Senator Clark's devotion to his duties as presiding officer of the eleventh congress, and the facility and justice with which he handled the mass of questions coming up before him was as marked as the fact that he was always in his place, ready to serve the congress.

Washington correspondent, attempting to be funny at expense of Idaho man, poking at big prize pumpkin: "I say, they raise bigger apples than that where I came from." Idaho man, with contempt.: "Apples, is it? Them's not apples, them's huckleberries."

Mr. Jabez Short, of Montana, expressed astonishment that forty inches of water on one acre of grapes would produce enough wine to irrigate successfully one hundred men. each five feet ten in height. "Thar's somethin' in this irrigation business I don't ketch on to," was his remark.

New York delegate talking with Governor Prince: "You say, Governor, that you can make anything grow with irrigation?"

Governor Prince: "I do most emphatically."

New Yorker: "Then why don't you use it as a hair wash?"

An eastern agricultural writer was moved to say, "I can look forward and see the time when scientific irrigation will become a necessity in the East. It will be a necessity where it is a profit in the West, and with it the eastern farmer can not only double his crops, but guarantee a productive yield every year."

"Best cigar I ever smoked," said the man from Virginia. The Oregon man snickered. "What you laughing about?" demanded the Virginian. "Oh, nothing, but that cigar is made of fresh cured Oregon beet leaf." Virginian puffs away for a while, then: "Well, it goes to show what irrigation will do."

At the Banquet and Ball. Cowboy delegate to silk-hatter from Boston: "Do you dance, pardner?" Silk-hatter moves away haughtily. Cowboy delegate draws and shoots off boot heels. "I asked you, pardner, do you dance?" Silk-hatter responds by jumping about to avoid the bullets: "There are circumstances under which I feel disposed to practice the art of terpsichore." Cowboy to friend later on: "I couldn't git the cuss to say whether he danced or not."

Dawson county? Why, Dawson county came sailing into Ogden by the carload, with banners flying and cheers for everything and everybody. Hurrah for Dawson county! They talk about two carloads for El Paso. If there is any place on earth where a man can live and be happy it is in Dawson county, Neb.

Mr. E. S. Carroll, city editor of the Ogden *Daily Standard,* deserves credit for materially aiding in making the Ogden congress a success by his contributions to the press during the year previous. In addition to that, he managed to handle all the matter rushed at him for the columns of his paper and to supply the Associated Press with a large volume of it.

W. C. Johnson, of Denver, second vice-president, is a man of strong personality and is active in all irrigation questions. His selection is very fortunate, from the fact that he will be in a position to keep an eye on the maneuvering of Mr. George H. Maxwell and be able to defeat his schemes.

Everything seemed to "pour" at Ogden, if the newspaper accounts are any guide. The delegates "poured" into the city. They "poured" out of the city. They "poured" into the halls, and "poured" and "poured" into and out of everything. There is not the slightest mention of their "pouring" anything into themselves. That would have been a regular "downpour."

Man from Colorado to Vermont delegate: "Pooh, what do you know about irrigation?"

Man from Vermont: "Enough to know that when a thing is dry it has to be moistened before it's good for anything."

Colorado delegate: "Come along then and nominate your liquid."

Argument continued at the bar reservoir.

The El Paso-Mexican band probably did the business for that city. They captured the city as soon as they arrived. With the band playing "Hiawatha" and the whole Texas delegation forming a background of yells and cow-punching war whoops, there was nothing that could be done but surrender. A delegate declared that he would not care so much about the noise if any other tune than "Hiawatha" had been played. "That," quoth he, "is worse than trying to raise a crop without irrigation—an awful strain on the mind."

Many comments have been heard recently on the manner in which George H. Maxwell advertises himself and his own association through his personal press bureau, and, as an illustration of his short-sightedness, we may mention a synopsis of the speech Mr. Maxwell delivered at the congress at Ogden. Interspersed in the printed outline of this speech, which was mailed to the leading papers throughout the country three weeks before it was delivered, were lines of this character: "He stirred his hearers," "applause," etc., etc. How Maxwell could stir his hearers or elicit applause from an audience three weeks prior to the delivery of his speech is more than many of us may understand and causes us to wonder if the man's vanity will lead him to more ridiculous situations than those in which he has already posed. George, *George!* We did not note any sign of tumultuous disorder during the time you were speaking.

Mr. Gifford Pinchot, chief forester of the United States, stated to the editor of IRRIGATION AGE that this journal had published something about him which was not true, and, in view of the fact that we have no recollection of ever having published the name of this gentleman, we are at a loss to understand his position. Mr. Pinchot may as well understand, however, that THE AGE will publish his name whenever its editor sees fit, whether it be in the form of a compliment on good work done, or a criticism on mistakes made in the past, or those which may possibly develop in the future.

ED. S. RALPH.

Some time ago the editor of IRRIGATION AGE was looking over a lot of half-tones in the office of a leading publishers' magazine, and among them found one of Mr. Ed. S. Ralph, which had been used in that journal when Mr. Ralph was an ordinary "printer, artist, critic," and before he had started his well known advertising agency in Springfield, Ohio. Those who read periodicals printed in the interest of newspaper makers and printers already know Ed. Ralph by reputation, but

ED. S. RALPH,
Manager Advertising Department American Seeding-Machine Co., Springfield.

to those who have not known him, we will say that it would be difficult to find a brighter man in the whole field of general advertising.

When Frank Johnson, of the American Seeding Machine Company, became general sales manager of that mammoth organization, he looked around to locate a man to fill the important position of advertising manager, and found him in the person whose likeness is herewith shown, Mr. Ed. S. Ralph.

The readers of IRRIGATION AGE have an opportunity of securing the finest almanac in the world by spending one cent for a postal card. This book of seventy-six pages contains breeding tables, veterinary recipes, grain table whereby a farmer may keep a record of all grain raised and sold. The housewife and children will also be interested as it contains valuable cooking recipes and household hints, weather forecasts and all games are explained. You can secure all this by sending a postal card to The American Seeding Machine Company, Springfield, Ohio, mentioning the offer in IRRIGATION AGE. No attention will be paid to your request unless you mention IRRIGATION AGE, as this is a special offer.

SILAS THORNAPPLE'S OPINIONS.

CONSARNIN' "OZONE GEORGE."

"I says to Priscilly—thet's my wife—last night, after hevin' greased my boots fur an airly start to cut the corn, 'Priscilly,' says I, 'we're a-goin to hev good times in this country in a few weeks. The rascals is a-goin' to be turned out, ever gol durned one of 'em. Thar ain't a-goin' to be any more swindlin', not any more land stealin'. Everybody ez wants a home in the great sunburned West is a-goin' to git one an' not be chouseled out of it by any syndicate, or land grabber ez hez alus been the custom hereuntofore. We're all a-goin' to jine in a enormous Sabbath school, with gals ez hev frizzled bangs, an' fellers with smooth, oiled locks ez expounders uv the Scriptures uv the new dispensation, an' a head deacon to take up the collections fur the benighted heathen uv Arizony, Californy, Utah, New Mexico, Texas, an' other unconvarted lands ez are obfusticated in darkness an' don't even know how to irrigate.'

"'Will thet interfere with our farmin', Silas?' asked Priscilly, anxious like, her flustrated appearance givin' me the impression thet she hed been a-saltin' the butter again pound fur pound.

"'No, I guess not,' said I, without lookin' at her fur fear she would betray herself, 'not unless they find out what you've ben a-doin', but ez fur ez the farm is concarned, it will hev to depend upon the size uv the mortgage I shell hev to put on it to pay my share uv the contributions to the holy crusade.'

"'Good land!' exclaimed Priscilly, 'a crusade? Do you mean to tell me thet they're a-goin' to drive the Turks out uv Arizony, an' them other places?"

"'Wuss'n thet,' says I. 'They're a-goin' to purify a dishonest government, sweep off uv the face uv the earth a horde uv scoundrelly officials ez is lettin' the sharks steal twenty-five millions uv acres uv good rich land from the government, repeal all the pernicious an' outrageous land laws an' restore the entire public domain to the fellers ez is in on the game.

"'Silas Thornapple, can you look me in the eye an' say that this great an' glorius government about which Theodore Roosevelt, our noble president, sheds tears every time he mentions it needs purifyin', an' thet it is composed of sich a lot uv rascals ez will permit anybody to squander twenty-five millions uv acres of its dearly bought land without their a-doin' anythin' to 'em to stop it?' An' Priscilly leant back in her rocker an' heaved a deep sigh ez she wiped the gatherin' tears from her eyes with the stockin' she was a-knittin'.

"'It grieves me to say thet it is the gospel truth, Priscilly, uttered by a man who would not lie, a man who hevin' been in the inside is calkerlated to know more about it than anybody else. It is too true, Priscilly, fur I read it in print, in a speech delivered by Ozone George, published in the newspapers several weeks before he actually spoke it in public out uv his own mouth. I also received a letter from him, beggin' me in the name uv humanity to send in my contribution so thet he might put a stop to it an' save the country. Do you suppose such a man could be deceived about the sufferin' uv the people uv this great nation? No, why, Priscilly, he hed his name up fur vice-president. He is a real, genuine, cheery-tree George Washington; ain't his name George?

"'Says Ozone George, in his fervent philanthropic appeal: "Friends, Romans, Countrymen. Rise up an' resoom your long since deceased rights through me. This rotten government is no longer able to protect you an' your homes. Your noble forests are a-goin' up into smoke with no man to stop it; my friends Theodore is too busy reducin' his fat for the next campaign to help you; he is permittin' several kinds of villyans to steal an' otherwise conceal about their persons twenty-five millions uv acres uv land per annum. Ten years ago when I began this crusade against this villanous robbery thar wuz only one hundred millions uv acres uv the great public domain remainin' fur homes, and at the rate uv twenty-five millions unlawfully taken away, it will not last much longer. I appeal to you as patriotic citizens, friends uv humanity, etcetery, to rise up an' help me to stop this desecration. I am the only man who can stop it, an', by lightnin', I will stop it, pervided you send in your contributions at an early date. Christmas is comin' an' I must have the money or all will be lost.

"'"Do you want to be saved, friends, Romans, countrymen, country Jakes? All you thet is weary an' heavy laden with land grabbin' concerns, come unto me an' I—I will give you rest. Come an' rest on my noble buzzom, an' while you are a-reposin' thar, let me git my hands into your pockets fur the wherewith to carry on this glorious job and make you eternally happy. I will stop these wrongs, I will wipe away your every tear, I will relieve you of your spare change, I will take a mortgage on your ranch if you haven't got the cash. Better a mortgage to me than to let the land sharks get your ranch without leavin 'you so much ez an equity uv redemption.'

"'Is he succeedin?' asked Priscilly.

"'Succeedin' in what?' I retorted. 'Ef you mean succeedin' in stoppin' the land stealin', I am obleeged to confess that after several years of determined collection of contributions he hezn't made ez much impression on it ez I do on a presidential election. But ef you mean succeedin' in gittin' mortgages an' contributions, my answer is the sayin' uv Lawyer Goodwin in the hoss trade, where Deacon Jones put a chestnut burr under his old crowbait's tail to make him prance around like a three-year-old, an' then traded him even for Mr. Timmin's thoroughbred pacer; says Lawyer Goodwin: "Your honor, with all due courtesy to this court, permit me to say that all the suckers are not yet dead."'

"'Who is this Ozone George, an' where does he live?' inquired Priscilly.

"'Nobody don't seem to know exactly,' said I. 'It is my private opinion thet he is an ancient gold brick like the one I got in Chicago when I bought the Masonic Temple at a bargain from a friendly feller I met thar, only this one has been scoured an' shined up with a new kind uv polishin' powder—'

"'Yes, I've noticed thet every little while thar is a new brand on the market, but it is the same old one under a new name,' remarked Priscilly.'

"'Ez to whar he lives,' I continued, without noticin' the interruption, 'I dunno, I don't guess he knows himself, thar's so many states callin' him "distinguished son." It is believed by some thet he hez the super-

natural power uv livin' in several different places to onct—he gits his hooks in wherever he finds an openin'.'

"'Silas, I tremble fur our little ranch,' said Priscilly, with a womanly whimper.

"'You may well be skeered,' said I, gloomily, 'fur he'll git a mortgage on it without our knowin' it ef he comes around here fur contributions. He must hev 'em, Priscilly, fur the expenses uv savin' the land fur the homeless is enormous, almost ez much ez the land is wuth, but he says it is a question of principle an' that settles all doubts. I think, myself, that his pussonal magnetism amounts to hypnotism. Why, Priscilly, a short time ago he came within several miles uv bein' unanimously nominated for vice-president, an' the only things that pervented him wuz the fac' thet there wuzn't any nominatin' convention in progress, an' thet he wuz a resident uv so many different states thet it was impossible to tell whether he wuz the favorite son uv any uv them. He can go on collectin' contributions, an' get a bigger pile, fur he hez only to present his card with "Ex-Candidate for the Vice-Presidency of the United States" on it an' every feller will git obfusticated an' reach fur his pocket-book. The vice-president ain't it alongside of this job.'"

A LESSON FROM ITALY.

The following letter from Elwood Mead to Mr. Fred J. Kiesel, chairman of the Executive Committee Eleventh National Irrigation Congress, and which THE IRRIGATION AGE is permitted to publish, contains some very useful and entertaining information on the subject of irrigation in Italy. Mr. Mead is an invaluable ally in the cause of irrigation, and his absence from the Ogden Congress was regretted by all who know his expert value.—ED.

MILAN, ITALY, August 24, 1903.

Mr. Fred J. Kiesel, Chairman Executive Committee, National Irrigation Congress, Ogden, Utah.

DEAR SIR:

I regret very much that I am compelled to write this letter instead of meeting in person with my old friends and neighbors of Ogden and Utah and the friends of irrigation gathered in your city. I have, however, been unable, since the receipt of your cable, to get a berth in any ship which would land me in America in time. The large number of Americans in Europe hurrying home early in September has more than equaled the capacity of the ships leaving this side. My disappointment is made the keener because I feel sure your efforts and the importance of the interests to be considered are certain to bring together one of the largest gatherings of men interested in the reclamation of the West ever assembled and result in discussions to which I should enjoy listening.

The purpose of my visit to Europe is to study its irrigation methods, and laws from the standpoint of the West: to endeavor, in the light of my twenty years' experience in the United States, to gather some facts and learn some lessons which would help solve the questions already created by our use of streams in irrigation and promote the extension of irrigation in the future. Thanks to the aid of our representatives abroad and the courtesy of every one with whom I have come in contact here, I have been able to learn much not heretofore published and which has had for me an absorbing interest. I do not think I can do better in this letter than outline some of its lessons.

The growth in value of rivers and water courses is one of the most significant economic facts of the past quarter of a century. It arises from three causes: The extension of irrigation in both humid and arid districts, the growing demand of cities and towns for water for domestic and industrial uses, and last, but not least, the generation of power. The ability to transmit power long distances cheaply and effectively by electricity is revolutionizing industrial methods in many parts of the world. Especially is this true in Switzerland and Italy, where every cataract has a market or potential value not dreamed of forty or even twenty years ago. Streams are coming to have a definite commercial value just as mines of coal or iron. Water is ceasing to be regarded like air, free to everybody, because there is not enough for everybody.

In Europe two things have become manifest from these changes. The first is the importance of preventing waste and loss. The second is the overshadowing importance of having definite and stable titles to water. In Italy, old crooked, leaky canals are being straightened and cemented at enormous cost. Waste and seepage water is being gathered into drainage canals and sold to other irrigators. The Government is aiding in this by offering large prizes for the best completed works and by subsidies to some of large cost. Farmers are economizing by using water in rotation so that the actual duty of water in Italy today is in many cases double that of any reports published in America.

The need of just and stable titles to water and the importance of protecting them in times of drouth is shown as strikingly in the older countries of Europe as it is with us. Some of the cantons of Switzerland hundreds of years ago gave away rights to streams in a lavish fashion. Now the Government is buying them back to prevent their being absorbed for speculative purposes. A new code of water laws has just been framed by some of the leading experts of the country. In Italy no more perpetual rights are given; all new ones are limited in time, usually to ninety years. Commissions are settling the status of old rights, both to prevent controversies and to give a safe basis for future investments. This is slow, laborious, difficult work, as everyone who has had to do with the right settlement of water titles in America knows. What it means to irrigators to have this well done was shown to me this summer by two examples. On one river where rights have been defined for a quarter of a century, I did not meet a farmer or talk to an irrigation officer who had a complaint or a fear that he would not have his proper share of the common supply, yet 27,000 cubic feet of water per second was being used by irrigators and 13,000 farmers were being supplied from one canal. On another river where the settlement of rights is now going on, the books of a co-operative irrigation society show that for many years their expenses for litigation have been greater than for all their other expenses combined. Water has cost these farmers just twice as much as it ought to and as it will when their rights are defined. They were ready to agree to the German proverb that "A lawsuit over water is worse than a lawsuit over a horse."

I am coming home strengthened in my belief that irrigation has a wide field of usefulness in the eastern part of the United States and that it will be adopted

wherever water can be had and distributed at reasonable cost. Especially is this true of the Southern States with their long, hot summers. In Italy $6,000,000 has been spent on one canal system to water a country where the unirrigated fields are as green and luxuriant today as the prairies of Iowa and Illinois, but they are not nearly so opulent in vegetation as the irrigated fields near by. The crops grown are corn, wheat, hay and mulberry leaves, all except the last product of our Middle State farms. It pays. The irrigated farm is far more valuable than the unirrigated one.

I shall come home believing as fully as when I left in the rapid development of the great possibilities of the West through private enterprise and through national aid, in the need and value of the investigations of the United States Geological Survey, the Office of Experiment Stations of the Agricultural Department, and the experiment stations of the several states, and with a renewed respect for the work of the state irrigation bureau, the significance and value of which will be far more apparent fifty years hence. Utah, like Venice and Panama, owes everything to water, and is fortunate in having an excellent code of laws and a painstaking and capable administrator.

Sincerely yours,

ELWOOD MEAD.

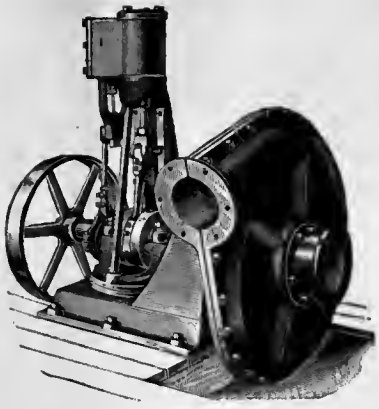
Farming in Colorado, Utah and New Mexico.

The farmer who contemplates changing his location should look well into the subject of irrigation. Before making a trip of investigation there is no better way to secure advance information than by writing to those most interested in the settlement of unoccupied lands. Several publications, giving valuable information in regard to the agricultural, horticultural and live stock interests of this great western section have been prepared by the Denver & Rio Grande and the Rio Grande Western, which should be in the hands of all who desire to become acquainted with the merits of the various localities. Write S. K. Hooper, G. P. & T. A., Denver, Colo.

PROPOSALS FOR DREDGING, ETC.

SEALED PROPOSALS FOR THE DREDGING and other work to be in the construction of the ditches for the Blue Joint Special Drainage District in Henry County, Illinois, will be received by the undersigned until twelve o'clock, noon, of Saturday, October 3d, 1903. Plans and specifications of the work may be had from either the undersigned or Henry Waterman in Geneso, Illinois. Each bid must be accompanied by a certified check or draft for One Hundred Dollars, and may be left with the Commissioners or Henry Waterman. The right is reserved to reject any and all bids.

BYRON BEERS, CHARLES SAND, J. T. MILLER, } Commissioners of the Blue Joint Special Drainage District of Henry County, Illinois.



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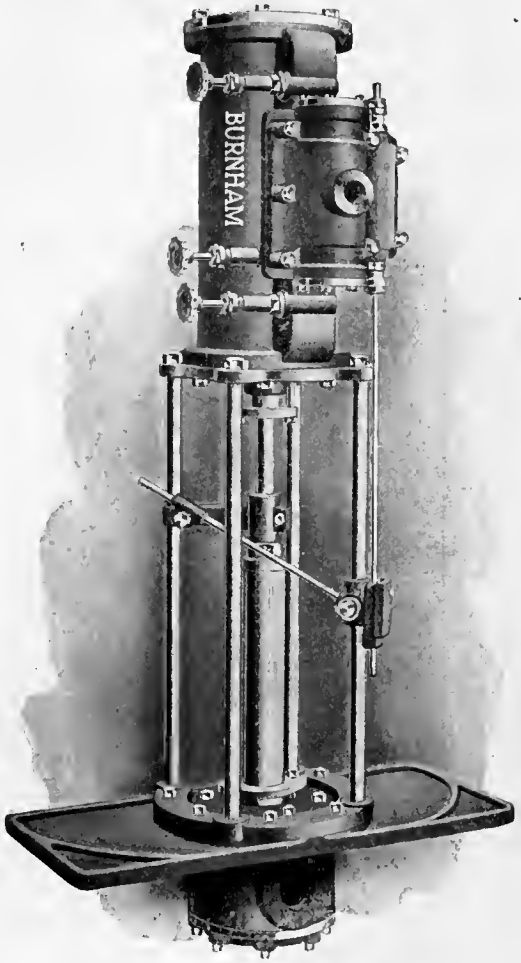

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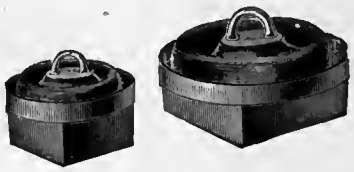

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