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УРАГАН ОДИСС
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Bind 27-30 THE
IRRIGATION AGE

With Which Is Merged

CHICAGO, ILLINOIS

National
Land and Irrigation
Journal

NOVEMBER, 1914

Vol. XXX

No. 1

TITLE REGISTERED U.S. PATENT OFFICE

Modern Excavating Machinery



Improved Type A machine digging ditch with 8 foot bottom.
 $1\frac{1}{2}$ to 1 slopes. 10 feet deep, with berm of 8 feet.

Aust. n Drainage Excavator
Austin Ditching Machine
Austin Farm Tile Ditcher
Austin Trenching Machine

FOR DIGGING

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n. 1914 - Oct. 1915 -

Canals for Irrigation and Drainage.
Small Open Ditches.
Farm Tile Trenches.
Sewers, Water and Gas Pipe Lines.

Send for Catalogues "S" and No. 200

F. C. Austin Drainage Excavator Company

Railway Exchange, Chicago, Ill.

AGENTS WANTED IN OPEN TERRITORY



Morris Machine Works

BALDWINSVILLE, N. Y.

The cut illustrating this advertisement represents a pair of 48" Double Suction Pumps directly connected to Horizontal Compound Engine. This plant is doing irrigating work in Texas. We have others. Let us figure with you for a Pump to do your work. Get our Catalog.

New York Office, 39-41 Cortlandt Street

H. A. PAINE, Houston, Texas

HENION & HUBBELL
217 North Jefferson St., Chicago

WHAT THE PROSPECTIVE SETTLER SHOULD KNOW

Thomas Forsyth Hunt and others connected with the College of Agriculture of the University of California have written

Myers Power Pumps

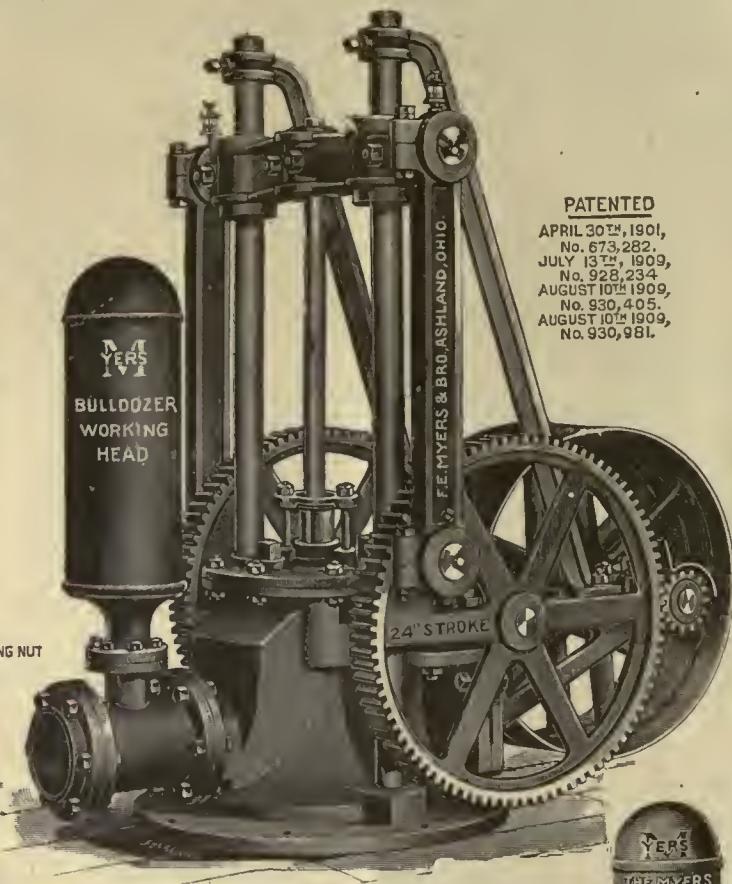
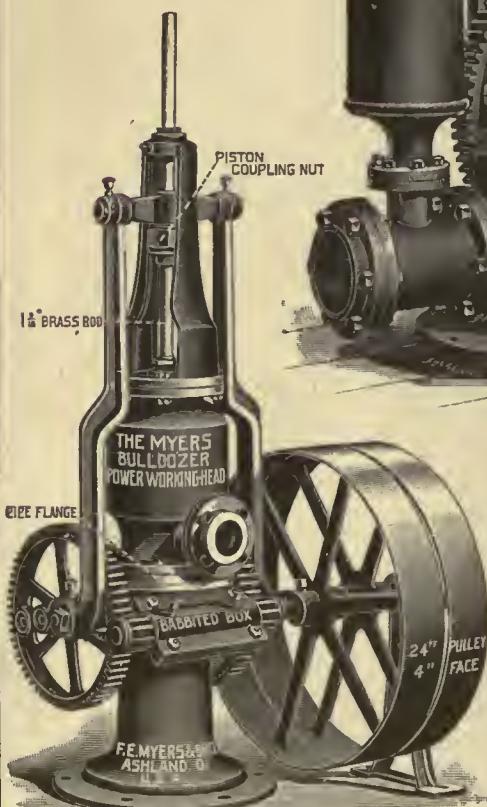
Working Heads, Pumping Jacks, Cylinders, Etc.

PATENTED

The Myers
Bulldozer Power
Working Heads
For Deep Wells

Length of Stroke
5 to 24 inches

Size of Discharge
Up to 6 inches



PATENTED
APRIL 30TH, 1901,
No. 673,282.
JULY 13TH, 1909,
No. 928,234.
AUGUST 10TH 1909,
No. 930,405.
AUGUST 10TH 1909,
No. 930,981.

PATENTED

The Myers
Bulldozer
Power Pumps
For
Shallow Wells

Double Acting
Length of
Stroke
5 to 20 inches

Size of
Cylinders
2 1/2 to 6 inches

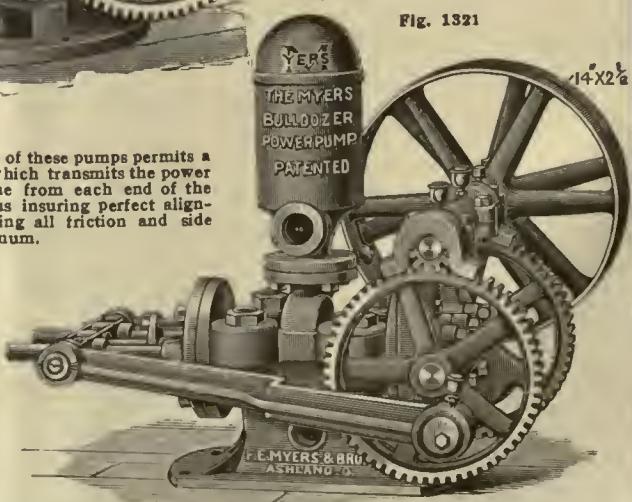
Size of
Discharge
Up to 4 inches

Capacities
600 to 7200 Gallons
per Hour

Fig. 1321

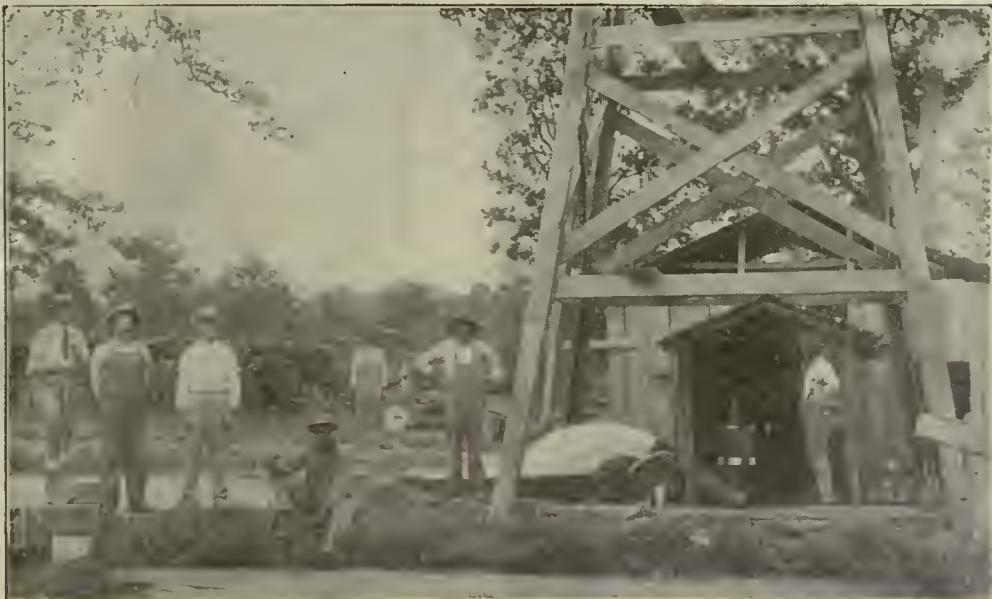
The construction of these pumps permits a double gearing which transmits the power in two lines—one from each end of the same shaft, thus insuring perfect alignment and reducing all friction and side strain to a minimum.

Write
for
Catalogue
and
Prices



F. E. MYERS & BRO., ASHLAND, OHIO
ASHLAND PUMP AND HAY TOOL WORKS

IRRIGATION FROM WELLS



An Arkansas Installation. Layne Patent Screen and Patent Enclosed Line Shaft Centrifugal Pump.

With the twenty-three hundred successful working plants using our system of irrigation, which inoculates and energizes the dormant forces, there is now being produced in previously non-productive districts throughout the United States and in portions of Europe and Asia over eleven million dollars worth of FOOD PRODUCTS ANNUALLY. That our system is not an experiment is forcibly demonstrated by the fact that much of this production is from localities which were arid and barren previous to the introduction of our system.

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LAYNE & BOWLER COMPANY

Address nearest office.

The World's Largest Water Development Company

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There are big opportunities awaiting you in the Great Northwest—a chance to become independent on low priced irrigated land in a new and growing country. These great states comprising "The Zone of Plenty" need men of brain and brawn to develop their immense resources.

Make a Fresh Start in the Bigger Crop States

There is room in this immense empire for nineteen people where there are now but five. These beautifully illustrated 36 page books, with maps, tell all about the low priced irrigated land—its location and the easy terms on which it may be secured. They also contain bona fide experience letters from settlers who took advantage of this opportunity and made good. These books are yours for the asking.

SEND TODAY

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Great Northern Railway, St. Paul, Minn.

Please send me your free book regarding opportunities in

(Name State).....

Name

Town

State



Keep Your Feet Dry While Ditching

"Ball-Band" Rubber Footwear is made for the kind of men who would rather buy one pair of good boots than two or three pairs of ordinary cheaply made goods.

"BALL (Red) BAND"

Being high grade footwear in every particular, it fits more comfortably, wears longer, resists snags and rough ground better and gives all-round satisfaction—at the same time saving you money because of

its low cost per day's wear.
Eight and one-half million men wear "Ball Brand" Rubber Footwear.
Over 50,000 stores sell it.



Look for the Red Ball

Write for our free booklet
"More Days Wear"

It tells you how to get the most out
of your rubber footwear.

**Mishawaka
Woolen Mfg. Co.**
346 Water St.
MISHAWAKA, IND.
"The House That Pays
Millions for Quality."

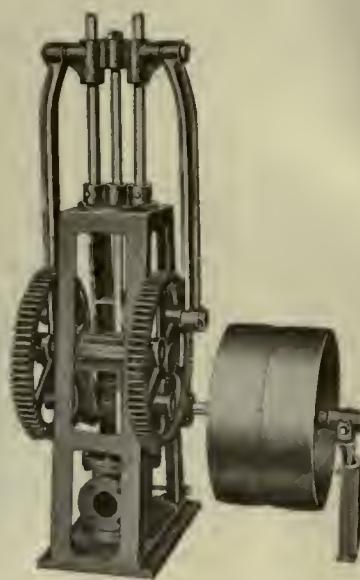
BUCKEYE

Power
Working Heads

DESIGNED especially for
IRRIGATION and pumping large quantities of water from deep wells.

Made in four sizes. Range of stroke, 5 to 24 inches. Size of cylinder can be varied to meet requirements of depth and diameter of well.

The frame is attached to the base of the pump so that it can be hinged back out of the way when the pump rods and valves are being removed.



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Manufactured by
MAST, FOOS & COMPANY
SPRINGFIELD, OHIO

PAYS FOR ITSELF IN ONE MONTH

and Keeps on Saving You Money at the Same Rate Thereafter.

THE RECLAMATION DITCHER

Cuts Canals and Laterals for less than any other machinery—because it plows the dirt out with One Continuous Sweeping Motion.

We guarantee the cost per yard and prove it before you buy.

The J. D. Adams Mfg. Co.
Indianapolis, Ind.



Delays Pay No Dividends. Mail This Coupon Today.

The J. D. Adams Mfg. Co., Indianapolis, Ind.

Below are descriptions of our proposed ditches. What will it cost per cubic yard to make them with the Reclamation Ditcher?

Length	Width in Bottom	Average Depth	Maximum Depth	Minimum Depth	Slope of Sides	Character of Soil

Name _____

Address _____





You Need Reliable Footwear

Why not get the best your money can buy? You save in the long run

Cutter's Cruiser's and Sportman's Boots

will meet your service requirements. This is our No. 106 16" Chocolate Chrome Sporting Boot—Hand made throughout.

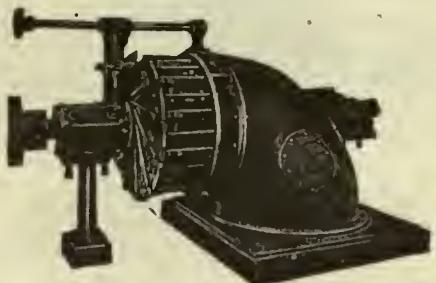
Send today for illustrated booklet describing the Cutter line of Driving, Cruiser and Sporting Boots.

*It
Will Pay
You*

A. A. CUTTER COMPANY

Eau Claire, Wisconsin

SAMSON TURBINE



When the PUMP cannot be direct connected to the turbine shaft, the power is usually transmitted by gears, shafting, etc. On account of the HIGH SPEED of the SAMSON, for a given power, lighter and consequently CHEAPER transmission machinery can be used.

JAMES LEFFEL & CO.
Springfield, Ohio, U. S. A.

316 Lagonda Street

That portion of a water-carrying line which is composed of

LENNON METAL FLUME

requires little or nothing in the way of inspection or maintenance.

Its mechanical construction is theoretically and practically perfect, and its material is



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Write the Nearest Manufacturer for Full Information on Armco-American Ingot Iron Flumes, Culverts, Tanks, Silos, Roofing and Formed Products.



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MONTANA—Coast Culvert & Flume Co., Portland, Oregon.

NEBRASKA—Wahoo,
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SOUTH DAKOTA—Sioux Falls,
Sioux Falls Metal Culvert Co.

TEXAS—El Paso,
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Lone Star Culvert Co.
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WILL IT BE A HEER? OR JUST "AN ENGINE"?



Copyright 1912.
The Heer Engine Co

**PERFECT
BALANCE**

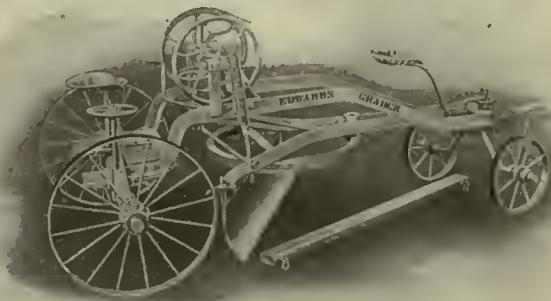
HEER ENGINES STATIONARY PORTABLE TRACTION

Simple, sturdy, strong, saving, steady-powered engines that give electric motor service at half the cost. Built on the two-cylinder opposed principle in heavy duty types for hard work and lots of it. Write for catalog.

THE HEER ENGINE CO., 2011 B St., Portsmouth, O., U.S.A.

10 H. P.
running 600
R.P.M. on an
empty bar-
rel. No
f stenings.

EDWARDS REVERSIBLE 4 HORSE ROAD GRADER



AN UP TO DATE MACHINE FOR BUILDING AND MAINTAINING ROADS

Having a complete line of adjustments it is equally well adapted for making ditches, both for dry land irrigation and rice field work.

I also manufacture THE RURAL ROAD GRADER and IRRIGATION DITCHER, STUMP PULLERS and other machines.

Write for descriptive catalog and prices.

C. D. EDWARDS, Albert Lea, Minn.

Gates and Flumes



The simplest and quickest erected flume joint on the market, consequently lowest in initial and final cost. Can be fabricated in the field on large jobs, effecting a great saving in freight.

We manufacture:

**Main Headgates
Lateral Headgates
Gate Valves
Metal Flumes
Steel or Wood Pipe**

We carry a complete stock of Wire Mesh and Steel Bars for Concrete reinforcement

Designs and estimates furnished on all irrigation structures and supplies.

Write us your requirements and full information will be sent.

Power Pumping Plants—Reasonable

The Fitts Machinery & Construction Co.
Main Office, McPhee Bldg., Denver, Col.

Combines Simplicity with Economy

**WRITE TODAY FOR
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SIMPLICITY and economy, heretofore widely separated in oil engine construction, are now combined with reliability and dependability in the famous

BESSEMER FUEL OIL ENGINE

All the above—just what you have always wanted in an oil engine—are to be found in the Bessemer. Not experimental, but the matured result of years of experience. Two-stroke cycle built with crosshead, thus adding years of life to the engine. 15 to 165 H. P. ready for quick delivery.

THE BESSEMER GAS ENGINE CO.

12 York St. - GROVE CITY, PA.

Gas Engines 5 to 350 H. P.

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Engines
2 to 10
H. P.*



**BESSEMER ENGINES RUNNING TODAY IN
FIFTEEN THOUSAND POWER PLANTS**

Thirtieth Year

THE IRRIGATION AGE

VOL. XXX

CHICAGO, NOVEMBER, 1914.

No. 1

THE IRRIGATION AGE

With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARIO AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

D. H. ANDERSON

PUBLISHER,

Published Monthly at 30 No. Dearborn Street,
CHICAGO

Entered as second-class matter October 3, 1897, at the Postoffice
at Chicago, Ill., under Act of March 3, 1879.

D. H. ANDERSON, Editor

ANNOUNCEMENT.

The "Primer of Hydraulics" is now ready; Price \$2.50.
If ordered in connection with subscription \$2.00.

SUBSCRIPTION PRICE	
To United States Subscribers, Postage Paid,	\$1.00
To Canada and Mexico.	1.50
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.	

Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Associations has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Interesting to Advertisers

It may interest advertisers to know that The Irrigation Age is the only publication in the world having an actual paid in advance circulation among individual irrigators and large irrigation corporations. It is read regularly by all interested in this subject and has readers in all parts of the world. The Irrigation Age is 29 years old and is the pioneer publication of its class in the world.

The Farmer Boy vs. The City Boy

Thoroughly worn out from a year's nerve-racking work in a big city, the writer recently went out into the country to rest. Under four great oak trees on a point jutting out into the river, he pitched his "pup" tent, dug a little furnace in the sod over which he could cook his own meals and prepared to rest. He fished a little, slept fourteen hours a day, ate well, drank cool spring water and meditated much. It was this or doctor bills.

A half a mile away was the farm house, where the kindly, big hearted wife gave him fresh cream and eggs and home made bread, when his supplies ran low. There are three boys on that farm, all clean cut, muscular, handsome fellows, brown as a nut, healthy and happy. It was necessary for the writer to keep in close touch with his business affairs by telephone and letter daily—that is why he was alone in camp instead of being out in the Rockies of Montana, where his wife and baby were spending their vacation. On his daily visit, he had opportunity to see much of the three farmer boys, in their home, in the fields, around the barns and at their chores. He talked much with them. And

as he wandered back to his little tent, he meditated much about them.

How much better off are these boys and practically every other farmer boy than the boys in the cities. How much healthier they are. How much easier is their lot. How much happier they should be.

True they have to get up with the sun. Milking is not easy work. Neither is the work around the barns. The work in the fields is done under the boiling sun. Yes, these might be cited as disadvantages of being a farmer boy.

But the advantages are such as to offset the disadvantages. Out in the fields these boys have no money-grasping boss to drive them; to demand every drop of blood and energy in their brain and bodies in return for the wage he pays them. When they reach the end of a furrow they can stop and rest for a moment or two. If a young rabbit or a gopher crosses their trail, they can jump from their plow and chase the "critter" to their heart's delight. And we do not believe riding on a sulky plow or a cultivator or a mower is the hardest work in the world.

If it rained hard the night before, after milking and the chores are done, there is little work in

the fields that can be done and these boys can go fishing or indulge in other recreations that their hearts might desire.

They are given three good, nourishing, appetizing meals each day and their work makes their appetites worth while. The mother always has some cake or sauce or fruit or some other delicacy in the cupboard or in the cellar, if they want to lunch between meals.

They can go to town occasionally in the evenings, in the buggy or on horseback.

They are not the sons of a rich farmer; just those of a good, substantial, clean citizen, who works with them, who is interested in them, who tries to give them the best of education and other things which a boy wants and likes, that his means afford.

Compare them with the city boy or man. The city boy does not get up so early, 'tis true; but once out of bed, it's generally a hurry-up breakfast, a rush for a street car or train, riding for half an hour to an hour; probably standing up in a stuffy car; then work—and work in the big city means grind, grind, grind; fight, fight, fight. There are a dozen others at your elbow ready to jump into your place the moment you falter; if you show a bit of weakness; if your health breaks down. They are there all the time ready to grab your job. And over you watching your every move is the employer and the bosses he hires, driving, driving, driving.

It is never ending competition and struggle. It is excitement, the battle for dollars, the clash with other men of equal or greater ability that keeps the city man at high tension all day long. He fairly grabs his lunch at noon time, gulps it down with his eye on the clock and rushes back to work. He goes home at night thoroughly exhausted. Two to one the strain of the day or his hurried, unmasticated lunch has destroyed his appetite for the dinner awaiting him. He goes to bed, sleeps hard—too hard, no doubt, and turns out when the alarm clock rings for another day, just like the day before. He finds little time if any for recreation. If he does, his income, even though it is what the farmer boy would consider very large, does not afford him many of the so-called pleasures the big city offers, if he is at all provident. And when opportunity affords, he is the happiest person in the world to get away from it all for a day, out into the country, close to nature.

And yet we found two of these three boys discontented. They are yearning to go to the big city; to "make a place for themselves" in the world.

We admire ambition in any boy. We believe

it should always be fostered, but as a city man who must admit he loves the strain and the strife and the competition of the big town, and who is not at all soured about his lot in this old world, we say to these boys and to all farmer boys and we say it from the bottom of our heart:

"STAY ON THE FARM."

There is lots more real joy to be gotten out of life on the farm than in the city. The farmer boy has a bigger and better chance to "make a place for himself" right on the farm than he has in the city. His opportunities for money-making and accumulating are greater than the average city boy's; so are his opportunities if he wants to enter public life. Of course if he has some particular aptitude for one of the professions, the city may offer a bigger chance. As for just going to the city to work, we say again and even more emphatically:

"STICK TO THE FARM. You'll be lots happier in the end."

It Pays To Clean Up the Farm

Have you cleaned up around the farm this year? Don't you think it would be a good plan to do so? Get ready to start the new year in "spick and span" shape. It's going to be the biggest year the American farmer has ever had and you want to be in shape to take advantage of all your opportunities. If everything is in its place, you are not going to waste any time hunting for a stray tool, or a piece of 2x4 or some other article which you may want in a hurry. Time is money, on the farm as much as any other place, today. You cannot afford to throw away any money—or its equivalent, time.

On a large percentage of the farms in any community things are not kept well cleaned up and there is a condition of disorder rather than neatness and tidiness. Is this because it pays better to "let things go" than to be continually picking up and straightening up and arranging and putting away machinery and gathering boards and kindling wood, and the thousand and one other things the neat man on a farm sees to do? Or is it that some are naturally neat and others slovenly? Or would it pay better on all farms if everything was kept "spick and span" at all times?

We believe it is the experience of many of the best farmers, not only in America but all over the world, that it pays to keep a farm orderly, and that there is no better motto, not only from the standpoint of "peace of mind" but also from that of economy, than "a place for everything and everything in its place."

**A Pioneer
Who Would
Stop All
Pioneering.**

William Hanley spent twelve years in the heart of tule swamp land digging the Blitzen canal to drain and irrigate 65,000 acres of land in Harney County, Ore. While keeping his long vigils on the dredge, hauled 250 miles from Nevada, Hanley evolved some ideas. He accepted his lot as a pioneer cheerfully, but he decided the world would be better if the lot of the pioneers of this and the next generation is made easier.

Some of his ideas are worth while; some seem to us, who have had just a taste of pioneering like a dream too good to be true, or perhaps even too good for the pioneer of the future. We are still enough of an old-fashioned individualist to believe that the better man is evolved from him for whom all things are not provided. We believe we prefer the self-made to the government-made man.

Perhaps the elimination by the government of some of the hard work and jolts of pioneering will make possible the development of even better self-made men than those of today. At least, William Hanley, who can claim honestly to be self-made, so contends, and he wants to go to the United States Senate to preach his doctrines and try to put them into operation. He meets the contention of excessive governmental paternalism by declaring his theories represent the true basis of economy. But let us have his own words:

"The pioneer days are over; they should be. The digging of drainage canals and irrigation ditches, and the clearing of land should not be the work of the individual. We have gotten past that time now. It is too much to expect a man to spend his lifetime at such work. We should prepare the land for our farmers. We ought not to expect a man to get out and grub stumps and dig ditches and do the preliminary work. The farmer should have the land turned over to him ready for seeding. It may be necessary to keep him off the land for two years, so the soil elements may be fitted for producing crops. The government has paid too little attention to our sources of food supply. The farmer is the man who feeds us and we should help him—not rob him every chance we have. When we dig ditches and drain the land and pull the stumps and sweeten the ground, we are not giving the farmer something; we are giving ourselves something—helping ourselves.

"We must get down to the true basis of economy. The work of farming is the most important of all our industries. To do this work economically is not the work of individuals but of municipalities,

states and nations, with modern machinery and plenty of capital and on a large scale.

"Our homestead laws have been absurd and outrageous. Think of asking a man to go out on raw land, covered with brush and trees, or practically a desert, making him stay there! He has to go away and work to get enough money to buy some beans and prunes to live on. Then he goes home to his cabin and raises his babies on prune juice. That is not the way to treat the real producers. The time has gone by for such crude and wasteful ways. Those ways were unjust, short-sighted and expensive.

"This is an age of machinery. No man ought to be permitted to break his back over stumps, or gather rheumatism down in a ditch. It is not necessary. There was a day when it was necessary, but it is not now. What is not necessary is wasteful and what is wasteful is wrong. We must not waste our men as we have in the past. We have the means of saving time and energy and muscle and money and human beings—and we must do it."

**Farmers
Warned
Against
Speculation**

The National Implement and Vehicle Association is doing a good work. It is sending to farmers throughout the land an urgent warning against speculation in his produce and an equally urgent plea for preparedness in meeting conditions next year.

These are extraordinary times. Hardly any organization is in better position to advise the farmer. Its members have foreign correspondents in all the lands at war and in those other lands, that must turn to America for supplies, which Europe previously furnished. They also have representatives, salesmen and banking connections in every corner of the United States, who keep them informed of conditions. And out of the information, foreign and domestic, which the association has received, it has evolved these suggestions which it is asking commercial clubs and other organizations to promulgate among the farmers:

(1) Urge the farmer who has harvested his grain not to speculate on the fluctuation of future prices.

(2) Recommend to the farmer of the South to diversify his crops. Experience has shown that a one-crop country cannot continue to bring prosperity to its farmers. The great wheat states of the Dakotas are diversifying. Our cotton states should do likewise.

(3) Preach preparedness for the 1915 harvest. Care in seed selection, proper tillage and cultivation will bring increased crops to meet the increased

demands. More intensive cultivation quite as much as increased acreage will bring prosperity to the farmers.

(4) Increase the number of farms raising stock and thereby secure a natural fertilizer for the soil. Cattle, hogs and poultry mean ready money and bank accounts.

(5) Secure for the agricultural community the benefits provided in the new currency law by creating a demand for the early opening of the various federal reserve banks.

(6) Discourage all speculation, but encourage the expansion of legitimate business in the rural communities by reasonable extension of credit.

A Filipino Experiment in Aiding Settlers

The government of the Philippine Islands is working out a system of loans to settlers in an organized colony, which may be fraught with possibilities, if adopted in the United States, for settlers on the Federal irrigation projects.

The colony is made up of Americans, nearly all of whom have been in government employ, either as soldiers or in civilian positions. Under government auspices, a committee of the settlers picked the site of the colony—Momongan, it is called, in the Lanao district, island of Mindanao. It is expected that about 100 families will join in the enterprise.

The soil is reported to be rich black loam capable of producing a great variety of crops, including some of those of the temperate zone, such as Irish potatoes. There is much forest land near by from which timber for houses and other buildings may be cut. The land may be homesteaded, leased or purchased, and each colonist purchasing or homesteading 40 acres will be permitted to lease an additional 40 acres at a nominal rental. The mountains near the site of the colony still abound in wild game, such as deer, wild hogs, etc.

Two transportation companies are operating automobile truck lines between Camp Overton, on the coast, and Momongan, and army trucks also run over the road.

The joint committee of government officials and private individuals which formulated plans for managing the colony has reported to the governor general these recommendations:

That the government lend to each colonist \$600.

That the government appoint a superintendent and three assistants, who shall have control and supervision of the colony.

That all the first crop produced go to the colonists.

That 20 per cent of the second crop go to the government as part payment on the loans.

The superintendent shall be the treasurer of the colony and shall expend the money lent the colonists for transportation, construction of houses and other necessary buildings, and for draft animals, implements and food.

No interest shall be charged by the government for the loans made, and the balance of the loans remaining unpaid after the government shall have collected 20 per cent of the second crop shall be paid as rapidly as possible, the colonists being allowed from each succeeding crop, until the amount is paid, enough to cover their necessary living expenses and the cost of putting in a new crop. The \$600 to be loaned to each colonist shall not be paid over in a lump sum, but shall be expended by the superintendent in installments as the money is needed.

Better to Stick to Staple Crops

The Department of Agriculture has just issued a warning, to which it would be well for farmers and gardeners to pay heed. It calls attention to the danger in special crops or those which inexperienced growers are very liable to fail in, that is, crops which are used for the production of drugs, perfumes, and other products for which we have depended on Europe. There is something attractive in growing a crop which few others produce and which has little competition in the market, but the growth of these plants calls for special talent, and if a contract is not made for a crop before it is planted it is very probable there may be no market for it. Staple food products always find a ready market, and while not always at long prices there is minimum risk in growing them.

Judging by his address to the Interstate Irrigation Commissioners, F. H. Newell, director of the Reclamation Service, is not trying very hard to win the favor of Congress for the settlers on the Federal projects.

Opportunity is knocking now at the doors of the United States. Remember, opportunity only comes once.

Let us not permit our muzzled neutrality to become a menace to our nationalism.

There is still need for a real Irrigation Congress in the United States.

DRILLING 30-INCH WELLS FOR IRRIGATION

By F. W. PARK



FIGURE 1. General view of the equipment used to drill 30-inch wells near Plainview, Tex. Only the lower part of the derrick is shown.

IRRIGATION by pumping is rapidly extending to all parts of the United States. In many localities it is feasible to pump from rivers or streams, or from open pit wells, and, wherever conditions permit, these sources of supply are usually more economical than deep bored wells. There are, however, immense areas in which water in sufficient quantity to irrigate is not found on or near the surface but may be obtained within practical pumping distance from deep bored wells. In many of these wells, the water rises to near the surface, so that the pumping lift is not great. To a large number of present and prospective irrigators, therefore, the most economical method of obtaining a water supply from deep wells should be of interest.

The first consideration in a deep well water supply is the type of pump that will be most reliable and economical. The well should then be made to accommodate this type of pump. It should be remembered that in irrigation by pumping the cost of pumping is continuous and the well that is adapted for installing the most economical type of pump is nearly always the cheapest through the saving it effects in cost of pumping.

There are three principal types of pumps used in deep well pumping; the deep well plunger pump, the air lift and the deep well turbine centrifugal pump.

Deep well plunger pumps are now made with single acting, double acting and triple acting water cylinders, with two stroke cylinders and with two or more double acting water cylinders mounted on a single line of plunger rods. Some of these are very reliable and economical for general purpose pumping, the best of them having all bronze cylinders and bronze ball valves. For irrigation pumping, wells are usually pumped at or near capacity and the water nearly always contains a considerable amount of sand or grit which will rapidly destroy the valves in any plunger pump. For this reason plunger pumps are not generally considered desirable for irrigation pumping.

The air lift will deliver more water from a deep drilled well than any other type of pump but requires a deeper well in which to operate and more power to deliver a given quantity of water than any other pump. The air lift requires three feet of submerged depth of the air pipe for each foot of actual lift so that if the actual lift to the surface is 100 feet the air pipe must extend 400 feet in the well. Various manufacturers claim comparatively high efficiencies for their air lift pumping systems and many laboratory tests have been made showing efficiencies of 25 to 33 per cent, but tests made of actual installations at Waukesha, Wis., in 1911 by the University of Wisconsin showed efficiencies of only 16 to 18 per cent. It has been dem-



FIGURE 3. Another view of the 30-inch drilling equipment. A special type of drill sometimes used is shown in the foreground.

onstrated that there are conditions in which there is an air compressor plant already installed and not in use for other purposes during the irrigation season, such as installations in sugar factories, where it is more economical to use the air lift for irrigation pumping than purchase some other type of pump, but the much higher efficiencies of other pumping equipment excludes the air lift from consideration in an installation designed primarily for irrigation pumping.

A leading manufacturer of pumping machinery published the statement, some time ago, that 90 per cent of all pumps used in irrigation pumping in the United States were centrifugals. The writer does not know of any statistics compiled to verify this statement, but it is certain that the number of centrifugal pumps used for this purpose far exceed all other kinds of pumps combined.

The adaptation of the centrifugal pump for deep wells is known as the deep well turbine centrifugal and these pumps are now made by a number of manufacturers of pumping machinery. The special advantages of this pump for irrigation pumping are:

It will deliver a remarkably large quantity of water from a deep drilled well.

When properly designed and installed, it attains high efficiency and requires little attention.

It is far less affected by sand and grit than plunger pumps and therefore maintains nearer its original efficiency.

Deep well turbine centrifugal pumps installed at the present time deliver up to 3,000 gallons of water

a minute from deep bored wells. A large number of these pumps have been installed for irrigation pumping and they have been so successful that they may be regarded as the present standard type of large capacity deep well irrigation pump.

In many places in the West where there is small rainfall, notably in Colorado, it has been extensive practice to drill several small wells in a group and form them into a single pumping unit by connecting them with piping through tunnels to a horizontal type centrifugal pump installed in a deep pumping pit. It is the opinion of engineers, who have had extensive experience in installing deep well turbines for irrigation pumping that better results can nearly always be obtained with less initial cost and lower expense for operation by drilling a single large well, inserting a casing having a strainer extending entirely through the water bearing strata and installing a turbine centrifugal pump.

To install a deep well turbine pump requires a larger well than is usually sunk for domestic purposes and a different drilling equipment than is used by well drillers in putting down wells by the jetting, hydraulic or churn drill methods.

It is the purpose of this article to explain how these large diameter wells are made. The writer does not know of any wells larger than 30 inches in diameter at the present time, but many of this size have been drilled and they have been put down so successful that there is reason for belief that much larger wells will soon be attempted.

As an illustration of this equipment, reference is made to a drilling outfit which has been putting down



FIGURE 2. Full view of the 30-inch driller.

30-inch wells near Plain View, Texas, for about one year. In a recent letter the well driller said they were drilling wells an average of 250 feet deep and they were at that time sinking a well on an average of eight days, including time of erecting and taking down derrick; the average drilling time being from three to three and one-half days. In this territory no rock is encountered and conditions are therefore most favorable for rapid work.

Figure 1 is a general view of the equipment showing only the lower part of the derrick. Figure 2 is a view of the entire derrick. Figure 3 illustrates a part of the equipment and shows in the foreground a special type of drill sometimes used. Figure 4 shows the type of drill generally used in earth work. Figure 5 illustrates the type of drill used in reaming out an earth drill hole.



FIGURE 4 (at left)—Type of drill used generally in earth work in drilling 30-inch wells.

FIGURE 5 (at right)—Type of drill used in reaming out an earth hole.

dition of a walking beam to connect with a solid line of well tools. This machine has a powerful hoisting drum placed in the front of the derrick frame which is used in connection with heavy pulley blocks and wire cable to lift and lower the rotary tools, or well casing, as may be required. The rotary machine is driven by chain belt from the machine shafting. The rotary is provided with powerful grippers so designed that they firmly hold either the drill rods, or well casing, when being rotated down into the well and at the same time permit the drill rods, or casing, to be raised or lowered as required.

The drill rod is usually 4 or 6 inch heavy wrought iron pipe coupled together with strong taper thread couplings. These rods are connected to the pulley block by a roller bearing rotary swivel and this swivel also has a connection for a water hose. On the outer end of the truck, carrying the engine, is a pressure pump, which may be either steam driven from any source of steam supply or chain belt driven from the machine shafting. The pump is connected to the rotary by piping carried up into the derrick and having two hose connections controlled by a three-way cock.

The hose connection not in use is connected to another swivel, which is joined to a length of piping and hoisted into the derrick during the time of operation. When it is desired to add another length of pipe it is only necessary to unscrew the swivel from the

pipe in the drill hole, screw on the other length of pipe, turn the valve cock to connect with this pipe and continue the drilling operation. The connection is usually made without stopping the pump. The two hose connections are illustrated in Figure 1.

The drill bit for drilling large wells in earth formation has been developed after many experiments. The drill bit most extensively used at the present time is illustrated in Figure 4 and consists of a fish tail bit having two water orifices, one on each side of the shank. Immediately above this bit is a 5-blade bit for enlarging the drill hole to the required diameter. If a test drill hole has been first made and it is desired to ream it out to larger diameter, the bit shown in figure 5 is used for this purpose. With this bit the end of the pipe extending down into the smaller drill hole forms a guide to produce a straight drill hole.

When a test drill hole is first made this should not be less than 8 inches in diameter, since experience has proven that a drill hole this size can be made at as small cost as one of smaller size and the larger drill hole affords better opportunities for testing and also forms a better guide for enlarging the hole. A drill like the one illustrated in Figure 3, consisting of a fish tail bit with two 5-prong bits immediately above it, the upper one being the full size of the drill hole and the lower one of an intermediate size, is sometimes used but drillers generally prefer the bit shown in Figure 4.

In operation the drill tools are suspended from the top of the derrick and extend through the rotary machine, which is shown on the derrick floor. The suction pipe of the pressure pump is led into a shallow basin excavated in the ground close to the derrick and a trench is cut leading by a circuitous route from the center of the derrick, where the well is located, to this basin. The object is to have the circulating water travel a considerable distance before reaching the settling basin, thus permitting the sand to settle in the trench from which it may be shoveled. The nature of the formation can be ascertained at any time by examining the sand in this trench. The basin is filled with water from any convenient source.

When the drill rods are connected with drill and suspended in derrick, work is commenced by turning on the water which flows down the inside of the piping and out through the two orifices in the upper part of the fish tail bit. The pipe is then gripped in the rotary and turned at a speed of 40 to 100 revolutions per minute, according to the nature of the work. By means of a powerful friction brake the drill rods are lowered as fast as the bit will cut away the ground and the water circulation carry the excavated material to the surface. New lengths of pipe are added as required. The circulating water is usually allowed to become puddled with the clay carried in suspension. This clay is necessary to the success of the work. If clear water were pumped into a sand formation it would be rapidly absorbed by the sand the circulation soon stopped. This is especially true when the sand is coarse and water bearing. The clay will not flow through sand to great extent and soon forms a water seal which not only prevents waste of water but prevents caving of the sand. This process is known as mud walling a hole and is so effective that holes

(Continued on Page 415)

STATES MUST TAKE UP RECLAMATION TASK

BY FRANCES
A. HOUSE

*Financial Expert of the
Rocky Mountain News
of Denver, Colo.*

S CONCERNs new construction by private companies, little is being done in the irrigable districts of the West. The unsettled state of things in financial markets necessarily interferes, to a serious extent, with efforts to get a sufficiency of funds for the numerous projects that are either planned or partly finished. Approximately \$30,000,000 in all is urgently required at the present time in Colorado, Idaho, Montana, Nevada, New Mexico, Oregon and Utah.

Pending a satisfactory readjustment in monetary affairs, the land boards of a few of the states named are energetically striving to have as much accomplished, constructively, as circumstances permit. They try to enlist the efficient aid of local bankers and capitalists, and even set aside such portions of state funds as are not appropriated for other or more pressing purposes. And I gather from dependable information that some striking advantages have already been gained as a result of the adoption of makeshift measures. In Idaho one magnitudinous project, covering about 150,000 acres, is expected to be rushed to completion within the next eight months by a company which has promised the state land board to invest nearly \$2,000,000.

Unless I much mistake the signs of the times it will eventually become obligatory upon state governments to participate actively in the task of reclamation. Such participation could be either direct or indirect. Direct through the appropriation of money for projects to be constructed under state supervision; indirect through the granting of legal or financial favors to private companies or statutory irrigation districts.

Owing to the unparalleled conditions in money and security markets, hopes that investment capital might again soon be procurable in such amounts and on such terms as would insure a hastening of the process of redemption are quite precluded. Besides, a decidedly timorous attitude has been engendered in investment circles by the unfortunate



Some Indian Corn, Grown a Short Distance East of Pueblo, Colo. Courtesy of The Earth.

outcome of some important irrigation enterprises in most every one of the semi-arid states.

In this connection it must be admitted that there has so far been entirely too much promotion of a questionable sort. It must also be acknowledged that some of the state land boards or irrigation departments have been culpably lax in the granting of concessions.

Estimates of cost and water supplies have not always been

submitted to rigid and authoritative investigation. Nor has proper supervision been exercised over the application of funds contributed by banks and investors. In other words, there has been much public and private graft in the planning and construction of projects, with interest charges, onerous costs of operation and inability of settlers to obtain adequate returns on their invested capital and labor.

Censurable methods have, however, not been characteristic of private enterprises alone. They have been brought to light, likewise, in the course of investigations of projects undertaken by the Federal Reclamation Service. In several prominent cases the federal engineers' estimates of cost and time of construction have been woefully and inexcusably wrong, as many a confiding settler can eloquently bear witness to in Arizona, Colorado and Montana.

It is very likely, though, that henceforth the Reclamation Service will give a better account of itself than it has given so far. The recent disagreeable disclosures have created quite a stir in congress and the appropriation committees are now determined to probe estimates submitted by the Service in a searching manner.

Approximately 3,000,000 acres have been or will be reclaimed by the federal government at a total cost of \$200,000,000. Since the government can raise the funds for constructive requirements more readily than can private companies, it will find it advisable or be importuned from now on to play a greater part in the irrigable districts than it originally intended. It is known that in recent times numerous incomplete projects of a private

(Continued on page 407.)

The Federal Water Users

A Department Devoted to the Interests of the Farmers on the Government Irrigation Projects

EDITED BY GEORGE J. SCHARSCHUG

THE WATER PAYMENT EXTENSION PUZZLE

Federal Water Users Baffled by Tangle of Law, Words and Decrees

SECRETARY of the Interior Franklin K. Lane was on his way west when this was written. Perhaps during a visit to the Truckee-Carson project in Nevada, which he announced he would make, he will clear up the Chinese puzzle which Federal Water Users seem unable to solve.

The puzzle is the entanglement of law, words, facts and ideas presented by the twenty-year water payment extension bill, Secretary Lane's public notice concerning this law, his letters to various Water Users' Associations concerning the public notice and special communications which settlers or their organizations have subsequently received.

What is the answer?

The Secretary's public notice was a novelty among Reclamation Service documents of this nature because it was quite clear in its language. The notice must be read, however, in connection with the law and the Secretary's communications.

The Belle Fourche Valley Water Users' Association has refused to elect the third member of the board, which Secretary Lane has ordered to revalue their project. This organization has issued a letter to Federal Water Users demanding that if any revaluation be made, it should be done by a non - partisan board. The proposed boards are to be made up of two members named by Secretary Lane and one elected by the Water Users. The Belle Fourche settlers are now pressing a suit to attempt to straighten out many of the kinks and uncertainties in the Reclamation laws. It is the opinion of many of these settlers that similar suits should be start-

ed on all other Federal projects.

The Shoshone Water Users' Association has named S. A. Nelson, a prominent settler and very capable man, to serve on the Shoshone revaluation board, but the Water Users there are in doubt, nevertheless, as to the exact meaning of the public notice.

The Powell (Wyo.) Tribune, one of the organs of the Shoshone Water Users, says concerning the public notice:

"As a public document, it is no doubt one of the most important that has yet appeared, at least so far as this project is concerned. As a specimen of good English, it is pretty fair, but its greatest claim to unquestioned preeminence lies in its skillful handling of words so as to leave the reader in the dark on a certain important point or group of points. 'Language,' said the great Talleyrand, 'was given to man to conceal his thoughts.'

"According to the notice and the letter of Secretary Lane, it appears that the cost of the project is to be determined by a board of survey and the price per acre to the entryman under the new law will be finally decided upon from the findings of the board. This is perfectly clear. The thing that

is a source of perplexity to us all is whether the unit-holder will have to sign his acceptance of the new law before he knows what his land is going to cost him. The Secretary's letter states very definitely that the charges will have to be paid only when a majority of the Water Users shall have signified their acceptance of the new terms, but



Making the automobile earn its hire. The engine of the "bubble wagon" is being used by this enterprising farmer to drive his silage cutter.

the notice is silent on this subject. In other words, the letter says things which the official notice only hints at. Our project manager, Mr. Sanford, is endeavoring to secure from Washington an interpretation of the order.

"Meanwhile one wonders just what insuperable obstacle is encountered at Washington when they take their pen in hand and tackle the knotty problem of inditing a public notice that can be understood without the aid of experts."

The settlers on the Truckee-Carson project, equally unable to solve the puzzle, had United States Senator Francis G. Newlands telegraph an inquiry to Secretary Lane. This was the reply: "Hon. Francis G. Newlands, Reno, Nevada.

"Answering your wire of September twenty-eighth; no increased charges will be announced as to the Truckee-Carson nor any other project as a condition precedent to the acceptance of the terms of the Reclamation Extension Act. General public notice just issued, together with form for acceptance of the terms of Act, distinctly provides that the amount heretofore fixed in the several public notices heretofore issued may not be increased except as provided in the Reclamation Extension Act, of which see section four.

"FRANKLIN K. LANE."

The part of section four referred to reads as follows: "Sec. 4. That no increase in the construction charges shall hereafter be made, after the same have been fixed by public notice, except by agreement between the Secretary of the Interior and a majority of the water-right applicants and entryman to be affected by such increase, whereupon all water-right applicants and entrymen in the area proposed to be affected by the increase charge shall become subject thereto."

Commenting upon the telegram and the quoted section of the law, the Churchill County Eagle, of Fallon, Nev., says:

"From this it will be seen that there can be no increase in charges except by a vote of a majority of the Water Users affected by the increase and this affords absolute protection against any arbitrary increase that might be proposed in the future by an administration less in sympathy with the Water Users than the present one."

That seemed simple enough, but it failed to



Filling a concrete stave silo on an irrigated farm in Texas.

satisfy a large part of the settlers on the project. They read the public notice again; then they read the Secretary's letter accompanying the notice. The Secretary wrote in a similar vein to each project, but his letters varied in some details. Here is his letter to the Carlsbad project, which is considerably longer than the letter received by the Shoshone association:

DEPARTMENT OF THE INTERIOR,
WASHINGTON.

October 6, 1914.

Pecos Water Users' Association,
Carlsbad, New Mexico.

Gentlemen: There is enclosed to you herewith a copy of the first public notice issued under the terms of the Reclamation Extension Act. The terms of this notice are such as to dispel any fears that may have existed concerning the intent of the department relative to the so-called increased construction charges on reclamation projects. It is not a condition of the extension of time that you shall agree to pay a higher construction charge. You are entitled to the extension of time on the charges as at present fixed. It is required, however, under the terms of the Reclamation Extension Act, that you shall sign an acceptance, binding yourselves to pay an increased charge only and when a majority of the Water Users on your project shall, after that increased charge has been determined upon, agree that the increased charge shall be paid.

It is desired to have a review of the expenditures made on the project and this review may result in a lower construction charge or it may result in a higher construction charge. Your representative on the board will be there to protect your interests. The charge which his board may determine is a proper charge will not be binding upon you under the terms of the public notice herein enclosed until it has been submitted to you and to all the Water Users for their consent and agreement. If and when this increased or lower charge is submitted to you the majority of the Water Users shall agree that it is a just and proper charge, which they are willing to pay, then all will be held for it.

The local board of review which it is my purpose to appoint will consist of an accountant and an engineer, whom I shall appoint, and a member to be designated by your association. The findings of this board will be referred to a central board of review, consisting of Mr. I. D. O'Donnell, supervisor of irrigation; General William L. Marshall, consulting engineer to the secretary, and some other person yet to be designated. I suggest that steps be immediately taken for an election by Water Users of their representative on the local board. Meanwhile, I will consider the selection of the other members of the local board, and as soon as your representative has been chosen, I trust you will advise me promptly, so that the local board may be completed and enter upon a review of the cost of the project.

In selecting your representative it is suggested that each Water User be entitled to one vote, whether his acreage is large or small, for the reason that the results may be as important relatively to the man holding a small acreage as to the large landowner. The latter should not be permitted

to have greater advantage than he would in a county or state election.

I am suggesting this because I believe that the outcome will be more satisfactory in having your representative selected for this particular purpose with your full knowledge of his qualifications for acting in this somewhat difficult and complicated situation.

Cordially yours,
(Signed) FRANKLIN K. LANE.

A later issue of the Powell (Wyo.) Tribune says:

"According to instructions received at the local office from Comptroller Ryan of the Reclamation Service at Washington it is going to be practically obligatory upon the entryman to file his acceptance of the terms of the Twenty-Year law before the final fixing of the cost of the land. This communication from Mr. Ryan is clear and to the point and is doubtless law to us unless it should be overruled by a decision of the Secretary of the Interior. It states positively that the entryman will be urgently requested to file his acceptance of the provisions of the new law before December 1. In case he does this, he will be required to make a payment equal to two per cent of the balance remaining unpaid. That is, if an entryman has made three payments on a forty amounting, say, to \$6.50 per acre, or \$260 in all, and the total cost of his land at \$50 per acre is to be \$2,000, then he has an unpaid balance of \$1,740, and on December 1 he will have to pay two per cent of this, or \$34.80. If, on the other hand, he does not accept the new law, a payment will become due which will be regulated according to the terms of the previously existing act.

"In regard to the many cases where seepage conditions have brought about a reduction in payments, it is uncertain just what the procedure will be. What is pretty certain, however, is that acceptances of the new law will have to be filed before December 1, or you will remain under the former law. It looks as if this was food for thought."

The Belle Fourche Association explains its refusal to join in the proposed revaluation in the following letter:

Newell, S. D., October 14, 1914.

To the Water Users' Associations and the Water Users on the Various Federal Projects:

Fellow Water Users: The Belle Fourche Valley Water Users' Association has during the past thirty days received communications from a number of the other associations with reference to Secretary Lane's plan of revaluation of the projects under the terms of the new extension measure, or presumably so. And it has been suggested that a meeting of the various associations should be held in order that some united action might be taken for the protection of the rights of the Water Users.

It doesn't occur to me that the act contemplates a revaluation, except in the event of extensions or betterments in addition to the plans upon which the original estimates and contracts are based, or upon which the public notices now in effect were issued. If this interpretation of the law is correct, then the Water Users should be informed on this point, as it seems to be the general impression among the Water Users that in order to secure the advantages of the extension of time they must submit to a revaluation of their project and enter into a new contract with the Department based upon the findings of the Central Board of Review.

The matter came before the annual mass meeting of this association October 10, and the association refused to appoint

a representative to act on the revaluation board. As you are probably aware, we have a suit pending in the Circuit Court of Appeals, instituted by the association against the local officials of the Reclamation Service, in which suit we are asking for an interpretation of the Reclamation Act of 1902 and the contract which our association entered into by virtue thereof. It is not a fair proposition, to say the least, to ask our Water Users to submit these honest and serious differences involving as they do so vitally their vested rights, to a partisan tribunal for adjustment.

In our opinion we believe it the utmost folly for the Water Users on any project to take such action as might be construed a waiver of their rights under the original law and an acceptance of the more recent reclamation legislation, especially until their rights are definitely and finally determined by the courts.

A meeting of the associations may accomplish something, and if it is the intention of Secretary Lane to readjust the charges on the various projects and fix a new charge to be based upon justice and equity, charging off certain items where the circumstances seem to justify, then it would seem that the secretary should be prevailed upon to give us at least a non-partisan board, and that this board should be governed in its deliberations by the laws in effect at the time our rights accrued, and in accordance with the interpretation of the law at that time by those who had to do with its enactment and putting it into operation.

First in importance, is a non-partisan tribunal before which to try our case, free from the influence of Newellism.

Respectfully,

O. E. FARNHAM,

Secretary Belle Fourche Valley Water Users' Association.

Surely this presents a situation which demands the most earnest consideration of the Federal Water Users. As Mr. Farnham's letter suggests, a meeting of the Water Users' Associations might accomplish something—such a meeting, no doubt, would accomplish a great deal. Steps should be taken by the officers of the National Federation of Water Users' Associations to call such a meeting immediately. Delegates from every project should attend.

BIG FIELD FOR U. S. PUMPS

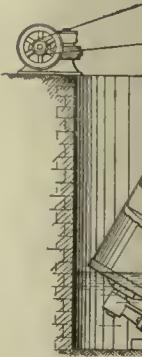
As a result of the need of irrigation being constantly impressed upon the farmers of the Transvaal, the Orange Free State, and Rhodesia, and the formulation of irrigation schemes by the governments of these countries, a big impetus is coming in the imports of engines, pumps, and other machinery for irrigation purposes. In these lines American manufacturers should be preeminently qualified to enter the district with a good prospect of success. Broadly speaking, there is no prejudice against American goods or methods. On the contrary, American products, as a rule, are in favor with both dealers and consumers.

Send \$1.00 for 1 year's subscription to the IRRIGATION AGE and bound copy of THE PRIMER OF IRRIGATION.

If you desire a copy of The Primer of Hydraulics add \$2.50 to above price.

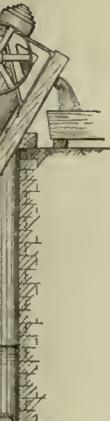
The Pump That Does

The Grimes Will Raise
More Water to a Greater
Height on a Given
Amount of Power Than
Any Other Pump that
You Can Buy,—a Strong
Assertion, but Every
Word Backed Up by
Actual Performances of
Our Pumps Under the
Most Exacting and
Varied Conditions.



*If you USE, or Plan to USE, Irrigation Machinery, Write Today for Our Folder
Giving Interesting Facts and Figures About This Simple and Always Depend-
able Pumping Device.*

Not Fail—The Grimes



W. W. Nichols, a Well-known Loveland Colo., Rancher, Has a Grimes Lifting 600 Gallons per Minute, 34 Feet, from a Ditch, at a Gasoline Cost Never Exceeding \$1.60 for 10 Pumping Hours. Any Irrigation Farmer Who Sees The Grimes at Work Marvels at Its Low Operating Cost.

THE GRIMES IRRIGATION PUMP COMPANY
1021 First National Bank Building, DENVER, COLO.

\$100,000,000 LOAN FOR RECLAMATION URGED

Interstate Irrigation Commission Begins Its Work

THE Interstate Irrigation Commission has begun its important duties of bringing order out of chaos in the irrigation situation in the West.

The first meeting of the Commission was held early in October at Helena, Mont. It will meet again in Washington, D. C., in December. The Commission was organized at the suggestion of Secretary of the Interior Lane, who urged that it attempt to obtain uniformity of the various state irrigation laws, seek methods to solve present irrigation financial tangles and make recommendations for state and federal legislation concerning reclamation of arid lands.

At its first meeting, the Commission recommended:

The creation of a revolving loan of \$100,000,000 to the Reclamation Service for the completion of projects now unfinished.

The enactment of a law providing for the creation of irrigation districts for the building of projects in the future.

A change in the law requiring continuous cultivation of irrigation projects instead of a residence requirement.

Ira P. Englehart, of Washington, was elected president; W. D. Beers, of Utah, vice-president, and A. W. Mahon, of Montana, secretary.

F. H. Newell, director of the Reclamation Service, and Clay Tollman, commissioner of the general land office, represented Secretary Lane.

The Commission endorses "The broad and comprehensive policies of Secretary Lane in his effort to develop the national resources of the West and also the prompt and efficient manner in which the business of the Department of the Interior is being dispatched."

It commends the Reclamation Service and recommends it be the agency through which future irrigation works be constructed; declares in favor of government ownership of storage works, and asserts they should be classed as national works; asks for state laws requiring from irrigation companies annual statements showing investment, annual cost, crop production, duty of water and other details.

The last resolution asks for federal legislation to provide for the construction by the government of projects formed under the state irrigation district laws, the districts to bond the completed projects to release the investments of the government; a revolving fund to be provided for by the bonding of reclamation projects now in operation by districts organized to purchase them, the government to be reimbursed for its present investment with the proceeds from the sale of the same. The resolution continues: "And in that connection it is recommended that such projects be sold at a discount in order that the reduced price at which they may be purchased by the land owners will offset the interest which the bonds will call for and from which the contracts for the purchase of water under

the existing law are exempt, or as an alternative plan for providing a revolving fund that provision be made by which the completed or nearly finished successful projects, built under the terms of the Reclamation Act, may be turned in at the earliest practicable date to irrigation district organizations, receiving in exchange twenty-year bonds of the district, which shall be interest exempt, principal to be paid in accordance with the provisions of the Reclamation Extension Act; these bonds to be disposed of or used as the basis of securing additional funds to build other meritorious projects."

Director Newell painted for the delegates a rather glowing view of Federal irrigation under the new Twenty-Year bill. He said the Reclamation Service has already invested \$100,000,000 in irrigation projects, but because of the recent congressional enactment requiring that hereafter all money in the reclamation fund shall be expended only as provided for by the annual appropriation bill, the West is confronted at present with a situation not of obtaining more money, but of keeping what it has already secured.

"The appropriations committee is largely made up of Eastern and Southern men," he said, "and they come from regions that have a most impossible idea of irrigation. I doubt if there is more than one man on the committee who ever saw an irrigation ditch. There is a deficit in the treasury and this will make it even harder for the West to obtain money that is needed. We are going to have the time of our lives simply to hold what we have. With the deficit in the treasury and the appropriations committee not understanding Western conditions, our chances of getting more money are very slim."

He declared that even Chairman Underwood did not understand conditions, believing that greater general good would be done if the money, instead of being expended on irrigation projects in the West, was expended in the buying of fertilizers for the worn-out lands in the South.

State members of the Commission have been appointed by the governors of various states as follows:

Arizona—Andrew Kimball, Thatcher; John P. Orme, Phoenix.

California—A. L. Cowell, San Francisco; M. N. Newmark, Los Angeles; Harold A. Gilman, Los Angeles.

Colorado—Fred Farrar, attorney-general, Denver; John E. Field, state engineer, Denver.

Idaho—J. M. Thompson, Caldwell; W. P. Guthrie, Twin Falls.

Kansas—John Q. Adams, Stockton; J. C. Hooper, Ness City.

Montana—A. W. Mahon, state engineer; R. E. Shepherd, Billings.

Nevada—Charles A. Norcross, state commissioner of agriculture and irrigation; Charles L. Deady, surveyor-general.

New Mexico—M. N. Mikesell, Springer; Francis G. Tracey, Carlsbad.

North Dakota—J. W. Bliss, state engineer, Bismarck; J. W. Jackson, Williston.

Oregon—Asa B. Thompson, Echo; C. C. McCulloch, Portland; Ivan Oaks, Brogan.

South Dakota—Elwood C. Perisho, president State Agricultural College; H. M. Derr, state engineer.

Texas—J. C. Nagle, chairman state board of water engineers; A. A. Stiles, levee and drainage commissioner.

Utah—W. D. Beers, state engineer; Prof. L. A. Merrill, Salt Lake City.

Washington—E. E. Benson, Tacoma; Ira P. Englehart, North Yakima.

Wyoming—S. G. Hopkins, state commissioner of public lands; A. J. Parshall, state engineer.

EASTERN FARMERS SHOWN VALUE OF IRRIGATION

IRRIGATION in the humid regions was given fresh impetus at a recent meeting of the Vegetable Growers' Association of America at Philadelphia, Pa. One day's program was devoted to irrigation. The delegates were taken through the truck gardening region of southern New Jersey to the irrigated Seabrook farm.

Concerning this highly developed piece of ground, the Philadelphia Record says:

"At the Seabrook farm, which is operated by a stock company, they found a comparative oasis in the midst of the parched and dusty scrub-oak country. The mammoth overhead watering system of the Seabrook farm was patented by a man who found that artificial rain depended only on a gasoline engine, some good pipes and nozzles that would spray the ground, and it now keeps 78 of the 275 acres of the farm free from the fear of drought. A big gas engine, capable of pumping 1,300 gallons of water an hour, sent a spray over the whole plot simultaneously. Sometimes it is called upon to do this for 24 hours in succession, when the germina-

tion of the seed will bear lots of moisture, and the results, spread out in a huge, symmetrical map of greenery, seemed to indicate that investment and science combined could make of farming just as profitable a venture as of any other business of production."

In a talk to the association while at the farm, Frederick F. Rockwell, state consulting agriculturist of Connecticut, declared: "The regular daily feeding and watering of food plants, just as livestock is fed and watered, is undoubtedly destined to become a recognized feature of intensive farming in the near future. Under this system the yields of crops will be quadrupled, crops will mature so rapidly that it will be possible to raise more crops in a season than can be attempted at present, and the vegetable grower will be freed from the dread of droughts."

Mr. Rockwell indorsed overhead irrigation, through a system of pipes rigged on posts, and with spray nozzles at regular intervals, as the best system he had observed in practice.

CAMPBELL PATENTS NEW OVERHEAD IRRIGATOR

J. P. CAMPBELL, of Jacksonville, Fla., head of the Campbell Automatic Irrigation Sprinkler Company, has just obtained basic patents on a sprinkling system, which he declared will greatly increase the efficiency of the overhead systems. Here is the way a Florida man describes the new machine:

"If you don't mind getting wet, stand in one place, take a good straight one-quarter inch fire nozzle attached to a one-and one-quarter inch hose, under good water pressure, turn around very slowly, once every two or three minutes, and at the same time slowly raise and lower the nozzle discharge from an almost vertical to a 45-degree position, and in this way you see the exact results obtained from this wonderful little machine.

"As everyone at all familiar with hydraulics knows, water can be thrown a very long distance from a straight nozzle elevated at an angle of 45 degrees, so when the nozzle is at this elevation the water is thrown to an extreme distance, 50 or 75 feet, from machine used, as it is slowly elevated the intervening area is covered. Anyone who has not seen this particular machine would think that

to accomplish this result a great deal of machinery would be required, but it is very simple, the entire movement being caused by pressure of the same water that is discharged by the nozzle, the movement being caused by reversing rotary valves in a manner claimed to be entirely new."

The machine shown the writer was equipped with a small discharge tube, and although on only a five-foot stand pipe, covered a circle fully 100 feet in diameter and broke the water up so fine that it would not wash or damage the tenderest plants or smallest seeds. The machine weighs less than ten pounds, is very strongly constructed, and even on a very tall stand pipe does not vibrate in the least.

Mr. Campbell says this new machine will cover about four times the area of the Campbell Automatic.

For grove use this machine can be placed on stand pipes attached to an underground system, and placed 75 to 100 feet apart, extending up through edge of trees so machines will discharge over them, and as anyone can see, by placing a valve in each stand pipe so that only one machine is operated on each lateral pipe at a time, very little pipe would

be required, which means that the best system of irrigation can now be obtained at a minimum expense for material and installation.

In designing this machine, Mr. Campbell says he had in mind the irrigation of groves and large areas as stated, but finds that by using a $\frac{3}{16}$ -inch nozzle, which will cover a circle 80 to 90 feet in

diameter, the discharged water is broken up so fine that it can be used on vegetables and other small crops without washing the soil in the least. This means that the small grower can purchase one machine for every one or two acres, and by changing from one stand pipe to another irrigate a considerable acreage at a very low expense.

KLAMATH WATER USERS LAUD LANE

THE Klamath (Ore.) Water Users' Association has forwarded to President Wilson a resolution urging "further promotion" for Secretary of the Interior Franklin K. Lane.

Members of the association, when the resolution was adopted, had in mind a place on the United States supreme court bench, as they point out that three of the present members of the court are now beyond the age limit, which entitles them to retirement, and it is highly probable that there will be one or more vacancies before the end of the present administration.

The Klamath association is forwarding copies of its resolution to other western organizations, urging them to adopt similar resolutions and forward them to the president.

"The requested promotion of Franklin K. Lane is a tribute due from every western organization," says the Klamath association in its communication to other associations.

The resolution, which is signed by Abel Ady,

president, and Albert E. Elder, secretary, of the Klamath Water Users' association, is as follows:

"We, the Water Users of the Klamath project, remembering our despairing condition through previous administrations of mistaken policies in administering the Reclamation Act, and grateful for the fullness of justice now extended to us, as a result of the executive promotion of Franklin K. Lane to the secretary of the interior, hereby petition the honorable president of the United States that Mr. Lane be promoted to a position of still greater service should opportune time for such promotion appear.

"While we would regret the loss of so valuable a man from the executive control of our personal welfare, we urge his promotion as a just tribute to the man and as a greater blessing to the nation.

"Motion made by Abel Ady; seconded by J. Frank Adams; passed by unanimous vote of the Klamath Water Users' association, in mass meeting assembled, on October 10, 1914."

IRRIGATES WITH ELECTRICAL CURRENTS

ONE of the latest aids to the farmer in the raising of bigger and better crops is a process invented by W. J. Anson, a Southern California inventor, for the sub-irrigation of the soil by electricity.

Anson claims for his system that it will stimulate and accelerate plant growth, save much of the labor now expended in ditch irrigation, reduce water bills to a minimum and prevent losses either by unusual heat or severe frost. He asserts that he has proved all these claims.

The process is simple to install and easy to operate. The conduits are laid in the soil to a depth of sixteen inches and about ten feet apart. Galvanized wiring is run through each conduit. The current is derived from a feed line.

Where the process is used in groves the plan followed is that of having a positive and negative current on either side of a row of trees with an upright tile outlet at each tree. At the top of each outlet is a resistance coil. In winter the coils are heated by electricity, the current being governed by a thermometer which automatically opens a switch whenever the temperature goes to the danger point. In times of frost these coils will keep the atmosphere around the trees at a safe temperature.

The system is supposed to aerate the soil. One of the claims for the process is that it will cause the soil to so retain moisture as to remain in an "ashy"

condition, instead of packing and becoming hard, as is the case of ordinary surface irrigation.

The inventor says that through the use of his system a single gallon of water in the conduits will serve the purpose of forty gallons used under ordinary methods on the surface. No ground space is wasted for ditch construction, either.

In summing up the results of his demonstrations Mr. Anson says that citrus fruit trees set out in April have obtained a growth of from eight to twenty inches of new wood during the summer, a gain which is nothing if not remarkable.

FIND MORE PREHISTORIC IRRIGATION

A stone building containing seventy-two rooms has been unearthed near Stanley, N. M. A large collection of human skulls, pottery and other relics was discovered in the rooms. A stone dam and other evidences of an irrigation system were found a short distance from the building. The discovery is expected to throw light on prehistoric civilization in that region.

Send \$1.00 for 1 year's subscription to the IRRIGATION AGE and bound copy of THE PRIMER OF IRRIGATION. If you desire a copy of The Primer of Hydraulics add \$2.50 to above price.

NEWELL HAS BIG TIME AMONG CANADIANS

Succeeds in Dominating Irrigation Congress at Calgary

"THE Calgary meeting of the International Irrigation Congress will long be remembered from the fact that it was absolutely dominated by officials of the Reclamation Service from Frederick Haynes Newell down," says a prominent Western engineer and irrigation expert in a letter to THE IRRIGATION AGE. "You are no doubt aware what Mr. Newell's affiliations have been, and that they are now with Pinchot, Roosevelt and the Progressive party, who have no use for the present administration in Washington."

"The resolutions of the Irrigation Congress were dictated by Mr. Newell, and they take a direct slap at the United States Congress and national administration. The idea of Newell and his associates to obtain all the power possible over the settlers under irrigation projects, after the works are completed, would seem to conflict with President Wilson's idea that when the engineering work is done, the projects should be managed by business men in harmony with the settlers."

"These differences of viewpoint were apparent in everything done by Mr. Newell and his subordinates at the Irrigation Congress. There were so few outsiders present at the meeting, aside from those living in Canada, who do not understand the matter, that Mr. Newell and his associates were practically allowed to do as they pleased."

"It seems to me that the present administration can not long endure the insults which it is receiving at the hands of some of the officials now in charge of the Reclamation Service."

At any rate, Mr. Newell seems to have had a very good time at the Congress. He was introduced as the special representative of the United States government and given at least three or four places of honor on the program of speakers.

And when he had spoken himself hoarse, the delegates were given a free ride to "Lake Newell," the big reservoir of the Canadian Pacific Railroad irrigation project near Calgary.

Another Western man, who visited "Lake Newell," writes this question to THE AGE:

"Did F. H. Newell act as consulting engineer for the Canadian Pacific Railroad during the construction of its irrigation project?"

THE AGE has no authentic information with which to answer this question.

The meeting of the Congress may also be memorable as the last gathering of what was once one of the greatest organizations working for the upbuilding of the West. The delegates adopted a resolution urging the amalgamation of the Irrigation Congress with the International Dry Farming Congress.

As more than 120,000 persons attended the Dry Farming meeting and exposition at Wichita, Kan., the "amalgamation" will probably consist largely of a swallowing of the Irrigation Congress. It may

not even be permitted by the "Dry Farmers" to stage an irrigation side-show.

Canadian Pacific Railway officials and land experts dominated largely the program, when Mr. Newell was not speaking, lecturing or extending greetings from the President, the Secretary of the Interior and the Reclamation Service.

Prominent American irrigation experts, who had been invited to speak, were paid rather scant courtesy, although their addresses were the most notable features of the meeting.

"The real reason for the existence of the International Irrigation Congress is that of helpfulness," said J. B. Case, of Kansas, who was elected president of the congress. "Its reason for existence is that it is an honest attempt on the part of men of different ideas from different sections to work out a system of betterment for those who till the soil. Back of it is the one principle that every family is entitled to enough land to sustain itself. This proposition of enough land for every family is so broad that it embraces more possibilities for happiness and free government than any other material condition."

"The land owner is master, and he who is master of the soil controls the government, happiness, morals and destiny of the people. There is no joy like living under one's own roof. Few men will fight for their neighbors, but all will fight to protect their homes. The naked and hungry can never make ideal citizens, and the wildest anarchist and agitator becomes tame when he gets the possession of property or has a bank account."

E. F. Benson, president of the Washington Irrigation Institute, dealt with the irrigation conditions in Washington.

"If we would hear less about the high cost of living and the difficulty of getting food at reasonable prices," said Mr. Benson, "we must help the irrigation farmer to make more of his opportunities and get more men on irrigated land. In this regard public sentiment would have to be awakened. As soon as it was demonstrated that greater production was needed, more land would be placed under cultivation."

The general resolutions of the Congress offered this suggestion for the solution of the problems of the Federal irrigation projects of the United States:

"Resolved, That we recommend the passage by Congress of an act authorizing the Secretary of the Interior to enter into contracts with irrigation districts created under state law, by which the responsibility and control of each reclamation project arising from the Reclamation Act of June 17, 1902, may be turned over to an irrigation district organized under said law; and in the case of interstate projects, we recommend that suitable Federal laws be enacted by which interstate irrigation districts may be formed; and in order that Federal projects may be turned over to the landowners as contem-

plated by the reclamation law, we recommend the careful revision and unification of irrigation district acts by the states of the arid regions, to the end that such projects may be turned over to the control of the settlers through such agency.

"Resolved, That full examination be made by experienced engineers in the employ of the state and Federal governments in advance of financing the construction of each large irrigation project, and that no such enterprise be entered upon by the governmental agencies unless it appears that such projects can return at least 3 per cent of the total investment for land and construction."

Delegates from the United States passed special resolutions on the Twenty-Year water payment extension bill, which said in part:

"In this act of August 13, 1914, making such extensions, it is now seen that the Congress of the United States has gone too far in permitting such extension to all landowners whether or not cultivating or improving the reclaimed areas. As a result, speculation in such reclaimed land is encouraged, and the real lands are held out of use, serving as breeding grounds for pests. We, therefore, urge that prompt action be taken by Congress to limit or restrict this privilege of extension of payments to the lands which are actually under effective cultivation, and to require interest on deferred dues on all lands not thus cultivated.

"We also urge the repeal of Section 16 of said act of August 13, 1914, which transfers the control of the expenditure of this reclamation fund from the Secretary of the Interior and his experienced ad-

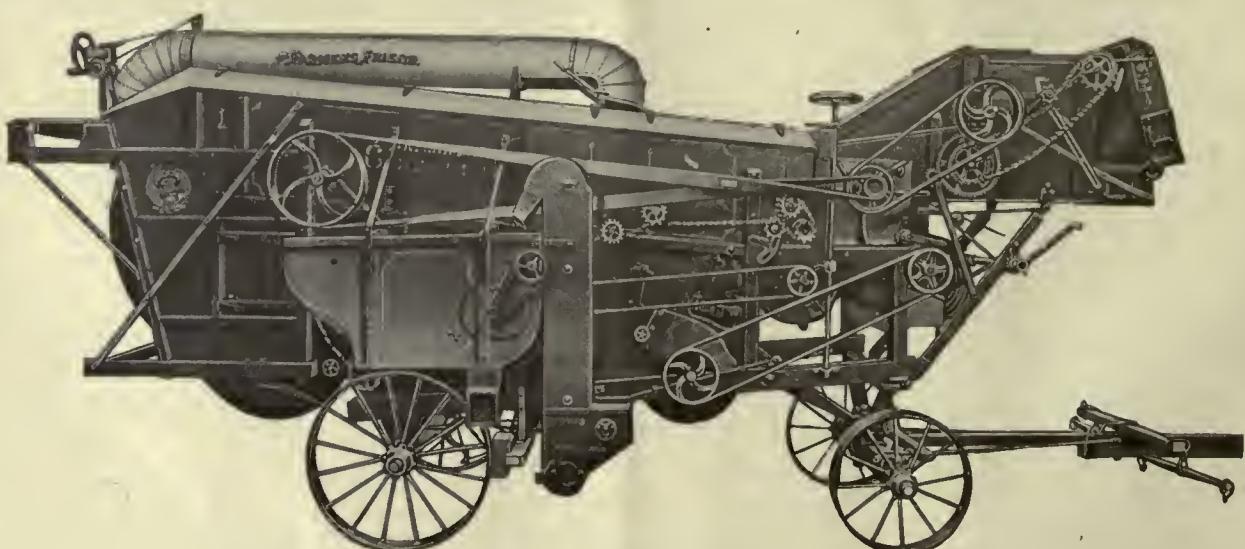
visers to a committee of Congress, the members of which do not and cannot learn that knowledge and deep interest in western conditions so essential to success."

Officers were elected as follows: President, J. B. Case, Abilene, Kan.; secretary, Arthur Hooker, Spokane, Wash.; first vice-president, J. S. Dennis, Calgary; second vice-president, Richard Burgess, El Paso, Texas; third vice-president, J. T. Hinkle, Hermiston, Ore.; fourth vice-president, Kurt Grunwald, Denver, Colo.; fifth vice-president, George Albert Smith, Salt Lake City, Utah.

Writing of the Dry Farming Congress, with which the Irrigation Congress hopes to amalgamate, Douglas Malcolm, of the International Harvester Company of America, says:

"As a bright contrast to the devastated fields and unharvested crops of our unfortunate kinfolk across the Atlantic, the wireless message from President Wilson which set in motion the Ninth Annual International Dry Farming Congress at Wichita presented a silent tribute to the national reliance upon the American farmer, rather than upon the American force of arms. Within three days after the receipt of his message more than 40,000 Americans fired with zeal for conquest were mobilized within the exposition grounds, and during the period from October 7 to 17, nearly three times that many visited what is considered the largest and most varied examples of soil conquest which the United States ever assembled together.

"Accompanying this congress from October 12
(Continued on page 414.)



HULL YOUR SEED QUICKLY, PERFECTLY and ECONOMICALLY With a
"MATCHLESS" CLOVER and ALFALFA HULLER

That's just what you will do if you use a "Matchless" Huller on the job. It's the one huller that will hull all the Clover or Alfalfa you can get to it without sacrificing the quality of the work. Here's the reason! We use square steel brads in our hulling cylinder. This construction has every advantage over rasps of spikes, because no set of spikes will knock the seed out of the damp pods. Rasps gum up and are easily destroyed. Our system of separation is unique and effective. This consists of a series of rotating troughs with perforation in the bottom, with provision for adjustment to meet the various conditions of clover. The Patented Steel Scrapers attached to the bottom of these troughs thoroughly scrape the separator bottom and insure a steady and positive delivery of the pods to the hulling cylinder, regardless of the condition of the clover. This construction enables you to hull seed under conditions in which no other huller can operate; enables you to hull earlier in the morning and later in the evening than with any other—this insures a longer day, thus increasing your earning power. Give us an opportunity to prove to you right on your own farm that the "Matchless" is the speediest and cleanest huller on the market. WRITE FOR CATALOG TODAY, or call at our nearest Branch House.

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BUILD YOURSELF A GREENHOUSE

R. A. McGINTY

Colorado Agricultural College, Fort Collins, Colo.

THERE are doubtless a large number of people both in the city and country who would enjoy a small greenhouse where they could grow plants during the winter, but who dismiss the thought of building one with the idea that the cost is prohibitive. A small greenhouse, however, can be attached to a dwelling house at comparatively small cost, provided the owner does the work himself.

The simplest type of greenhouse is the "lean-to," a shed-like house, which may be attached to the south side of a dwelling or other building. A greenhouse of this kind 10x16 feet will cost for materials seventy-five dollars and up. Where second-hand material can be secured this figure may be reduced. If wooden construction is used, most of the material can be secured locally, but if the more durable iron construction is wanted, the framework will have to be ordered from one of the greenhouse companies.

In building such a house, the foundation and outside walls are best made of concrete or brick, though board walls with a "dead air space" will serve. These should be built two and a half or three feet above the floor level. On top of the walls is placed glass sash making the height from the floor to the eaves five to six feet. The glass for the roof should be 16x24-inch double strength to give a maximum of light and guard against breakage. Ample provision must be made for ventilation.

The greenhouse may be heated by the same system used in heating the dwelling or a specially designed heater found on the market may be used. Hot water or steam heat is best for the greenhouse.

Such a greenhouse can be used for several purposes and if properly handled can be made to pay dividends. In addition to furnishing flowers, bedding plants, etc., for the owner, plants like geraniums, coleus, pansies, asters, tomatoes and cabbage may be grown to supply the demand that will come for such plants in the spring when those living in the neighborhood learn that they can be had. Moreover, the greenhouse furnishes a pleasant place to work during days in the winter when there is little that can be done outside.

STATES MUST TAKE UP RECLAMATION

(Continued from page 396.)

nature have been referred to the considerate attention of the Reclamation Service, with a view towards having them carried through with the aid of federal funds.

When the Reclamation Act was pending in 1902 many eastern financiers and publicists vigorously protested against its passage. They regarded it as a perilous departure in government. They prophesied a series of disastrous results. They designated it a most obnoxious Socialistic experiment. But there has been a surprising change since then in this respect.

The voice of criticism has become small. It failed to grow strident once more, even when it leaked out some time ago, that the Reclamation Service had not wholly lived up to its opportunities and promises.

The cause for this remarkable turn in thought lies close at hand. It can be detected in the general knowledge throughout the country of the marvelous good that the building of irrigation systems has already accomplished.

Mr. J. W.
Lough, Scott,
Kan., writes:

"My 60 H.P.
Charter Type
'R' Oil Eng-
ine burns
about 100
gallons of oil
every 15 hrs.,
costing 2½c
per gallon
laid down in
Scott."



This flow of water is pumped by Mr. Lough's
60 H. P. Charter Oil Engine

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Operates on Distillate, Kerosene and Gasoline, fuels that are obtainable at all times.

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For Porch, Lawn or Camp

The Enterprise Tent-Cot will protect you from all the discomforts and dangers of sleeping out. You sleep 17 inches above the ground under a storm-proof covering that enables you to use the Tent-Cot every night in the year, and all the doors and windows are fitted with both storm and mosquito curtains that can be raised and lowered at will of the occupant. For anyone afflicted with lung trouble there is nothing equals the Tent-Cot. It also has a splendid appearance and can be set up on your porch, lawn or roof and taken down when not in use. Can be set up in a space 30x78 inches and only requires about 30 seconds to operate. It is ideal for hunters, fishers and campers as it eliminates all the annoyance of "making camp." With a Tent-Cot you carry your camp with you under your arm and sleep safe and sound any place.



SPECIFICATIONS—Length of cot open, 6 ft. 6 in.; width of cot, one person, 28 in.; width of cot, two persons, 44 in.; height of bed from ground, 17 in.; height of tent over cot, 32 in.; size of cot folded, for 1 person, 28x36; size of cot folded, for 2 persons, 44x36; weight, 1 person, 29 lbs.; weight, 2 persons, 44 lbs.; frame is of hard maple, painted green; covering is of heavy waterproof canvas in colors, tan or olive green.

PRICE—Tent-Cot 28 in. wide, open 1 side, \$9.00; Tent-Cot 28 in. wide, open 2 sides, \$9.50; Tent-Cot 44 in. wide, open 2 sides, \$11.50.

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BRIEF NOTES FROM IRRIGATION PROJECTS

Oregon

State Engineer John H. Lewis of Oregon, has prepared a statement showing that he issued a total of 173 permits for the appropriation of water during the quarter ending Sept. 30, 1914. The permits give the cost of the proposed works as approximately \$3,000,000 and involve the construction of 230 miles of canal lines, the developing of 30,460 horsepower, and the irrigation of 13,100 acres.

The Modoc Point irrigation project, which will irrigate about 6,500 acres of land in the Klamath Indian reservation in Oregon, is about completed.

Steps toward irrigation in the Rogue River Valley, Oregon, entailing an expenditure of more than two million dollars by the Roguelands company, will soon be taken. A campaign will be launched to secure signers to twenty-year contracts among the land owners. All portions of the valley north of Talent will be covered. The contract will provide a water right at \$50 an acre and an annual maintenance fee of \$2.50 per

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FOR SALE—One 7½ H. P., V. S. Oil Engine, located in El Paso Texas. Was used as a sample, good as new. Price quoted on application. R. R. STREET & CO. INC., 541 W. Washington Street, Chicago, Ill.

WANTED—Practical Engineer to take charge of Canal System in Idaho. Acreage 100,000. Also state experience and salary wanted. J. L. DAUBE, c/o Irrigation Age, Chicago Ill.



The Royal

does the work of several typewriters in one—it writes, types cards and bills! All this without a dollar for "special" attachments. The one machine does it all.

Write Direct

for our new Brochure, "**BETTER SERVICE**," and a beautiful Color-Photograph of the **New Royal Master-Model 10.**

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Royal Typewriter Building
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acre, the land owner being given from three to five years to make the first payment, the payments to extend over a period of twenty years.

An offer to the Central Oregon Irrigation Company to sell its North Canal project to the state and federal governments for \$135,000 was made to the State Desert Land Board, which referred it to the Secretary of the Interior for investigation. Engineers for the federal government reported that the work could be done for about \$180,000 and reported adversely on a previous offer of the project for \$300,000.

The Berney Construction Company of Lakeview, Ore., has been awarded the contract for the construction of the tunnel at the Northwest Town-

site Company dam on the Chewaucan River in Oregon. This tunnel is about 300 feet in length, and is through solid rock. The contract calls for immediate construction and for completion this winter.

The irrigation project at Drewsey, Ore., under the supervision of Edwin Johnson, civil engineer of Vale, is nearing completion. The ditch will carry water for 2,400 acres.

The advance report of the Reclamation Service, in co-operation with the state of Oregon, on the proposed new west side unit of the Deschutes River project, has been made public. The proposed project is located north of the Tumalo project, now nearing completion, and contains a total of 15,630 acres. The area included is



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Growing Wheat in Volcanic Ash

was made possible on the Phillips Estate at Ft. Pierre S. D., by the use of a Fairbanks-Morse oil engine belted to a centrifugal pump. Excellent crops of oats, corn, potatoes and alfalfa are also raised on this irrigated land.

Only \$2 DOWN and One Year To Pay

For any Size—Direct from Factory

You can now get one of these splendid money-making, labor-saving machines on a plan whereby it will earn its own cost and more before you pay. You won't feel the cost at all.

\$24 BUYS THE NEW BUTTERFLY

No. 2 Junior—a light running, easy cleaning, close skimming, durable, lifetime guaranteed separator. Skims 95 quarts per hour. We also make four other sizes up to our big 600 lb. capacity machine shown here—all sold at similar low prices and on our liberal terms of **only \$2 down and a year to pay.**

30 DAYS' FREE TRIAL GUARANTEED A LIFETIME

You can have 30 days FREE trial and see for yourself how easily one of these splendid machines will earn its own cost and more before you pay. Try it alongside of any separator you wish. Keep it if pleased. If not you can return it at our expense and we will refund your \$2 deposit and pay the freight charges both ways. You won't be out one penny. You take no risk. Postal brings Free Catalog Folder and direct from factory order. Buy from the manufacturers and save half. Write TODAY.



Albaugh-Dover Co., 2253 Marshall Blvd., Chicago, Ill.

generally considered at least as fertile as the lands of the Tumalo project, with the advantages of lower altitude and possibly greater freedom from frosts, says the report. The project proposed is a diversion from the Deschutes River, approximately a half mile above Aubrey Falls and immediately above what is locally known as Little Falls, raising the water about 58 feet, and a canal to lands, with ultimate storage by reservoir at Crane Prairie, on the west fork of the Deschutes River. The estimated cost of the new project's construction work is dependent upon certain requirements, one estimate being \$43.44 per acre and another \$41.40.

Complete plans and specifications for the electric light and power plant to be installed by the Farmers' Irrigation Company are now in the hands of President August Guignard of the irrigation company, who has filed on the water site on Hood River, and who is now holding the same in trust for the irrigation company in his name. The new plans provide for a 2,000 horsepower plant of four units, capable of developing 4,000 horsepower peak load. The new dam to be built of concrete will be 50 feet high and 68 feet wide, with a 43-foot base. The tests that have already been made for the foundation of the dam indicate that solid bed rock is located at a distance of 15 feet below the present river bed. The dam, when completed, it is claimed, will be one of the most substantial of its character in the west. It is estimated that the four unit plant complete, together with the rural and city distributing system, can be built for approximately \$225,000.

The government geological engineers, who have been working on Crooked River, near Prineville, Ore., examining the formation of the earth, with a view to making plans for irrigation works, have struck a roaring river of water 70 feet below the surface of the earth. Further investigation may prove that this will be the salvation of this country in the matter of irrigation. In the northern part of Prineville, at about the same time, William Wageoner struck artesian well water, which flowed out of the top of a 150-foot well.

State Engineer Lewis of Oregon has approved the application of the Goose Lake Valley Irrigation Company for the irrigation of 46,500 acres of land and the construction of a large reservoir in Goose Lake Valley, in the southern part of Lake county. The company will within a few months have completed the reservoir and main canal lines at a cost of approximately \$1,000,000. The impounding dam, 66 feet high, 200 feet long at the bottom, and 600 feet on the top, has been completed and permits the storage of 65,000 acre feet of water. Two canal lines, known as the north and south canals, are almost completed. The company expects to sell water for irrigation at the rate of \$25 per acre. As soon as the land under

the present canal has been sold, the project will be extended by the construction of high line canals which will probably bring the total acreage under the project to 60,000.

Nebraska

Government and Nebraska engineers have filed a report favoring the use of water from the Platte River for irrigation in the counties of

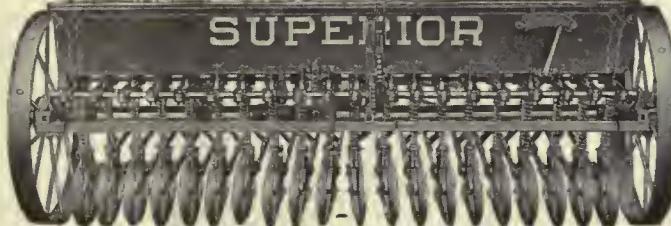
Phelps, Kearney and Gosper. The report is signed by R. F. Walters, supervising engineer, United States Reclamation Service; Mr. Pease, engineer, United States Reclamation Service; George Condra, director Nebraska water supply; Donald D. Price, state engineer of Nebraska. The engineers find 340,000 acre feet available for irrigation in the counties mentioned. It can be used from March 1 to June 30 of each year, thus

Alfalfa for profit

"One-Half the Alfalfa Seed Sown is Wasted Every Year"

This statement has been made by many recognized Alfalfa experts—men who know what they are talking about.

They say that they secured better stands of Alfalfa with 10 pounds of seed, drilled with the Superior Special Alfalfa and Grass Seed Drill than with 20 pounds of seed sown broadcast.



SUPERIOR

THE SUPERIOR 20 X 4 SPECIAL ALFALFA AND GRASS SEED DRILL.

There are 20 discs on this machine set 4 inches apart. The construction is such that all the seed is sown at an even depth, and an equal amount of seed in every furrow.

None of the seed is wasted, when drilled in the ground with a Superior Alfalfa and Grass Seed Drill

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RENEWS OLD PASTURES AND MEADOWS
PRODUCES BEST STANDS OF MILLET
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FREE—A copy of "Boyd's Farmers' Alfalfa Guide," price 10c, will be mailed free to any reader of Irrigation Age who will write for the book and mention Irrigation Age.

insuring a good wheat crop, also alfalfa and possibly the water can be used in raising corn.

Construction within the very near future of the Fort Laramie unit of the North Platte reclamation project, which will irrigate 59,000 acres in Wyoming and 48,000 acres in Nebraska, is expected as a result of the important conference held in Washington recently through the efforts of the members of the Wyoming delegation, says the Sheridan (Wyo.) Post.

A special committee from the Alliance (Neb.) Commercial Club met with the county commissioners recently to obtain their co-operation in promoting the sinking of some wells for irrigation purposes. Water is now found at a depth of from 14 to 35 feet, which has been sufficient for stock purposes, but up to date these wells have not been tried out for irrigation purposes. The commissioners agreed to drill at least three wells, and if they produced 35,000 gallons in ten hours' pumping, the farmer was to pay all expenses, and if they did not produce that much water the county is to pay half the expenses.

California

There is considerable interest developing in the Coalinga section of Fresno county in California in the matter of irrigation. The most practical efforts so far have been the drilling of wells north and south of Huron. C. M. Gifford has drilled a well on his place, about 10 miles south by east from Huron station. The well was finished up at 1,010 feet with 7½-inch casing. A deep well pump is operated which develops about 600 gallons per minute. The water is of good quality for irrigation. Mr. Gifford has planted 110 acres of olives that are growing very nicely, only a very few having to be replaced. Over toward Wheatville, on the Fitzwilliam ranch, there are several wells that are flowing from 500 to 800 gallons per minute. The olive culture promises to be a feature in this section, several orchards having been set out and others are to follow this coming spring.

The Alameda Sugar Company which owns considerable property near Meridian, Cal., is making a number of improvements on their irrigation system and it is believed that the company still intends building a factory at Meridian. The present irrigation pumps are being taken up and sunk deeper into the ground to enable the farmers leasing the company's property to plow over them. Surveys are being made for a new drainage system for the property.

Work is being rushed on the irrigation canals which are being dug by the Natomas Consolidated Company near Pleasant Grove, Cal.

A. W. Leichfuss and W. A. Knuth have recently completed a well on the corner of the former's property at

Orange, Cal. The water from the well will be used for the irrigation of the two ranches, as soon as a pump can be installed. The well is 385 feet deep, passing through five strata of water. The water stands within 165 feet of the top of the well.

John Tweedy, proprietor of the Tweedy ranch near Watts, Cal., recently installed a new pump on his property which is said to be giving excellent results. The plant produces about 1,250 gallons of water per minute on a 46-foot lift and with a fraction of over twenty-four horsepower input into the motor, or about twenty horsepower delivered into the pump pulley.

The Hallwood Irrigation Company of Marysville, Cal., voted Oct. 30 on the proposition to increase its capital stock from \$25,000 to \$50,000.

F. H. Palmer of San Bernadino, Cal., received notification that a patent has been granted for his invention known as "Palmer's hydraulic propeller pump."

The directors of the Oakdale and South San Joaquin districts in California, have decided upon a reservoir site to be utilized for future emergencies. While there is plenty of water for present needs, as the districts continue their development more water will be needed, and the two districts are preparing to build reservoirs to store flood water which can be utilized in case of emergency.

The Webber Creek dam, which will impound much water for irrigation of lands in the Missouri Flat district of California, is completed.

A party of Californians have organized a company for the purpose of



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Some folks plan to build all their lives and never do. Before they realize it, the family has grown up and gone. Quit *idle* planning and do some *real* planning, now. First of all, write for the H-L-F House Pricer. Get our delivered freight paid price on materials—lumber, millwork, hardware and paint. Get it even if you've never had bill of materials made.

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It's free! You'll be amazed when you find how low H-L-F prices are. They are the *producer's price* to you. We control the forests and mills—sell you direct—no middle profits. We make deliveries in two to three weeks. Guarantee grades, full count and satisfaction. Better lumber for less money. Write today.

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Hewitt-Lea-Funck Co., 371 Crary Bldg., Seattle, Wash. (Please write plainly)

Gentlemen—Please send me the following:

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Name _____ Business _____

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When are you going to build?



diverting water from Leving Creek to irrigate 20,000 acres of land in the Mono Basin, high up in the Sierras. Construction work on this project is expected to begin next spring. On Russ Creek, a stream also running from the Sierras into Mono Lake, and not far from Leving Creek, Los Angeles capitalists have started a project for the purpose of irrigating land in the Mono Basin. The canal from Russ Creek will run around the lake in one direction, while the Leving Canal will form a half circle around the lake in the other direction. There are 100,000 acres in the Mono Basin susceptible of irrigation from these two projects.

Water users in California Reclamation District No. 1606 around San Joaquin, Cal., voted Nov. 5 on a proposed issue of \$600,000 worth of 6 per cent bonds.

Blaine & Bowen of Tulare, Cal., have just completed installing 2,000 feet of 12-inch concrete irrigation pipe in an alfalfa field on their ranch. It has been tested out and found to work in good shape. A little later 800 feet more of the pipe will be laid in an orchard, and still later other fields will be irrigated by the same system. Water is supplied by a 5-inch pump driven by electricity.

Reclamation District No. 70, Meridian, Cal., has placed a contract with the Yuba Construction Company, Marysville, for a 40-inch pump of 50,-

000 gallons per minute capacity, and with Fairbanks, Morse & Co. for a 300-horsepower motor.

Much interest is being manifested in the irrigation plant on the J. E. Cain place, south of College City, Cal. This is the first large pumping plant to be installed in the district, and its success was a matter of doubt. At the present time a flow of 800 gallons per minute is being secured, and this can be increased when occasion demands. This one pumping plant has been the means of turning a half section grain ranch of small returns into a big paying dairy proposition.

Idaho

The Snake River Irrigation Company, Ltd., of Ada, Idaho, has practically completed its project. The company takes 200 second feet of water from the Snake River.

The North Lake Canal Company, Roberts, Idaho, has filed articles of incorporation and will irrigate a tract of 30,000 acres, installing a pumping plant. Bids for machinery required will be called for soon.

Colorado

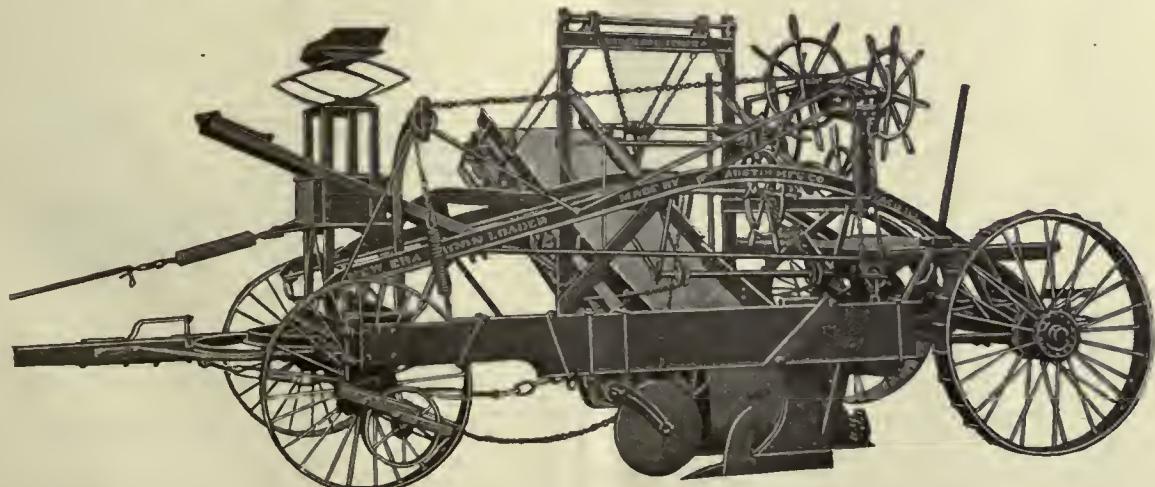
It is announced by Attorney T. H. Devine, receiver for the Pueblo-Rocky Ford Irrigation Company of Colorado, that the new company which has purchased the project will form a corporation as soon as the sale made by Samuel D. Trimble, master

in chancery, is approved by the federal court. The new company will probably incorporate for \$1,000,000 and will have ample funds to complete the project and colonize the land.

The legal tangle that has delayed the completion of the irrigation project planned and partially completed by Senator George W. Swink, pioneer of Otero county, Colorado, has been straightened out by a compromise settlement made outside of court, and work of completing the project will start early this month. On Nov. 3 a meeting of stockholders of the Swink Ditch and Reservoir Company was held at Rocky Ford to elect officers. Mr. Swink died in 1910 without seeing the completion of the big irrigation project which bears his name, but in his will he left a proviso that before his heirs should divide his estate worth probably \$1,000,000, the project which had been his dream for years should be completed with the funds of his estate. The project covers 18,000 acres.

C. B. Sherwood, a Rocky Ford, Colo., irrigation contractor, has encountered a remarkable soil formation near Meredith Lake. It is a formation of sandy doby and mica, which, in some manner, has become cemented together to such an extent that it is almost impossible for a dredge to work it. After it is taken from the ground and is exposed to the air for a few days it crumbles to pieces.

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More than a mile of this has been encountered. Another peculiar thing regarding the formation is the fact that it seems to stand on its side and leans from north to south while all the other formations of shale and sandstone found in Colorado run from west to east. All the ditch men are taking samples of the formation as a curiosity.

Washington

A decree giving the Dexter-Horton Trust and Savings Bank of Seattle judgment for \$346,025 and the American Power and Light Company judgment for \$497,945 against the Hanford Irrigation and Power Company has been filed in the United States district court at North Yakima, Wash. It establishes the mortgage given Dec. 31, 1906, by the Hanford company to the bank as a first lien and in default of immediate payment of the amount of the judgment it calls for the sale under the direction of the company's receiver, E. F. Benson, of all the company's mortgaged property. Included in the property to be sold is the land and power plant at Priest Rapids; the pumping plant site at Coyote Rapids; the main irrigation canal and six laterals, including the White Bluffs pipe line; property in Yakima county; lands under the irrigation project; a half interest in the Todd & Cover lands between Hanford and Priest Rapids; the townsite of Hanford and miscellaneous property there, including the Planters' Hotel; the Hanford-Priest Rapids 66,000 volt transmission line, the Coyote stub line and the telephone system used in operating them; the Coyote Rapids pumping station and the Hanford substation; all title of the Hanford company to a long list of lands, whether in the form of contracts, notes and mortgages, and all property of the company of every kind. The court decrees that the receiver shall sell the property all in one parcel for not less than \$380,000.

The Washington Irrigation Institute will meet at North Yakima, Dec. 16, 17 and 18.

A 950 gallon per minute pumping plant has been completed near Quincy, Wash. The engine is 80 horse-power and pumps from a well which it is thought encounters a subterranean body of water which is supposed to underlie a portion of the Quincy country. The plant is on the Wenatchee Apple Land Company's tract a mile east of Quincy and the cost was \$20,000. The plant is designed to water the 520-acre orchard tract of this company, of which R. H. Kipp of Spokane is the president and manager.

Feasible but prohibitive in cost, is the report of a board of managers appointed to review the resurvey of the Palouse irrigation project in Washington, made by Engineer E. McCullough of the Reclamation Service. Nine reservoir sites were examined and all but three rejected, Rock Lake and Washtucna in Washington

and Potlach in Idaho. Using all three reservoirs, the board places the cost of irrigating 73,500 acres at \$102 per acre.

The Cascade irrigation district near Ellensburg, Wash., has arranged for the sale of \$100,000 worth of bonds, sufficient to replace every foot of wooden flume with new steel flume, and it was announced that the work would be done between now and the first of April, totaling approximately \$138,000. The Hess Flume Company of Denver, which furnished approximately \$50,000 worth of flume last year to this district, is to furnish approximately as much more under a new contract just signed and take bonds in payment. The Coast Culvert and Flume Company of Portland is also furnishing 9,000 feet of flume and taking bonds in payment. The Cascade irrigation district originally voted a bond issue of \$700,000 to cover the cost of erecting new steel flume to replace all the old wooden flumes, the digging of the tunnel, the widening of the ditch and the taking over of the capital stock of the old Cascade Canal Company. The tunnel was completed last spring at a cost of \$30,000 and 6,700 feet of flume were put in. With the 18,000 feet contracted for the flume will be taken care of and the only other work necessary will be the widening of the ditch. More than \$80,000 has already been spent. The water right comes from the government.

Plans are a-foot for the irrigation of the "prairies" around Tacoma, Wash., using water from the Puyallup River.

William Young of Victoria, provincial water rights commissioner; W. M. Reed and S. H. McCrory of Washington, D. C., engineers for the government of the United States, have been appointed by their respective governments to work in conjunction on plans to reclaim large areas of land along the Kootenay River, both in the United States and Canada, which has been urged. Considerable work has, according to Mr. Young, already been done on the other side of the line.

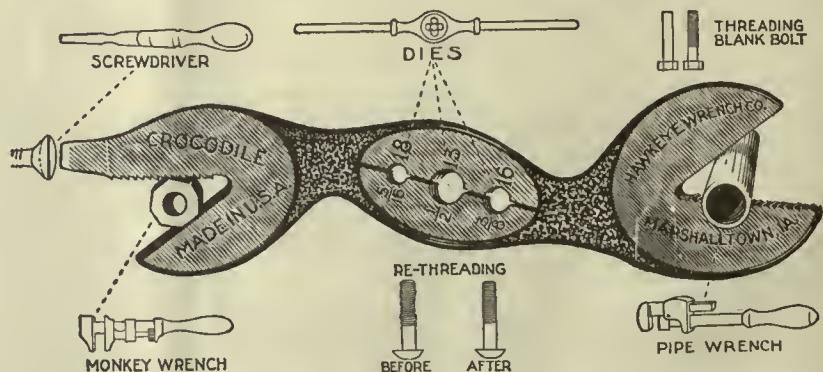
Florida

W. C. Thomas has installed a Campbell irrigation system on five acres of his large farm near Elfers, Fla.

Mexico

Development of the San Carlos ranch in the state of Coahuila, Mexico, is about to be resumed after a lapse of four years. The ranch is located south of Del Rio and Eagle Pass and embraces 500,000 acres. About 30,000 acres are ready for irrigation and the irrigation plant will allow a total of 85,000 acres to be watered. This plant was installed four years ago at a cost of \$2,000,000. The property is owned by Gen. Gonzales Trevino.

The CROCODILE WRENCH



Six Handy Farm Tools in One

The Crocodile Wrench is drop forged from the finest tool steel and scientifically tempered. Every wrench guaranteed against breakage. It is 8½ inches long and weighs ten ounces.

A pipe wrench, a nut wrench, a screw driver and three dies for cleaning up and re-threading rusted and battered threads; also for cutting new threads on blank bolts. Dies will fit all bolts used on standard farm machinery.

Teeth and dies are case-hardened in bone-black, making them hard and keen.

The dies on this wrench are tempered to wear and would be of inestimable benefit to any farmer or ranchman, as they would often save valuable time, besides an extra trip to town for repairs.

Sent free with each order for Irrigation Age for one year—price for both \$1.00; also sent to old subscribers who renew their subscription for one year.

Address: IRRIGATION AGE, 30 No. Dearborn St., Chicago

Texas

The Green Machinery Company has brought in irrigation well No. 5 for the Littlefield, Texas, interests. This well is located adjoining the railway four miles southeast from Littlefield. The pump has a normal capacity of 1,200 gallons per minute. The well has a depth of only 148 feet and 45 feet to the water.

Ward County Irrigation District No. 1, Barstow, Tex., will purchase system of canals, etc., at cost of \$125,000 and construct new work to cost \$350,000, including an intake canal 29½ miles long, head works, diversion wier, sluiceways, retaining wall, regulator gates, levee, 6-mile outlet canal, 3-mile main canal, 15 miles of levee and laterals, etc.; total excavation 1,470,000 square yards. The system will irrigate 24,000 acres. The district has voted bonds for \$475,000.

W. L. Hargis of Cotulla, Tex., will construct an irrigation pumping plant.

The Lubbock Irrigation Company in Texas, including 12,000 acres of shallow water land, an up-to-date irrigation plant and growing crops, has just been sold to John G. Edwards of Kansas City, president of a fire insurance company, and known as "the wheat king of Kansas." The consideration was \$35 per acre. The Lubbock Irrigation Company has developed a magnificent irrigation proposition in one of the best portions of the shallow water belt of the plains country. Fine yields of alfalfa, corn, cotton and other crops have been made this year.

Cameron County Irrigation District No. 1, Harrington, Tex., voted \$750,000 bonds and will take over canal system at \$400,000 and expend \$350,000 for improvements to existing system and developing territory not under irrigation, plans to install pumping plant capacity 50,000 to 100,000 gallons per minute, build 15 or 20 miles main canals, laterals, etc.; district embraces about 40,000 acres.

The Bedell Moore estate of San Antonio is preparing to irrigate 4,500 acres of a tract of 12,000 acres of land near Del Rio, Tex., by a method

distinctly new in this country. The first large sized Humphrey direct-acting explosion pump ever installed in the United States will be used in this project. Some time ago Alexander Potter, consulting engineer of New York City, was in San Antonio and was asked to pass upon the most economic plan of development. He recommended pumping, preferably by Humphrey pumps, instead of the long and hazardous gravity canals. The Bedell Moore estate commissioned Mr. Potter to study the European installations of this type and the detail plans of the immense Mix (Egypt) plant now under construction. As a result of these investigations the Bedell Moore estate has purchased Humphrey pumps and Akerlund type producers for wood and coal burning. The pumping station is located fifteen miles by road from Del Rio, the nearest railroad station. Much of the land is covered with mesquite wood and will have to be cleared before cultivation. The use of this wood as fuel until clearing was completed seemed attractive and its possibilities as a gas producer was fully investigated, with highly satisfactory results. This cut down materially the cost of fuel for the pumps, which is usually a big item. The pumping station is located directly on the banks of the Rio Grande at a point where a rock ledge extends entirely across and creates a slight fall. A forebay is being excavated in the river bed adjacent to the pumping station and just above the ledge. The operation of the Humphrey pump is interesting. A charge of gas-air mixture is exploded in a chamber above the water surface, no piston being used. The explosion drives the water downward and sets the whole water column in the play-pipe in motion. The inertia of the moving column of water permits the burned gases to expand below atmospheric pressure, and both exhaust and water valves, which were shut by the explosion, open. There follows a return surge of the liquid column until the water reaches the exhaust valves and closes them by impact. There is a second forward surge set up by the trapped and compressed gases, and when the pressure again falls below atmospheric a fresh charge of gas and air is drawn in. This is finally compressed by the second return

surge and exploded and the cycle repeats. The inlet and exhaust valves are interlocked so that the proper sequence of operation is maintained.

At a recent meeting of the farmers and water users on the San Benito tract in Texas, it was decided to make the present bondholders a proposition for the purchase of the water system. In pursuance of this an election will be held for formation of an irrigation district. It is estimated that it will require a bond issue of \$600,000 for the purchase and improvement of the present system.

Arizona

The Schweitzer Machine Company, Tucson, Ariz., has just completed the construction of its new plant. A specialty will be made of irrigation and pumping equipment.

Michael Hale, Springerville, Ariz., will construct a water storage reservoir and install a pumping plant to irrigate several thousand acres of land.

Wyoming

The world-wide effect of the European war on the money market has been brought sharply home to Wyoming in the announcement by Keneffick & Hoffman, the Kansas City firm that has the construction contract on the Big Wind River irrigation project in Fremont county, that the beginning of the construction work has been postponed until next spring. Construction equipment including two steam shovels and two drag lines were ready to be moved to Riverton when the growing stringency resulting in the withdrawal of European capital from all foreign projects rendered further procedure impossible.

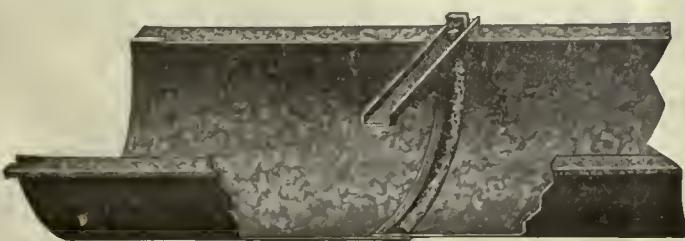
State Land Commissioner S. G. Hopkins of Wyoming, on behalf of the Medicine Bow Valley Irrigation Company, a \$750,000 corporation, has just completed the filing of an application for the segregation of a 16,727 acre tract of land in the vicinity of Medicine Bow, subject to the provisions and reservations of the Carey arid land act. The main supply of water will be procured from the Medicine Bow River, a tributary to the North Platte. Two enormous stor-

GALVANIZED METAL IRRIGATION FLUME

(Newcomb Patent)

Made entirely of rust-proof, galvanized iron. No bolts or rivets used in construction. This flume is considered by experts to be the most serviceable equipment for the purpose on the market.

A careful examination of the construction as shown herewith will convince those who are acquainted with irrigation conditions of its lasting quality and the ease with which it may be put together. Complete information, with prices, will be furnished on application to the



Section of Flume

KLAUER MFG. COMPANY, Dubuque, Iowa

NEWELL HAS A BIG TIME

(Continued from page 406.)

to 15, was the annual meeting of the International Congress of Farm Women—an organization which some day will be as formidable a factor in the life of the average farm woman in her campaign for better homes, as the votes for women organizations are in the life of her metropolitan sister.

"To one who has not followed the progress of this dry farming movement since the first meetings were held nine years ago, the eagerness with which thousands of farmers from all over the world reach out after its teachings is astonishing. Years ago it outgrew the word "dry," so that now, although moisture conservation is the keynote of inception, it is more of a "better" farming congress.

"Every phase of rural achievement from raising short horns to an address by Mrs. Elbert Hubbard on 'The Farm Beautiful,' was not only discussed, but constructively outlined."

Dr. E. Dana Durand, former director of the census bureau, but now Professor of Economics at

the University of Minnesota, warned the country of the dangers of careless farming.

"Because the population in this country tends to overrun the food supply, it means an everlasting hustling if we get food enough," said Mr. Durand.

"We have had no reason to worry about the population outstripping agricultural products until within the last ten years, when conditions have reached the danger signal point where we may become an importing instead of an exporting nation. We have got to be active and keep our wits or we will be falling behind in the race. In 1912 the production of cereals increased only 2 per cent, cattle and hogs fell off, but the population increased 21 per cent.

"The main thing for us to do is to restore the balance between the food supply and the population. We must induce more people to go onto the farms by legislation or some other way. We may have to force immigrants onto the farms by law. We lead the world in mining, manufacturing and other industries, but not in agriculture."

IRRIGATION NOTES

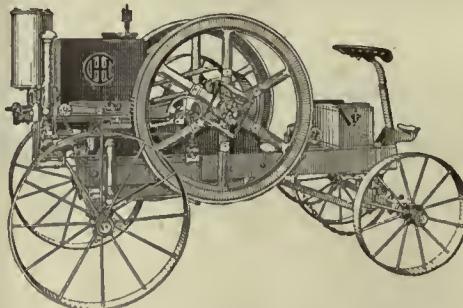
(Continued from page 413)

age reservoirs, to be known as the Cronberg and the Sand Creek, are planned in the project. The project has been under the advisement of the state board of land commissioners the past year. The system was eventually pronounced feasible after detailed examinations by engineers and the procuring of water rights. The advancing and promoting of the project now awaits the action of the government in the withdrawal of the land. It may require from one to five years before the segregation is eventually declared, it is said. The irrigation company plans to supply water for fully 30,000 acres of land, the greater part of which is owned by private concerns.

Utah

W. J. Elwood, superintendent of the Independent Coal & Coke Co. of Kenilworth, Utah, has solved the problem of high water lifts for the fertile bench lands of eastern Utah. Through a pumping plant installed under Mr. Elwood's supervision water was lifted vertically for a distance of 347 feet and by utilizing the waste product of the Independent Coal & Coke Co.'s mines at Kenilworth as energy for the generation of the necessary power, the cost is minimized to such an extent that in comparison with electricity it means one-third of one cent per kilowatt hour. The outfit installed by Mr. Elwood is a steam turbine with direct connection to a centrifugal pump and capable of generating 250 horsepower. One hundred horsepower raised 700 gallons of water per minute into a reservoir on top of the bench north of Price. Several other reservoirs will impound water for irrigation of 800 acres belonging to the Kenilworth-Price Land & Water Co., of which Mr. Elwood is president; Benton Randolph, treasurer, and B. R. McDonald, secretary.

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Not every local dealer handles IHC engines. The one who does is a man you can't afford to miss. If you do not know who he is, we will tell you when you write us for catalogues.

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U.S.A.



DRILLING 30-INCH WELLS

(Continued from page 395.)

in pure sand are made to stand open without casing for a considerable time. By this process in many cases the drill rods are not pulled until the well is drilled the required depth.

If rock is encountered, when drilling by the rotary process, the drill rods are drawn from the well and a core barrel substituted for the earth drill. This consists of a tube usually 6 to 20 feet long and the diameter of the drill hole and having a slot extending diagonally upward several inches from its lower edge. Crushed steel, sometimes called steel shot, is fed down the drill pipe from the surface, a handful at a time, and is carried by the circulating water and the slot in the barrel under the edge of the bit and the rock is cut by abrasion. This barrel cuts a circular slot, or kerf, and produces a central core of rock which is usually lifted in small wells by dropping pebbles down the drill rods and wedging the core in the barrel and in the large wells by special gripping devices which are lowered into the drill hole after removing the drill tools.

Rock formations can also be drilled with the usual rock drilling tools attached to a walking beam connected with this machine and reamed out to the required size with the rock reamers which have been extensively used by well drillers for many years, but the well drillers that have been most successful in putting down the large wells required for turbine centrifugal pump installations, use the rotary process almost exclusively.

The writer is indebted to the American Well

Works, Aurora, Ill., for the illustrations accompanying this article, and also for much of the information relative to drilling large wells.

BITTER ROOT FINANCES

Some interesting facts concerning the Bitter Root Valley Irrigation Company are contained in a report of G. M. P. Murphy, an expert, to the creditors of the Assets Realization Company.

The Assets Realization Company is a Chicago concern, at the head of which was Ira M. Cobe of Chicago, president. The company has \$10,000,000 capital stock, all of which, it appears from the report of the expert, is worthless. Nevertheless the company paid dividends at the rate of 7 per cent to October, 1912, when it was increased to 8.

"The Bitter Root Valley Irrigation Company stands on the books of the Assets Realization at \$5,418,334," says the Murphy report. "This is the most pretentious asset in the list. It consists of irrigable and non-irrigable land in the Bitter Root Valley, Montana. The persons who bought property in this valley and gave mortgages were extraordinarily poor pay. The reports giving the condition of the notes and accounts receivable overdue on July 1, 1914, says:

"On that date the mortgage installments past due aggregated \$402,581, and the contract installments past due aggregated \$432,543. On Sept. 1, 1914, out of 286 outstanding mortgages 211 were in default, and out of 252 outstanding contracts 115 were in default."



distillate with unequaled economy. The Aultman-Taylor 30-60 is not an experiment. Their real worth has been demonstrated on thousands of farms throughout North America. Let us explain to you why you should own and operate one of these money-making and labor-saving tractors.

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**THINK what it means
to you! To have at
your service—day and
night if desired—the com-
bined power of 30 to 35
horses and 10 to 15 men—
ready at a moment's notice to
plow, disc, harrow, seed, har-
vest, build roads, irrigate,
thresh and do numerous other power jobs, all
at the minimum expense for fuel and main-
tenance. That's what you get when you
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AULTMAN-TAYLOR 30-60 GAS TRACTOR

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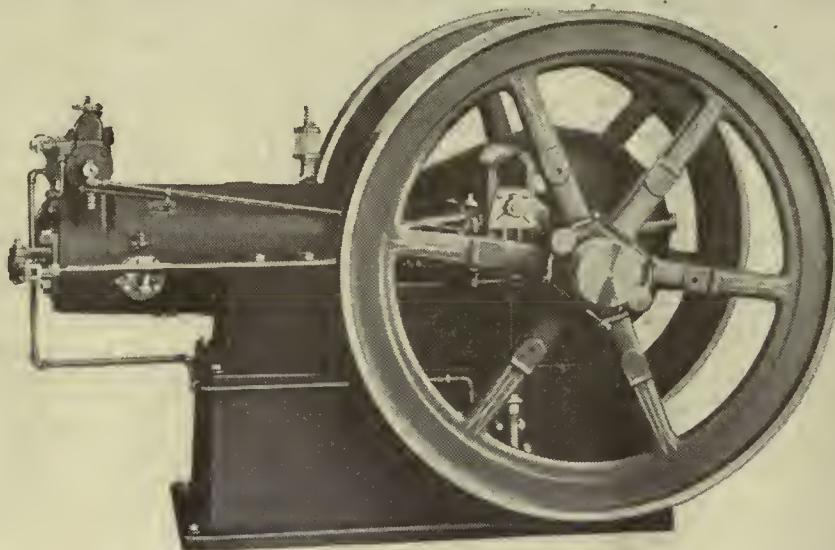
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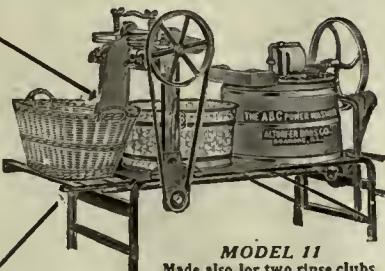
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Figure the cost of your rubber footwear on its cost per day's wear and you will see why "Ball-Band" is the lowest priced. ¶ "Ball-Band" is sold by 50,000 stores. ¶ If you don't know a store that sells "Ball-Band" write us, we will tell you of a nearby dealer who can supply you. Write anyway for our free booklet.

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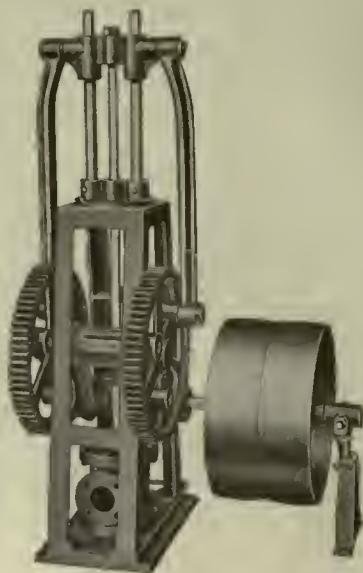
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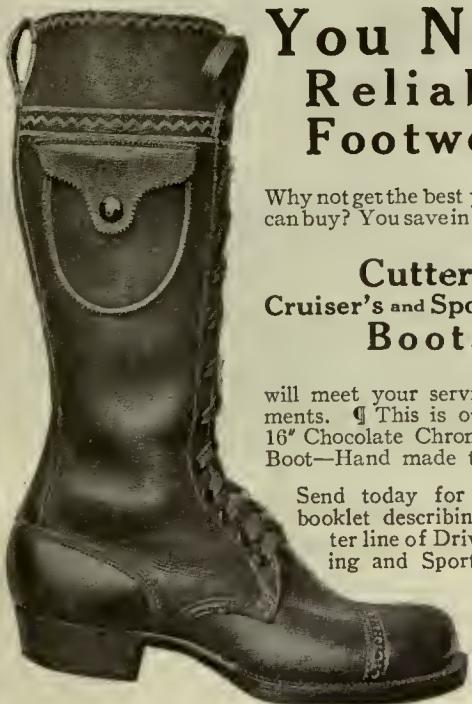
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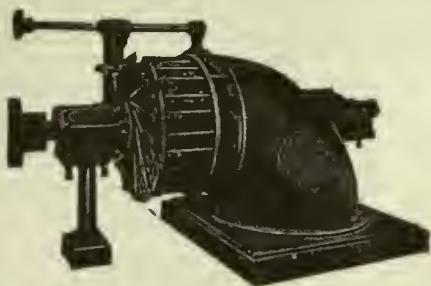
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A material which represents the utmost durability yet achieved in iron or steel for exposed situations.

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OREGON—Portland, Coast Culvert & Flume Co.
SOUTH DAKOTA—Sioux Falls, Sioux Falls Metal Culvert Co.

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STEADY POWER

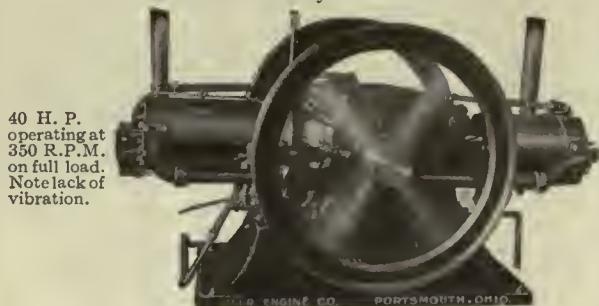
is the secret of the success of the Heer Engine on irrigation work. Its lack of vibration, absence of lost motion and practically perfect balance not only cause it to pump more water per gallon of fuel, but prevents jerks and jolts to the engine and pump which on others cause the shaft to get out of line and bearings to run hot.

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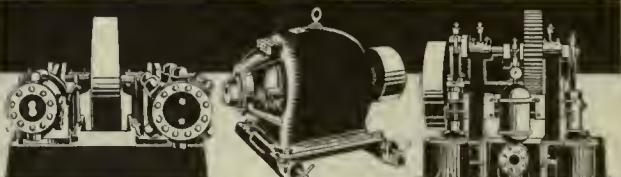
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Having a complete line of adjustments it is equally well adapted for making ditches, both for dry land irrigation and rice field work.

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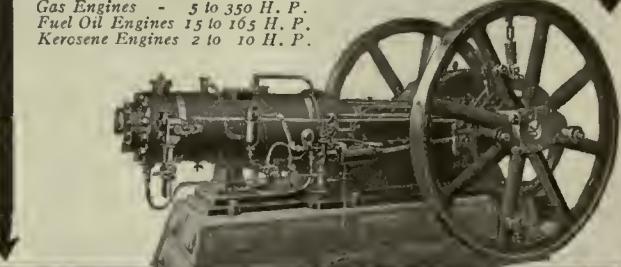
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FIFTEEN THOUSAND POWER PLANTS**

Thirtieth Year

THE IRRIGATION AGE

VOL. XXX

CHICAGO, DECEMBER, 1914.

No. 2

THE IRRIGATION AGE

With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARIO AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

D. H. ANDERSON

PUBLISHER,

Published Monthly at 30 No. Dearborn Street,
CHICAGO

Entered as second-class matter October 3, 1897, at the Postoffice
at Chicago, Ill., under Act of March 3, 1879.

D. H. ANDERSON, Editor

ANNOUNCEMENT.

The "Primer of Hydraulics" is now ready; Price \$2.50.
If ordered in connection with subscription \$2.00.

Make This Christmas One of Real Joy

This is the season of holiday cheer. THE IRRIGATION AGE extends to all its subscribers, its advertisers and its friends the most hearty wishes of its publisher and its editor that they may have the merriest of Christmases and a most prosperous New Year. These wishes come from the bottom of our hearts and are but scant compensation for the kindly and friendly treatment which you have extended to us in the thirty years' life of THE AGE.

THE AGE also would like to extend to its readers just a bit of Christmas advice—advice which we believe will make the holidays more cheerful to you and yours.

Do not try to overdo Christmas. Give the children the best Christmas your means will afford—they will not be young much longer—but do it in such a way that it is not going to be a burden or rob the home of necessities.

Try to give useful gifts. They need not be expensive. In many cases, a card expressing your good wishes will prove far more welcome and acceptable than will a present, which the recipient may know you could hardly afford to give.

Add to your Christmas cheer by making some

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Associations has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Interesting to Advertisers

It may interest advertisers to know that The Irrigation Age is the only publication in the world having an actual paid in advance circulation among individual irrigators and large irrigation corporations. It is read regularly by all interested in this subject and has readers in all parts of the world. The Irrigation Age is 29 years old and is the pioneer publication of its class in the world.

poverty-stricken or sick person, to whom the world has not been so kind, happy on Christmas day.

When you start on your Christmas shopping tour try to find gifts that will spell value every day in the year. If mother has to do her own washing, what's the matter with a power washing machine that will save her from rubbing her poor arms off once a week during the years to come? Or a little engine that will turn the washing machine, pump the cistern water and operate the churn?

Do something at Christmas time to make the housewife's burden lighter. Not only will it please the wife, but it will be a good investment for the whole family. The mother will have lots more time to give to the little niceties about the house that she yearns to do but now has not the opportunity.

Give the children toys, but also give them books and games—particularly books worth while, among them a book that will interest the boy and the girl in modern agriculture, that will show to them that in all this world there is no place which offers so many advantages today to the boy or girl as the farm, if the farming is done along approved and scientific lines. There are books of this kind in the markets. We shall not attempt to suggest a list of them. Ask the school teacher. If he or she is really interested in your community life, he can

tell you of at least one book on farming as well as good works of literature, which your children will enjoy reading. You are building for the future of yourself as well as your nation, when you give your children good books. Build well.

We in America have become so fetish about Christmas that we are inclined to give more than we can afford, and as a result Christmas is looked forward to with horror rather than joy. Start right now to make this a Christmas of joy. Be sane about your Christmas shopping. Join the Society for the Promotion of Useful Giving. It does not cost you anything to belong to it. You do not even have to fill out a membership blank.

Better than gifts, give to all the world smiles and words of cheer. They count more than gold. Let us make the next year a year of smiles and optimism. You cannot do anything more patriotic or more noble and God-like than to pass the smile along.

A Merry, Merry Christmas to you!

Why Not Help the Settlers, Mr. Lane?

We regret very much that Secretary of the Interior Lane should have laid himself open to comment such as this from the *Churchill County Eagle* of Fallon, Nev.:

There was a large crowd present, but there was sad disappointment in the reclamation talk that was expected. For, instead, Mr. Lane made a straight-out political speech for Francis G. Newlands' candidacy for the United States Senate. Several of the farmers came into this office after the meeting and expressed their indignation that they should have been called from their work under the pretense of hearing the Secretary of the Interior talk on reclamation affairs. They said the Secretary of the Interior did not come—that instead, it was a stump speaker.

Because he comes from the West, the settlers on the Federal projects have had unusual confidence in Mr. Lane. This seemed fully justified when he called a conference of water users in May, 1913.

When the first draft of the Twenty Year Extension law was made public by THE IRRIGATION AGE, some of the settlers shook their heads, but the majority still felt Mr. Lane would obtain justice for them. The bill as it finally became a law was mere political sop, containing relief with many strings—and some of them very dangerous strings—tied to it.

Still, under the law—as bad as it is—Mr. Lane has it in his power to confer some real benefits upon the settlers. No steps, however, have been taken by the Reclamation Commission to do anything under this law except to drive the farmers to accept it by using the lever of the loan shark. Ac-

cept this law and pay 84 cents an acre or stay under the old law and pay \$18 or \$24 an acre by March 1 or lose your farm is, in plain English, the ultimatum delivered to the settlers on the Umatilla project. It reads about the same way on the other projects.

Does acceptance of the new law also mean acceptance of the increased charges, which are certain to result on practically every project from the revaluations? Settlers have asked this question repeatedly. They have received no answer except these cryptic words: "No increased charges will be assessed unless a majority of the water users agree to accept them." What does that answer mean? When are the settlers to vote on these charges? Before they are fixed?

Is it Mr. Lane's duty to recoup the vast financial losses incurred by the Reclamation Service under the administration of F. H. Newell, whom Mr. Lane is pleased to keep in office as Director of the Reclamation Service?

No! we answer. It is his duty to see that the solemn contracts between the United States government and the settlers are fulfilled, even though it costs the reclamation fund \$40,000,000. The settlers must not be made to pay for the mistakes and experiments and engineering foolishness of the Newellites. Such action would be un-American and dishonest.

Some Figures That Will Cheer You

If anybody starts to talk hard times or depression to you, just refer him to the "Statistical Record of Progress of the United States, 1800-1914."

We all get some bumps occasionally. We all run into spells of slow pay or poor markets. There is no such condition as perfect in this nation or any other, but when things look blue or some one tries to discourage you, we repeat, just study the government figures.

Those cold figures are startling. They will make you swell with pride because you are a part of what those figures represent. They show clearly how well founded is this nation; how firm it has been builded and how even world-wide war conditions cannot shake it.

Those figures spell on-coming prosperity.

The population of the United States today is more than 100,000,000 and the money in circulation totals \$3,419,000,000, while 11,000,000 of the thrifty inhabitants have \$4,375,000,000 in the savings banks. The farms of the nation are worth \$41,000,000,000.

Commerce has grown from \$318,000,000 to \$4,259,000,000 and the per capita value of exports from \$16.96 to \$23.27.

National wealth has increased from \$7,000,000,-000 in 1870 to \$140,000,000,000 and the money in circulation from \$279,000,000 to \$3,419,000,000. For the entire country bank clearings have grown from \$52,000,000,000 in 1887 to \$174,000,000,000 in 1913.

Improved social conditions among the people are shown in that 19,000,000 children are enrolled in public schools and 200,000 students in colleges. The total expenditure on education approximates \$500,000,000 a year.

More than 22,000 newspapers and periodicals are printed.

In 1850 there were 251,000 depositors in savings banks. There are now 11,000,000, with deposits aggregating more than 100 times as much as at the middle of the last century.

The value of farms and farm property increased during the last half century from \$4,000,000,000 to \$41,000,000,000; value of manufactures from \$1,000,000,000 to over \$20,000,000,000, and the number of miles of railroad in operation from 9,021 in 1850 to 258,033 in 1912.

In the last twenty-five years the number of passengers carried has increased from 492,000,000 to 1,004,000,000, and the volume of freight handled each year from 632,000,000 to 1,845,000,000 tons.

Nearly 20,000,000,000 pieces of outgoing mail matter are handled annually by the Postoffice Department, which disbursed last year \$262,000,000, or \$2.70 per capita.

Don't those figures make you feel better?

Diversified Crops Stop Worries A lot of people marvel at the ability of the German people, shut off from all the world, to supply their immense armies and still have plenty of food for the home-folks.

The answer is the German farmer. Look at the German farmer in your own neighborhood. Two to one, he is doing less worrying because the war has disturbed financial conditions and thrown markets askew, than anyone else in your vicinity. There is a reason for this.

The German farmer, no matter where he is located or what the condition of his land may be, raises more or less of the things he requires for his table. Also, he generally has a surplus which furnishes ready money throughout the year. If the price of cotton declines to the point where he does not see a big enough profit, the German farmer invariably retires his holdings until such time as he thinks it expedient to turn loose all or a portion of his crop. The German farmer furnishes concrete evidence of the good sense in diversifying and always being prepared to meet an emergency.

A Law Under Which Farmers Can Help Themselves

Wisconsin's law for the establishment of co-operative land mortgage banks offers some features to which Federal Water Users can well afford to give careful consideration. In this law

may be found the nucleus of a system whereby the Water Users' Associations on the Federal projects or the wealthier members of these associations may develop banks, which will furnish substantial aid at reasonable rates to the settlers.

The new law permits any number of freeholders (not less than fifteen) resident in Wisconsin, to form an association with a minimum capital of \$10,000 divided into shares of \$100 each, and gives such an association power to make loans against first mortgages on agricultural lands, forest lands or lands occupied by dwelling houses situated within the state.

The associations are intended to promote rural credit and to disburden farms by granting amortization loans at moderate rates of interest. The most important provisions which safeguard the security of the mortgages and, consequently, of the bonds issued against them, are the following:

No loan shall be made unless the Committee on Loans is satisfied that it will benefit the borrower and will be used either for effecting improvements in the land or other property mortgaged, or for the purchase of live stock or implements to be used for agricultural purposes directly in connection with such land. In the latter case the loan shall be made only to a bona fide resident upon the land offered as security. All mortgages must contain provisions for the proper conservation of the soil and for the full insurance of all buildings. Further, all mortgages must make provision for the annual or semi-annual reduction of the amount of indebtedness; no loan shall be made against the mortgage of any real estate in which an officer or trustee of the association is interested, directly or indirectly, except upon the approval of two-thirds of all the trustees; and, finally, the maximum amount for which a loan may be made shall not exceed 65 per cent of the value of the mortgaged property, in the case of improved farm land, nor 40 per cent in the case of unimproved land.

A borrower may repay his loan by instalments of such amounts and at such intervals as may be agreed upon and, upon sixty days notice, may repay the whole amount outstanding.

Each association is required to build up a reserve fund equal to 20 per cent of its subscribed capital by setting aside, out of the earnings of each year, an amount equal to 2 per cent of such capital.

No association may acquire any real estate except such as serves for its own use as office buildings or comes into its possession through the foreclosure of mortgages of which it is the holder. In the latter case the real estate so acquired shall be promptly sold.

**Corn and
Pumpkins
On Irrigated
Land**

It was not very long ago when even the suggestion of growing corn in the irrigated country was met with ridicule.

Some determined farmers refused to be ridiculed out of the idea of growing corn and after more or less discouraging experiments, succeeded in proving that some of the best corn area in the United States lies west of the one hundredth meridian. Then came the silos. They gave the corn growing idea further impetus.

Now the scene is complete. The ripening corn fields of Colorado are dotted with yellow pumpkins. No longer can the corn-belt farmer feel lost in the West, particularly if he lands around Longmont, Colo., where the corn and pumpkin industry was brought to full success this year.

Several farmers around Longmont wanted to begin raising corn for the silos they were putting in, but they were uncertain as to whether it would succeed. They bethought themselves of the lowly pumpkin, and contracted a good-sized pumpkin crop with a canning company.

The two crops were planted on the same ground, neither interfering with the growth of the other. The corn crop proved to be equal to that raised in the famous corn states, the growth of the fodder being heavy and the kernels large and solid, making a profitable crop by itself, being worth to the feeders from \$30 to \$40 per acre.

The pumpkin crop, which at planting time was regarded as secondary, in most cases proved the most valuable. The contract price is \$3 per ton and the yield from fifteen to twenty-five tons to the acre, making two of the easiest crops to tend return about \$100 per acre.

At this distance, it looks as if Newell and his ilk, who talked so much about REPUDIATION, are being forced to eat their own words. REPUDIATION seems to have become a reality on the Newell side of the fence, although attempts are being made to disguise it by a mask of relief for the "poor settlers"—REPUDIATORS of yesterday.

**Reorganization
of Farm Loan
Business
Is Urged**

Secretary Coulter of the United States commission on rural credits is advocating a reorganization of the farm mortgage business so that the lender will become the friend and financial adviser of the borrower. It is essential, he says, that better financial principles be applied to farm mortgages. As a guide to loans he suggests, first, that the amount and period of the loan be adjusted to the purchase for which the loan is required; second, provision for the extinction of the loan in annual installments.

In accordance with his suggestion loans made to equip the farm with machinery or live stock should run from five to ten years. If made to construct buildings the loan might extend over a period of fifteen years. If the purpose is to purchase a farm the loan might extend from twenty-five to thirty-five years.

In support of his recommendation that loans be paid off in annual installments, Mr. Coulter points out that the farmer's revenue is produced this way, and unless he gradually reduces the loan he is almost sure to ask for a renewal at its maturity.

Mr. Coulter is strongly opposed to direct government loans or subsidies in connection with farm mortgages.

How about a year's subscription to THE IRRIGATION AGE as a Christmas present. If you have a friend living in the East who is interested in the West, you cannot do better for him. If he is farming in the East and intends to stay there, the articles on irrigation and particularly those which show how the irrigation lessons which the West can teach and the results which the West is accomplishing through irrigation, which THE AGE publishes each month, will prove of real value to him. Give some friend or relative a subscription to THE IRRIGATION AGE as a Christmas present. It will be a useful and valuable present.

Federal project settlers are proving in no uncertain words that however poor may be their financial condition, they cannot and will not forget they are American citizens who will not sell their principles for "easy payments."

If the settlers refuse to accept increased costs of their projects, who is going to make up that \$40,000,000 deficiency in the Reclamation fund?

The Twenty Year Reclamation Extension law is having rough sailing. The settlers consider contracts sacred.

WHAT THE PROSPECTIVE SETTLER SHOULD KNOW

Some Excellent Advice and Information By Thomas Forsyth Hunt and Other Members of the Staff of the College of Agriculture of the University of California

An agent who is seeking to sell land holds that he may, with propriety, state the maximum yield which may be expected from a given crop on the land which he is offering for sale. It is difficult to deny that he has such right. It is worth while, therefore, to consider whether there is any relationship between maximum yields and yields that may be expected in the ordinary run of business.

The question now arises, how may one estimate the yield which may be used safely as a business guide? If only an average yield of these different crops is obtained, the raiser secures a very modest daily wage plus a small interest on the investment. A man who can produce only average yields of crops will, generally speaking, do better in some other business, or by working for a daily wage for others. An intelligent, thrifty, careful farmer may properly hope to secure twice the average return that is customary under the conditions of his soil and climate, but even this is not a safe estimate on which to do business. Very broadly speaking—necessarily there must be many exceptions—a competent farmer may expect to secure an increase of 50 per cent over average yields. To illustrate, the following table may be prepared showing what may be expected in California under average conditions of soil and climate:

	Wheat	Barley
Average yield	13	25
A safe estimate for business purposes.	20	40
A good yield which competent men may hope to obtain.....	25	50
Yield not infrequently obtained under favorable conditions	40	75
Possible but extraordinary yields.....	50	100

These figures are merely illustrative, but it is probable that they represent a somewhat general law: namely, first, that it is possible to secure, under favorable conditions, a yield that is four times that usually obtained; and, second, that for business purposes, it is not safe to count on secur-



Some baby beef raised on silage—Courtesy Santa Fe Railway.

ing more than two-fifths of the maximum yield. There are many exceptions to the rule because of varying soil and climatic conditions.

It is not intended to assert that larger returns may not be obtained, but to suggest that if a profit cannot be calculated upon this basis, then further study of the situation is needed before

making a purchase.

The chief purpose of this discussion is to enforce the principle that the large yields which are obtained under very favorable conditions are not a true business guide. It is necessary to recognize frankly that only a fraction of such possible yields are obtained ordinarily in actual practice. The purpose is not to try to state what yield may be obtained under each given condition of soil and climate, but to give a sort of working basis for reasonable estimation. Thus if in a given region on a particular type of soil one determines that it has been found possible to get a yield of thirteen tons of alfalfa per acre, on the basis of two-fifths previously stated 5.2 tons of alfalfa would be a safe estimate for business purposes. If, on the other hand, eight tons were found to be an extraordinary yield, then 3.2 tons are all that could be safely predicted. However, it must always be kept in mind that the competent man may hope to secure better yields.

Persons will differ widely as to what is a satisfactory income. Some arbitrary figure must be assumed, however, as a basis of discussion. All that can here be hoped is to show such relationship as to enable one to forecast a condition that will be satisfactory to himself. Let it be assumed, then, that a gross income of \$4,000 per year is desired. The annual gross income from the chief farm crops of the United States is about 16 per cent, or one-sixth of the capital invested. Under these conditions an investment of \$24,000 would be required. Only a modest wage and a small interest would be earned. A satisfactory gross income, one perhaps that competent men may reasonably expect to earn,

would be 25 per cent, or one-fourth of the capital invested. An investment of \$16,000 would therefore be necessary. Suppose a gross income of \$4,000 per year is obtained, what becomes of it? In a general way this sum may be divided into three parts: (1) expenses, (2) interest on the investment, (3) return to the farmer for his management and labor. The latter may be called the labor income. There have been gathered, for example, some data on general farms tending to show that if a man has invested wisely in land and equipment he may pay about 7 per cent of the total investment for a working manager. This is equivalent to saying that a farmer should receive 7 per cent on the capital invested for his management, assuming that he is himself actively engaged either in managing or laboring or both. In reaching this conclusion from data collected, 5 per cent interest on the capital invested was assumed. On this basis the following will result:

For labor income—7 per cent on \$16,000.....	\$1,120.00
Interest on investment—	
5 per cent on \$16,000.	800.00
For expenses	2,080.00

Total \$4,000.00

One thing that is at once obvious from an examination of the data is that if one must pay 10 per cent interest for money to purchase land and equipment there would be only 2 per cent, or \$320, left for labor income. It will be noted that for each per cent which is added to the interest charge an equivalent reduction must be made in the labor income. Thus if the interest is 6 per cent one may expect his labor income to be only 6 per cent of the capital invested. If the interest is 8 per cent, the labor income will be but 4 per cent. Moreover, there is a tendency for the labor income to be further reduced on farms growing a single crop, since such farms furnish employment for a relatively small portion of the year. However, on fruit farms, this condition is somewhat offset by the opportunity for employment in the packing houses, thereby augmenting the income of the owners and their families. Of course, owners of fruit and other farms, who are not actively employed thereon need not expect to secure more than a fair interest on their investment and then only when intelligently and efficiently managed.

Some surprise may be felt that any definite relation can be assumed between labor income and capital invested. The explanation seems to be that the value of the land rises with the income and thus the interest on the new capitalization prevents the labor income from rising. Thus, if a man buys a farm at \$50 per acre and the subsequent income justifies valuing the land at \$200 per acre, the interest upon the new valuation keeps the labor income from rising. It is well known that this rise

in the value of land has been the source of much profit to farmers.

Of course, very much will depend upon the wisdom with which expenses are incurred. Without doubt there is in individual cases great opportunity for increasing the labor income by decreasing expenses. What this paragraph suggests is that it is not wise to assume a gross income greater than one-fourth the capital invested and that one must concede that one-half the gross income may be required for running expenses. Unless a man can estimate a satisfactory labor income on this basis, it is prudent to proceed with caution. It is obvious that if a man is satisfied with a labor income of \$560 per year an investment of \$8,000 will suffice. If the farm is paid for he may expect a cash income over expense of \$960 per year, since he has a right to expect interest on the investment plus his labor income.

How large must a farm be to furnish a satisfactory living? From what has been said the best practical measure with which to answer this question is the gross income. The area of land necessary to obtain a gross income of \$4,000 will depend upon the crops raised. Thus, if the land is to be put into barley, from which may be expected 40 bushels per acre, worth 60 cents per bushel, or a gross return of \$24 per acre, there will be required 167 acres to return a gross income of \$4,000. If adapted to potatoes, yielding 175 bushels per acre, worth 70 cents per bushel, 33 acres would be required. An orange grove, yielding 225 boxes, netting the grower a dollar per box, would require less than 18 acres in trees. As there is more or less waste land in all types of farming, it may be stated, in general terms, that 200 acres of land would be required for barley and 40 acres for potatoes, while 20 acres would suffice for oranges.

A similar estimate may be made concerning dairying. Estimating a yield of 225 pounds of butter fat per year and that three pounds of butter fat are worth a dollar, the total income for butter fat per year is \$75 per cow. Each cow may raise a calf, and some pigs and chickens may be kept. It may be possible, therefore, to secure a gross income from all sources of \$100 per cow. The amount of land which is required to keep a cow in California varies at least as widely as from one to ten acres where dairying is now actually practiced. Where alfalfa is grown in the open valleys under irrigation, it requires about $1\frac{1}{4}$ to $1\frac{1}{2}$ acres to support a cow. Assuming the latter figure, it will require 60 acres to bring a gross income of \$4,000. It is interesting to observe that in a certain irrigated region tracts of 20 acres each were sold for dairy purposes. As time has gone on the farmers located upon these tracts have acquired additional lands, so that at present the one-family dairy farm, based



A few New Mexico pears.

upon alfalfa, is actually about 30 acres. This is perhaps another way of saying that these families are satisfied with a gross income of \$2,000 per year.

The one-family farm just mentioned is a familiar instance of the influence of family co-operation in farming. Various members of the family help on these farms. In this way the labor income is apparently increased and the expense of conducting the farm is decreased.

This, however, is merely because members of the family are not paid for this labor at current rates. Nevertheless, one of the important reasons for engaging in certain types of farming is that it gives rational and remunerative employment to the children of the family. Farming remains the one great industry where children are a material asset. A man with a family of children may wisely engage in dairying, fruit raising, or vegetable growing, not only because he can use the labor of his children to advantage, but because the training in contributing to the family income which they receive before the age of twenty-one is one of the most valuable assets these children can acquire. If the ideal of a successful home is not a part of the program it may be well to question whether some other activity may not better engage attention.

The gross return per acre depends, of course, upon two factors—yield and price. The size of the farm required for a given gross return will depend, therefore, not only upon the fertility of the soil, but also upon the location. The latter materially affects the price, especially in a state of great size with many communities remote from the larger centers of population. Nowhere, probably, is community effort more important in securing satisfactory prices than with the fruit raiser in California. No matter how satisfactory the yield and quality of the fruit may be, if the grower is not surrounded by others raising a like commodity, usually it will be found difficult to market the crop at a satisfactory price.

How may one estimate the value of land? All that one can hope to do is to give an illustration of a method. For this purpose, the dairy farm, previously mentioned, may be used. It was seen that sixty acres may be sufficient to produce a gross income of \$4,000 per year where cows are kept on land raising alfalfa by irrigation. According to figures previously mentioned, this would represent an investment of \$16,000. This investment may be roughly divided into four parts: (1) raw land, (2)



Some currants on the Yellowstone federal irrigation project in Montana—Courtesy of Northern Pacific Railway.

water rights and the preparation of the land for irrigation, (3) buildings, (4) animals, tools, and other floating capital. The animals, tools, and other floating capital may be estimated at 25 per cent of the total investment, or \$4,000. If the buildings are satisfactory, they may easily cost an additional \$4,000, thus leaving \$8,000 for the raw land, for water rights and the preparation for irrigation.

It is a matter to be determined in

each individual instance, but if the water rights and preparation for irrigation are to cost \$2,000 on sixty acres, this would leave \$6,000 which may be paid for raw land, or \$100 per acre. Obviously if water rights and preparation for irrigation cost \$4,000, then only \$80 per acre should be paid for raw land. No one must assume that the figures stated necessarily apply to an individual case. Each person must take the principle here illustrated and determine what the figures should be under his circumstances.

It was estimated that twenty acres of land planted to oranges might be required to return a gross income of \$4,000. According to the basis on which we are working, this represents a capital of \$16,000, or \$800 per acre. In this instance, probably \$2,000 may be estimated for the buildings, leaving \$14,000 for land, water, and trees. Let it be supposed that the water rights, including water delivered to the highest point of the tract, cost \$150 per acre, and the cost of bringing these trees to the age of five years, including the purchase of the trees, planting, cultivation, irrigation, fertilizers, and taxes, is \$350 per acre, then the situation would stand as follows:

Twenty-Acre Orchard	
Buildings	\$ 2,000.00
Water rights	3,000.00
Bringing orchard into bearing	7,000.00
Value of raw land	4,000.00
<hr/>	
Total	\$16,000.00

Under this estimate, raw land capable of being irrigated and suitable for growing oranges, may be estimated to be worth \$200 per acre. It is not intended to say that such raw land is worth \$200 per acre. What is intended is to point out that in finding the value of raw land one should determine the cost of buildings, water rights, and the expense of bringing the trees into bearing, and deduct these items from the value of a bearing orchard.

If a person owns a ranch that is profitable he

is not generally anxious to sell it. If a man owns a herd of cows and desires to sell some of them he will, if he is a good business man, seek to sell his poorest cows. Lands follow the same economic law. The ranches that come upon the market are apt to be those that have for some economic cause become unprofitable. This may, of course, be due to several reasons. It may be that it is not possible to compete with other lands of greater fertility. It may be that the growth of cities and the development of transportation have made it no longer capable of competing with other areas. It may be due to mismanagement. It may be that changing conditions have made the area too large and that it needs subdivision. However, thoroughly desirable areas may be placed upon the market for various reasons, as through the settling of estates. Frequently splendid areas are brought into the market through the development of new water supplies.

The settler should look carefully into everything that pertains to the extent, reliability, permanency, and cost of an irrigation water supply for his farm.

Soils should have good depth and good drainage. The need of drainage is hard to appreciate or even determine before the land is irrigated in areas of limited rainfall. One reason why analysis of the soil is of so little value in ordinary practice is that the depth of the soil and the position and character of the hard pan usually affect the productivity of virgin soil to a greater extent than existing variations in plant food. Soils in sub-humid climates are peculiarly prone to possess layers of hard pan. These layers are very irregularly laid down. Hence, a minute examination is required to determine its extent and possible injury on a given piece of land. The United States Bureau of Soils has, on account of these structural differences, adopted the rule of examining a cross-section of the soil to the depth of six feet in western United States, while elsewhere three feet has been deemed sufficient.

Without natural or artificial drainage, alkali is the inevitable consequence of irrigation wherever the evaporation from the soil is greater than the rainfall. "Irrigation without proper provision for drainage has, in the past, in very many cases, been the cause of abandonment of lands once abundantly fruitful."

Without stopping to go into the matter exhaustively, it may be said in general, that those lands most likely to be brought under irrigation are the areas which usually lack good natural drainage. In humid sections the water table may be within three or even two feet of the surface without injurious results. In arid sections the water table should be not nearer than five feet from the surface, while a depth of six or more feet is desirable. This is due to the deeper feeding area of the roots of plants in arid climates as well as greater danger from alkali where the water table is near the surface. No prediction can be made as to the length of time which will elapse before alkali will appear under irrigation. Clay lands usually suffer sooner than sandy ones. There are areas that have been irrigated for more than twenty-five years which do not yet show the need of under drainage.

Excellent opportunities exist today for the pur-

chase and reclamation by tile drainage of lands that have "gone bad" under irrigation. The intending purchaser should be cautioned, however, to try to reclaim only lands which are known to have been fertile. Lands which have never been known to have grown profitable crops may well be avoided in the present state of our knowledge.

The goodness or badness of land is largely in relation to the crop it is intended to grow. Thus there are soils excellently adapted to olives which will return poor yields of wheat or barley. There are vast areas in California well adapted to grains and alfalfa, on which potatoes cannot be grown economically because of the character of the soil, and on which oranges and lemons cannot be grown on account of the danger of frost. Certain lands which are adapted to raising olives are not worth, and in the past, have not been valued at more than five dollars per acre for other types of farming, are now valued, and may be worth one hundred dollars per acre for olives. The fact that lands are valued at much higher prices when adapted to oranges, lemons, or alfalfa than when adapted to grains, has led to the placing upon the market of a great deal of land for crops to which it is not adapted.

A person buying farm land in California seldom deals with the owner. This is especially true where large tracts are subdivided and sold to settlers. The owners of such tracts ordinarily place their holdings in the hands of a real estate firm who, of course, handles the sale on commission. But even the members of the real estate firm seldom, in the case of these large holdings, make the sale in person. The real estate firm employs agents of a more or less itinerant character, who make the actual sales. Under the present system, the agent with whom the purchaser deals is not infrequently an irresponsible party and cannot be found later to substantiate the statements made. It is therefore absolutely necessary for the purchaser to act only on evidence confirmed from other sources and to sign no contracts that he does not fully understand and cannot fully verify, and to be absolutely certain his titles to the land and to the water rights are satisfactory.

Probably nothing can make a man keen in a horse trade save experience. No law can furnish a man with judgment. The United States and the State government are endeavoring to furnish information on which men may base sound judgment if they are level-headed and already have some knowledge of farming. Persons with no knowledge of farming are advised not to purchase farm lands in California until some months of experience have brought them into actual contact with conditions. It is, of course, important to "help the investor as much as possible through supplying accurate data, but the buyers must assume some of the responsibility when they buy without attempting to inform themselves."

The dairy farm and the orange grove are illustrations of two very different types of business. In the case of the dairy farm the farmer receives his pay check every month. With the orange grower, payment comes in during a restricted period. On

(Continued on page 438)

The Federal Water Users



A Department Devoted to the
Interests of the Farmers on the
Government Irrigation Projects

EDITED BY GEORGE J. SCHARSCHUG

SETTLERS' VIEWS AND ACTS ON 20-YEAR BILL

A Symposium of Letters and Editorial Utterances from the Projects

CANVASS of various federal projects shows the percentage of settlers who had accepted the twenty year extension bill on December 1, to be rather small. This is true despite the fact that Secretary of the Interior Lane and the Reclamation Commission, aided by all the projects officers and various project newspapers have made a vigorous campaign to convince the Water Users of the advantages of the new law.

Water Users' Associations on several projects have voted either to ignore the new law or in favor of delaying acceptance of it until the proposed revaluations are completed or the law is finally and definitely construed by the Secretary of the Interior.

Not only do many settlers seem to fear that by signing the new contracts of acceptance of the twenty year bill they are giving their approval to any increased charges which may be fixed by the revaluation boards, but many of them fear even more the various penalty, cultivation and other paternalistic features with which the bill is filled.

In the pleas to settlers to accept the new law, the Reclamation Commission has said nothing concerning any feature of the law except its "financial advantages." Upon the finance feature, great stress has been laid not only in the Commission's letters, but in "copy" prepared for various project news-



Ahel Ady, of Merrill, Ore., who is working hard to induce settlers to accept the twenty-year bill.



Earl B. Smith, of Somerton, Ariz., who asked Comptroller Ryan some interesting questions.



O. E. Farnham, secretary of the Belle Fourche Valley Water Users' Association, which refused to accept the new law.

papers.

Consider the feelings of the settler on the Umatilla project in Oregon, when he picked up his weekly newspaper and read this:

"Under the terms of the extension act, Water Users have six months to accept. In this connection the settler must bear in mind, however, that on March 1, 1915, an install-

ment of \$6 per acre will be due, which must be paid then unless acceptance of the extension act has been previously filed. If such acceptance is filed before December 1, 1914, there will be due on that date only 2 per cent of the unpaid balance, instead of \$6 March 1.

"If the Water User is in arrears for any sum accrued prior to March 1, 1915, and has not filed his acceptance before that date, he will not only have to pay the \$6 installment then due, but all back charges as well. If a man is back three payments or \$18 per acre, he would on March

1 next have to pay \$24 per acre if he has not signed for the extension. Should this same man sign up before November 15, his installment would fall due December 1 instead of March, but he would need pay only 84 cents per acre, and not \$24 per acre.

"The Water User can see the need for immediate action in this matter."

If the settler is three years behind in his water payments and there are several little mouths in the farmhouse to be fed, and the children have

already begun to talk about what Santa Claus is going to bring to them, he is inclined to forget anything except the financial feature of the law.

If a horse or a cow has just died and another one must be purchased immediately in order to keep up the farm work, the farm regulations which the Secretary of the Interior can enforce under the new law, or the twelve per cent a year penalties, seem of little consequence.

If the wife or one of the children is ill or crops have been bad—well, what is he going to do? Twenty-four dollars an acre or eighty-four cents an acre?

In the face of a war market for their cotton, which still threatens many of them with ruin, settlers on the Yuma project in Arizona gathered in the largest meetings ever held on the project, and after three hours' discussion of the Extension law, voted unanimously not to accept it. The settlers voted equally unanimously to refuse to appoint a member of the board of review of project costs "for the reason that we do not wish to be put in the position of giving seeming consent to the findings of the Board by participating therein, when we have a special contract determining the cost, and further, that the original law stipulates the basis of charges."

This action was taken in the face of letters by the Secretary of the Interior and the Reclamation Commission attempting to assure the Water Users that they would not be assessed any increase in project costs unless "a majority of the settlers agreed to such increase."

Earl B. Smith of Somerton, Ariz., chairman of the Executive Committee of the National Federation of Water Users' Associations, was one of four speakers designated by the Yuma Water Users' Association to address the settlers concerning the new law. Before delivering his talks, Mr. Smith addressed a letter to W. A. Ryan, comptroller of the Reclamation Commission. The letter is remarkable because of the analytical penetration with which it handles the new law. The letter follows:

"Somerton, Yuma Co., Arizona, Nov. 9, 1914.

"Hon. W. A. Ryan,

Comptroller U. S. Reclamation Service,

"Washington, D. C.

"Dear Sir:

"The Board of Governors of the Yuma County Water Users' Association have requested me (with others) to address three separate mass meetings of

the Water Users on the subject of whether we should accept the Extension Act as it has been presented to us by the Secretary.

"Strange as it may seem to you, the sentiment seems to be that we are not in position to accept, but I am of the opinion that the objections to accepting can be removed by a better understanding. Therefore, I write you for further information, thinking it more proper to seek your expressions rather than that of the Secretary, who undoubtedly has his hands full of more important matters.

"While these meetings have been called for this week, I can only advise delay until we can hear from you, hoping that your reply may clear the situation so that we can accept.

"I will do my best to present the situation as follows:

"Section 2 of the Act provides that the first payment shall be due on Dec. 1 of the year that the first public notice is issued under this Act, and as such notice (170) was issued September 24, 1914, our first payment will fall due within about thirty days from the date the notices were mailed to us. This situation is met by Section 4 of our Articles of Agreement with the Secretary of the Interior of May 31, 1906 (a copy of which is herewith enclosed), which provides that the first payment shall be payable at the time of the completion of the said proposed works, etc. The November issue of the Reclamation

Record (p. 428) announces that our project is 69.5% completed, consequently if we accept the Act under the notice we thereby waive a very, if not most, important feature of the contract, which is our main reliance on securing a speedy completion of the works for which we have so long and earnestly petitioned. Therefore, in view of that clause of the contract we cannot help thinking that Notice 170, so far as it relates to the Yuma Project, has been issued prematurely and with apparent oversight of the terms of that contract. Again, for us to assume to pay 2% of an uncertain amount is a jump in the dark.

"The only suggestion I can make at this time is that Notice 170 be withdrawn by the Secretary so far as it relates to this project, with the view of reissuing it in some subsequent year when the project has been completed. I think there is a special law permitting such withdrawal.

"In writing to you as I do I have not lost sight of the proposed cost revision which may be terminated long after the first payment has been due



Irrigating potatoes. A field on the Lower Yellowstone Federal project in Montana.
—Courtesy Northern Pacific Railway.

under the Act and Notice, but it seems to me to be the ordinary business procedure to agree to the first payment when we know what it is to be. In the case of long delay in having the construction charge acquiesced in by both the Water Users and the Secretary the first payment might be held as delinquent, but that is not a desirable situation for either party.

"Congress passed the Extension Act for the general welfare, and left it to the judgment of the Secretary when the notice should be given, and the law does not force him to give it at a time when it would enforce a violation of an existing contract solemnly executed by a former Secretary of the Interior.

"There is one more matter I will ask you to explain, which is the following extract from Secretary Lane's letter to our Association of October 6, 1914, which refers to the Board of Review of costs:

"The charge which the Board may determine is a proper charge will not be binding upon you under the terms of the public notice herein inclosed until it has been submitted to you and all the Water Users for their consent and agreement."

"The question naturally arises, What would be done in case our Water Users did not consent and agree to the same, for the reason, for instance, that the findings did not come within the provisions of former contracts with the Government, or did not come within the terms of the original reclamation law wherein it specifies the basis of the charges; what would be the result of our said want of consent and agreement? Does the Secretary mean that our consent and agreement will be obtained at the time that water right applications are presented to us for signatures, and that we will be forced to sign or have our *rental* water contract cancelled? This situation was presented to the Secretary at the Washington Conference in May, 1913, and he condemned it as harsh and unreasonable; yet it is something we have always feared. I believe such fears should be dispelled—and can be, by a carefully conducted meeting between members of the Service and officers of our Association.

"I do not desire to renew any rupture of mutual confidence between the Water Users and the Service, and furthermore, I will frankly state that I have full confidence in the good intentions of the Secretary, and no one could make me think that he has

knowingly endeavored to force us to waive any written contract solemnly executed by a former Secretary of the Interior, in order to avail ourselves of this Act passed for the general welfare.

"Assuring you of my confidence and esteem, I am

"Your obedient servant,
EARL B. SMITH."

J. R. Baird and A. S. Moore, editors of the Tribune of Powell, Wyo., in the Shoshone Project, take this view in an editorial in their newspaper of the new law, after reading the Reclamation Commission's letter urging the settlers to accept the new law:

"The official discussion and interpretation of the new twenty year law on another page of this issue comes to hand at an opportune time, and a careful study of it ought to dispel most of the doubts that many people have had as to the justice of one or two requirements which are features of the new law.

The most important of these criticized features is the fact that pressure seems to be applied to the entryman to accept the new law and agree to pay the new charges before he knows whether those charges are going to be greater or less, a sort of thing which is, to say the least, a most unusual procedure in business transactions.

But let us look

at the matter calmly and dispassionately.

"To begin with, it may be taken as a basic fact that the affairs of the Reclamation Service are in a most awful snarl. We don't know this, but we believe it hits pretty close to the mark. It is certain that nearly all the irrigation projects have cost more than originally estimated; that the settlers thereon have not been able to get their predicted profits from the land; that unexpected local conditions have developed—such as necessity for drainage, etc. In short, the work of the Service was concerned with a proposition which was considerable of an experiment, and as the years followed one another various devices had to be adopted in the accounting of the department's finances in order to meet these unforeseen conditions.

"A general overhauling and readjustment of the affairs of the Reclamation Service has no doubt been urgently needed for some time, and we have seen how, about a year ago, the first step was taken in this direction by the creation of the present commission. Then followed the discussion of the new law which dragged on almost interminably until



A New Mexico gusher. A typical artesian well in the Deming district, used for irrigating.
—Courtesy Santa Fe Railway.

The Pump That Does

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its passage a little over two months ago. Secretary Lane was reported, while the fate of the bill was in doubt, as refusing to act upon any new business until its passage. This was business-like on his part. But many feel, very likely, that there has been time enough to have the boards of estimate meet and determine this much-talked-of final cost of each project.

"At first glance, this feeling appears justifiable. But we must remember, for one thing, that the government bureaus move slowly—a fact which we have to accept just as we admit that ice is cold. It must also be admitted that the boards of estimate will have to consider a vast mass of more or less complicated data before arriving at the final figures.

"The foregoing shows, we hope, that no definite knowledge of what each project, or part of a project, would ultimately cost could be looked for before spring. In the meantime, payments that had been repeatedly put off were coming due December 1. Should they be put off again till next spring? If so, what surely would the government have that the settlers would even then accept new contracts? So, to argue from the Washington standpoint, it would seem best to get these acceptances as soon as possible so that a sound basis for action might be had. Again, this is good business.

"And in order to induce the settler to execute this acceptance before a fixed date, a reduced payment only was to be required; and further, to safeguard the interests of the settler in signing this early acceptance, the proviso is made that the new building charge shall be in effect only when it shall have been accepted by a majority of the entrymen. If there should be an apparent injustice in these new charges they will hardly get by a majority of the settlers. This last is the big, important point and it ought to reconcile everyone to the workings of the new law.

"We believe the thing to be all right. We believe that Secretary Lane and the Commission can be trusted to do the square thing. The new law was framed with the interests of the people in view and we believe it will work out in that way. An especially admirable feature is the provision which gives the people a voice in the determining of what new expenditures shall be entered into on each project. A careful perusal of the letter of the Commission will repay our readers and very likely put the whole matter in a different light to some who have hitherto been inclined to disparage it."

At the special meeting of the Lower Yellowstone Water Users' Association called for the purpose of considering the General Orders of September 24, 1914, and the correspondence received in relation to the order, after careful consideration, the following resolution was passed by the Board of Directors:

"That the general public notice of September 24, 1914, is not applicable to the Lower Yellowstone Project. First, because it is in direct conflict in both spirit and letter, with the rental order of March 4, 1914, which provides that applicants 'may, by the acceptance of the provisions of the order, obtain a supply of water for the irrigation season of 1914, and thereafter until further notice, on a rental basis of fifty cents per irrigable acre for the

irrigation season,' and as this order was issued after a careful investigation on the project by Mr. I. D. O'Donnell, personal representative of the Secretary of the Interior, who recommended that this project be placed on a rental basis for a term of years before coming under Reclamation Extension Bill, which was then under consideration, and he reported, both by letter and by wire, that the people under the Lower Yellowstone Project were in dire financial straits, and unable to pay maintenance and operation charges.

"That we believe that the keeping of 'good faith' with the people of this project requires and demands the withdrawal of the order of September 24, 1914, and we believe if this is not carried out there would be no hope of inducing the Water Users to sign or accept any further orders;

"We must even go further and demand that the provisions of the Order of March 4, 1914, be carried out in its relations to the people of this project, for otherwise they will have no confidence either in the Commission or this Board, and this notice in conflict with an existing agreement, has shaken all confidence at this time;

"We recommend that the order of September 24, 1914, be revoked as to this project, and made again of date of January 1, 1916, so that the spirit and letter of the order of March 4, 1914, and the conditions on this project be met, and provided for.

"By Board of Directors of Lower Yellowstone Water Users' Association.

"E. C. HICKS, President,
"BURTON S. ADAMS, Secretary."

O. E. Farnham, Secretary of the Belle Fourche Valley Water Users' Association, which voted to ignore the new law, wrote the following letter to the editor of THE IRRIGATION AGE concerning the feeling on his project:

"On the Belle Fourche Project we have abandoned the idea of revaluation for the present. Former public notices have fixed our building charges at \$30 and \$40 per acre, and these, we understand, are to be recognized by the extension measure.

"There are some matters which the law does not make clear to us, and we are trying to get an understanding with the Department as to these questions before advising our people to accept the new law. Of course, a few of our Water Users have signed and filed their acceptance of the law, but a large majority are standing with the Board of Directors of our Association with a view of getting all our difficulties adjusted.

"The operation and maintenance charge in the past has been in part made up of many overhead expenses and expenditures for construction work and betterments, items which we think are not properly chargeable to operation and maintenance, and which have created a deficit against the O. & M. fund of the project of hundreds of thousands of dollars, and it is our purpose to secure a definite understanding with the Department as to the nature of the items to be included in this charge in the future.

"We had hoped to get a decision of the courts interpreting the Reclamation Act and our contracts with the Department before required to accept the new law, but under the provisions of the

Act and the public notice issued, we only have until March 24, 1915, to file acceptances.

"In my opinion, the new law does not change the manner in which the building charge is directed to be fixed under the Reclamation Act. Unless this charge is based on the 'estimated cost' as provided by the law, it cannot be determined in any instance until after a project is completed in its entirety. Hence, it can readily be seen that during the construction period of a project, which, in the past, has covered many years, the uncertainty of ultimate cost is such that colonization and development work is necessarily retarded even in those portions of a project as are completed and for which water is ready for delivery. I am also of the opinion that the water-right charges, or building charges, shall be equitably assessed, and that a different rate on the same project cannot be lawfully assessed, as has been done on the Belle Fourche Project. There might be exceptions to this rule where a project is made up of several units and the cost is fixed for each unit, or where there are prior existing rights to be considered.

"I believe that it is to the interest of every project to have the original Reclamation Act fairly and conclusively interpreted by the courts, and that a reasonable interpretation of the law would mean much to these projects and would lend stability to business conditions therein. It is the uncertainty of ultimate cost, and the great latitude exercised by Department officials in their construction and application of the law that has created the chaotic conditions on most of the projects, and which is now destroying independent thought and

action characteristic of American freedom, and building up in its stead communities of forced subserviency to a Governmental Bureau and the Administration that happens to be in power. The present policy is undemocratic and dangerous, and without authority of law."

In publishing the Reclamation Commission letter, the Valley Irrigator, of Newell, S. D., on the Belle Fourche project, says:

"This ought to convince everyone that the new law cannot increase the building charge, or any other charge, for that matter, without the Water Users voting for it. We believe, however, that while the affairs of the Water Users are being adjusted there should be a definite understanding as to the 'betterment' charges and the deficit charges to the maintenance and operation. A clear understanding will benefit both the government and the Water Users."

Concerning the penalties, the Powell (Wyo.) Tribune says:

"A phase of the new law that is not very generally realized or appreciated is the provision that fixes a penalty of one per cent for each month that the payment of any year is overdue. To most people this arrangement has appeared to be a penalty pure and simple, but it actually works out as a money-lending proposition. If the entryman is unable to pay on December 1, he may let the payment go until later on, paying at the rate of one per cent a month, which, in a year's time, would amount to just what the banks would ask for the accommodation."

NEW CULTIVATION REQUIREMENTS

HERE are the agricultural requirements under the Twenty Year Reclamation law, which the settler must fulfill before he can prove up on his land, as stated in instructions of the Commissioner of the general land office to various registers:

"To comply with the provisions of the Reclamation law requiring the reclamation of one-half the irrigable area of any entry made subject to the provisions of that law, the land must have been cleared of brush, trees and other incumbrances, provided with sufficient laterals for its effective irrigation, graded and otherwise put in condition for irrigation and crop growth, planted, watered and cultivated, and during at least two years next pre-

ceding the date of approval by the project manager of proof of reclamation, except as prevented by hailstorm or flooding, a satisfactory crop must be grown thereon.

"A satisfactory crop during any year shall be any one of the following: A crop of annuals producing a yield on similar land under similar conditions on the project for the year in which it is grown; a substantial stand of alfalfa, clover or other perennial grass substantially equal in value to alfalfa or clover or a season's growth of orchard trees or vines, of which 75 per cent shall be in a thrifty condition."

IRRIGATION RECLAIMS MICHIGAN LAND

THE irrigated gardening experiments that were carried on during the past season at the Moses Seabolt estate, two miles north of Eaton Rapids, Mich., known as the old Michigan Peat Company farm, proved so much more successful than had been anticipated that it is now an assured fact that the gardening proposition will be conducted there on an extensive scale.

Mrs. Fred Osborn, of Ann Arbor, Michigan's pioneer irrigator, who has conducted an extensive gardening enterprise in the suburbs of the Univer-

sity city for seventeen years, was engaged by the trustee of the Seabolt estate to take charge of the experiments, and, as a starter, put in six acres of celery, several acres of cabbage, a patch of carrots, and a few other vegetables, and all of these developed a growth that fully demonstrated that the soil is just the sort that will make the gardening industry profitable.

Wells are being put down to be used in irrigating the tract, which ultimately will cover 360 acres.

COURTS UPHOLD OREGON WATER CODE

BOTH State and Federal courts have upheld the Oregon water code.

Until in 1909, when the water code, considered a model of its kind, designed to meet the needs of a growing state by establishing and protecting all appropriations for irrigation, power, domestic or other purposes, was enacted, water rights were in a chaotic condition in Oregon, and continual litigation was the rule on a majority of the streams of the state. The state water board was created by this law for the purpose of defining and establishing all of the early water rights, most of which had never been recorded in any way. When a request for the determination of water rights on a certain stream is made, the board, if it sees fit, may compel every water user on such stream to submit statement and proof of his claim. If any of these claims are contested, informal hearings are had before the division superintendent. The findings of the board are submitted to the circuit court for confirmation or rejection and appeal may be taken from the decision of the circuit court in the usual way. After the circuit court of Malheur county had modified the findings of the state water board in *re Willow Creek*, an appeal was taken to the supreme court by the Eastern Oregon Land Company, Lower Willow Creek Water Users' Association, and others, it being alleged that the water code was unconstitutional, in that it attempted to confer judicial power on an executive board, and authorized the confiscation of private property without due process of law.

In writing the opinion, Judge Bean, of the state court, stated that the enactment of the water code was a lawful exercise of the police power of the state to "accelerate the development of the state, to promote peace and good order, to minimize the danger of vexatious controversies wherein the shovel was often used as an instrument of warfare, and to provide a convenient way for the adjustment and recording of the rights of the various claimants to the use of the water of a stream or other source of supply at a reasonable expense."

ATTACKS RECLAMATION SERVICE

Gov. E. M. Ammons of Colorado stirred the recent conference of governors at Madison, Wis., by a spirited attack on the United States Reclamation Service. He charged that the Reclamation Service had disobeyed the orders of Presidents Roosevelt, Taft and Wilson in refusing to allow the state of Colorado the use of public lands for the building of a reservoir to develop adjacent lands.

Gov. Ammons also charged that eastern conservationists had been so unfair as to deny the western states the opportunity to state their side of the case in the magazines. He charged that a magazine which printed conservation articles on Colorado was filled with misrepresentation and has refused to print the other side. By way of indicating the degree of misrepresentation, he said that the magazine had printed the statement that Rockefeller

owned practically all the coal lands in Colorado, while, as a matter of fact, the Rockefeller interests owned but 800 of the 472,000 acres of coal lands under lease.

ASK SACRAMENTO RECEIVERS

Two suits have been filed in the United States District Court at San Francisco, demanding an accounting, the appointment of receivers and order for sale of all the property and assets of the Sacramento Valley Irrigation Company, which in 1909 floated a \$10,000,000 development project, covering 200,000 acres in Glenn and Colusa counties, in California.

The project was financed by the Kuhns of Pittsburgh, who failed some time ago.

The Equitable Trust Company of New York, as trustee for the bondholders, is plaintiff in one of the suits, and Merle B. Moon of Detroit, chairman of an organization of creditors known as the Sacramento Valley Committee, is plaintiff in the other. The amount of \$5,046,944.01 is alleged to be due for money advanced by the American Water Works & Guarantee Company, and by Moon as chairman of the creditors' committee.

TEXAS WATER LAW ATTACKED

Because the constitutionality of the act creating the State Board of Water Engineers of Texas is involved, the board has requested the attorney general's department to assign one of the members to assist the city attorney of Corpus Christi in defending the suit styled the Nueces Irrigation Company vs. the City of Corpus Christi.

The State Board of Water Engineers, following a hearing, allowed the city of Corpus Christi additional water appropriation from the Nueces River for municipal and domestic purposes, and refused to increase the amount of water for which application had been made by the Nueces Irrigation Company and others who were riparian owners and water users from the river.

The suit instituted contests the right of the board to allow appropriation of the water and the constitutionality of the act creating the board, alleging illegal delegation of power by the legislature.

CANALIZE PROJECT RIVERS

Cheap transportation for the market products raised on irrigation projects is provided by the Australian Government before farmers are asked to settle in such districts. This cheap transportation is established by canalization of the rivers and the building of railroads. Such roads, necessarily operated at a loss during their first few years, are said to be now earning 6 per cent on money borrowed at 4 per cent.

SIMPLIFYING THE GAS ENGINE

MODERN manufacturing involves many carefully elaborated processes as the raw material develops into the finished product, and armies of inventors and designers pile improvement upon improvement. Unfortunately, in many instances, this march of progress tends rather to complicate than to simplify the methods of production, until the modern manager or superintendent finds himself encumbered with more details than he can efficiently handle.

The developments which have taken place in the past few years in the design of oil engines have brought that prime mover to such a state of perfection that it can be regarded as fully reliable. In very many instances this convenient source of power may be made to show considerable saving in power cost and labor of power plant operation and management.

The Bessemer Gas Engine Company, of Grove City, Pa., has developed a type of oil engine embodying some original features, by means of which they have sought to secure the utmost degree of economy of fuel which may be obtained in this type of power unit without employing those aids to efficiency which would tend to greatly increase plant charges and to lessen reliability.

The general design of the engine, which works on the two cycle principle, has much in common with that of the modern automatic steam engine. The driving parts are fully enclosed and run in an oil bath, assuring copious and unfailing lubrication. The connecting rod thrust is borne by a crosshead fitted with adjustable bronze shoes. The design of the crank shaft bearings is novel, combining, as it does, the virtues of the four-part box with the simplicity and rigidity of the two-piece bearing shell.

The scavenging air does not pass through the crank case, but is compressed in the crank end of the cylinder instead, the latter being isolated from the crank case by a stuffing box. This leaves the designer free to construct the engine bed for its normal functions only, without the necessity of contrivings for making it air-tight at the bearings, as well.

Inlet and exhaust valve gear, as well as valves in the combustion chamber, are conspicuous by their absence. The makers claim that no loss of efficiency results as a consequence of this simplification, loss of fuel at the ports being avoided, as the fuel is not injected until the firing point is reached, long after the ports are closed.

The fuel pump is operated by an eccentric carried by a shaft governor of the inertia type, which



A gas engine that has much in common with the modern automatic steam engine.

determines the eccentric throw and consequently the pump stroke to suit the load imposed upon the engine. No "bumper" is used to get the necessary short injection angle, the pump being coupled directly to the eccentric rod by means of a small crosshead. Short injection, constant in both timing and duration, is accomplished by mechanical control of the fuel pump suction valve, this being always open except

for the short interval during which discharge to the cylinder takes place. For priming the pump, novel and simple mechanism is provided for operating the fuel pump plunger by hand without disconnecting from the driving rod.

Water feed to the combustion chamber is handled by a small pump also under governor control. This pump is mounted in the fuel pump housing and driven from the fuel pump crosshead through a short reversing lever. The fulcrum of this lever is adjustable as to position, and by this means the proportion of water to oil may be set. Once set, this proportion is maintained for any load by the governor.

The governor itself is of rather peculiar design, having been devised particularly to meet the conditions imposed upon it.

The fuel injection is entirely automatic and requires no adjustment.

The engine will operate satisfactorily on a broad range of fuels without change in adjustment. This range includes the lighter as well as the heavier grades of fuels from alcohol and gasoline to the heavier gas oils, fuel oils and residuals sold for internal combustion engine use.

OREGON IRRIGATORS TO MEET

The fourth annual session of the Oregon Irrigation Congress will meet in Portland, Ore., Jan. 7, 8 and 9. The officers are: President, Asa Thomson, of Echo; vice-presidents, J. W. Brewer, of Portland; J. R. Blackaby, of Ontario, and W. Lair Thompson, of Lakeview; secretary, Fred N. Wallace, of Laidlaw.

OPEN ALL KLAMATH LANDS

All the lands withdrawn from entry under the Klamath irrigation project in Oregon and California will be thrown open for settlement December 30. The Reclamation Service estimates call for the irrigation of more than 200,000 acres of land in this project by 1920, but it is stated that all land now offered is "dry farming" land.

WHAT THE SETTLER SHOULD KNOW

(Continued from page 428)

a new dairy farm it will take a year to get the farm under full headway. In the case of the orange grove it will take about five years to bring the trees into commercial bearing; that is, into a condition where it will pay expenses. It may not come into full bearing for ten years. Dairying is a going concern almost from the start, while to secure a successful orange grove it requires many years of waiting, which can be afforded only by men who have other sources of income. One of the most important questions to determine in the purchase of a piece of property is how soon it will become a going concern. Some banks adopt it as a policy not to loan except to going concerns. The man who must earn a living through his own labor will do well to invest in an orchard or ranch from which he can get immediate returns, rather than to invest in land which will require years to develop. On the other hand, a man who merely wishes to invest capital may easily spend five or even ten years in developing a business farm enterprise. The fact that relatively few men have capital so to invest gives them a greater opportunity to reap eventually a good return.

It is, however, possible for a man to make himself a going concern by taking up side issues while his orchard is growing. There are two general methods of doing so: one is to grow intercrops in his orchard while the trees are small. The success of this method will depend upon a number of factors, including the kind of fruit, the abundance and cost of water, and market conditions. The other method is to engage in outside work while the orchard is growing. It is a rather common practice in the citrus sections for a man who is starting a grove of his own to care for other groves at the same time; thus a man with a ten or twenty acre tract of his own may have charge of two or three other bearing groves, ranging from five to twenty-acres each. It is generally estimated that one man can do the cultural work on forty acres.

It has been assumed that only a single crop was being used. In fact, however, many farms do and most farms should raise a variety of products. A diversity of crops helps to conserve the soil, to keep down insect enemies and fungous disease, and to make possible a more constant and economical use of labor.

Assume a man has \$5,000 to invest and that he desires eventually to secure a gross income of \$4,000 per year, but is willing to accept less in the beginning, how is he to proceed? The discussion which follows is intended to suggest that a person with a small or insufficient capital, by economy and self-sacrifice, may achieve a satisfactory competence. The main items to be considered in estimating the probable or possible outcome are illustrated by a concrete, although imaginary, example. In order to caution the reader against taking the figures here mentioned too literally, there follows a discussion of the application of the particular illustration to existing conditions.

Whether the figures apply to any given place or time is wholly immaterial so far as the involved

principles are concerned. The intelligent reader will realize that yields and values will vary with the locality and that what is true of prices of land and products today may not be true tomorrow. The purpose of the discussion throughout is to state principles and methods by means of concrete illustrations. Its value to the reader will depend upon his ability to apply the principles and methods suggested to the particular conditions which he may meet.

First Year.—The first act should be to set aside \$500 for family expenses during the first year. Assuming the purchase of sixty acres of undeveloped land with water rights attached at \$100 per acre, or a total of \$6,000, he may pay \$1,000 upon the land, set aside \$1,000 for buildings, \$1,000 for teams, machinery and tools, and \$500 for running expenses, including water charges. He may purchase a four-horse team and will spend most of the first year in leveling, checking and seeding his land. He has left \$1,000 with which to buy ten cows, a couple of sows, and a few chickens. Most of these will be purchased during the latter part of the year and not more than \$300 cash income should be assumed during this year.

Second Year.—Since the owner is now going to get his pay check every month, he may pay the interest on \$5,000 at 6 per cent with the \$300 and meet his family and running expenses out of current income. During this year his cows, bull calves, pigs and chickens may bring in a thousand dollars, while another thousand dollars may be received from the sale of alfalfa. Assuming running expenses to be \$700, living expenses \$500, and interest \$300, there is left \$500. With this sum five cows and a bull may be purchased.

Third Year.—This year the return from dairy products and livestock may be assumed to be \$1,500, while, on account of the greater age of the alfalfa, \$1,000 may again be assumed from that source. Assuming the running expenses to have increased to \$1,000, the family expenses to \$700, the total outlay will be \$2,000, leaving \$500 with which to buy five additional cows.

Fourth Year.—The returns from alfalfa may be reduced this year to \$800, while the other returns may be increased to \$2,000, making a total of \$2,800. Allowing for increase in running expenses the yearly outlay may be stated as follows:

Running expenses	\$1,200.00
Family expenses	700.00
Interest	300.00

Total.....\$2,200.00

The balance would thus be \$600, with which to buy five cows and a bull.

Fifth Year.—The returns from alfalfa may be reduced to \$600, while the other returns may be increased to \$2,500, making a total of \$3,100. Allowing again for an increase in running expenses, the following may result:

Running expenses	\$1,400.00
Family expenses	700.00
Interest	300.00

Total.....\$2,400.00

The balance will thus be \$700, with which seven cows may be purchased.

Sixth Year.—Assuming a reduction of alfalfa to \$300 and increase in milk and meat to \$3,300, the income the sixth year would be \$3,600. The outlay may be assumed as follows:

Running expenses	\$1,600.00
Family expenses	700.00
Interest	300.00

Total.....\$2,600.00

This leaves a balance of \$1,000, with which eight cows and a bull may be purchased.

Seventh Year.—There will now be on hand forty cows, which will stock the sixty acres fully, so that the only return will be from the sale of butter fat and livestock. During the seventh year, under this plan, the owner should receive an income of \$4,000 and may estimate his running expenses at \$2,000, leaving \$2,000 to be divided among living expenses, interest, and reduction of debt. Assuming living expenses to have been \$700, there would be left \$1,300 for interest and reduction of debt. At the end of the seventh year, therefore, this man's account would stand as follows:

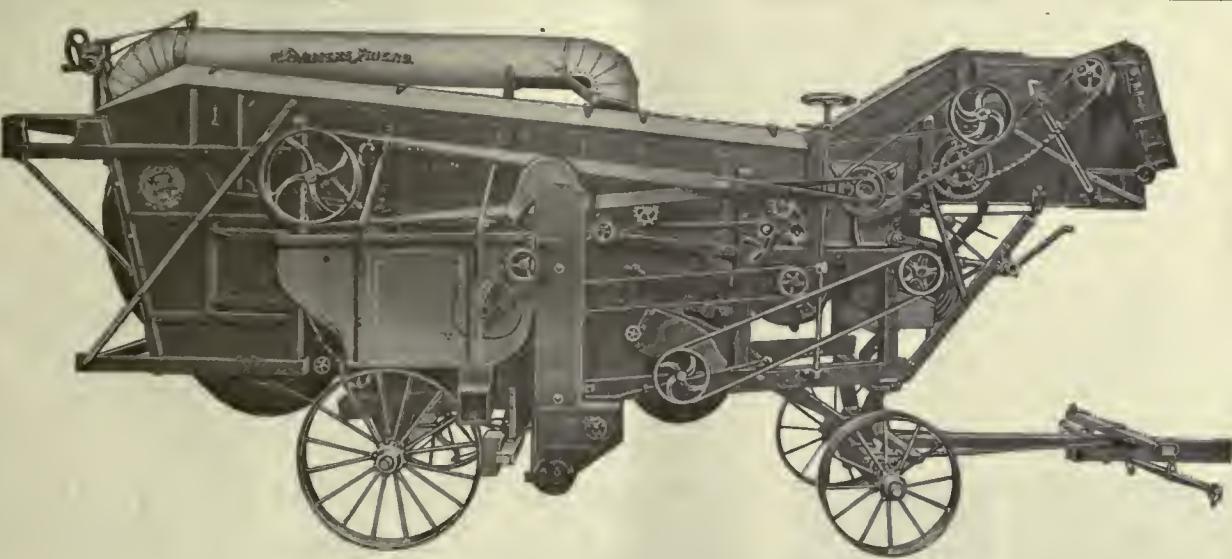
Property, worth	\$16,000.00
Cash on hand	1,300.00
	<hr/>
Original investment	\$ 5,000.00
Debt	5,000.00
Interest due	300.00
	<hr/>
Balance.....	\$ 10,300.00

Balance.....\$ 7,000.00

The net annual gain, therefore, over living expenses has been \$1,000. Most farming operations are not so simple as this illustration, because most farming is, as it should be, more diversified. Neither does this illustration provide for sickness, lack of water, or other accidents. Further, it assumes land well adapted to alfalfa and suitably located with reference to a creamery. On the other hand, the increase through the saving of the heifer calves has been ignored in order to balance possible loss of cows. This estimate also assumes that the owner hires all labor except, of course, his own. If he has grown or growing children, part of the running expenses here estimated may be kept within the family.

INVESTIGATES IRRIGATION DROPS

Justin T. Kingdon is making an investigation of vertical and incline drops in irrigation systems and their respective values. While working around Boise, Idaho, recently, he said he had been engaged in this work for the past irrigation season, and it will take until about the first of the year to complete his work. There is little or no information of a technical character in existence on the subject of irrigation drops, and the Department of Agriculture, realizing the necessity for reliable data along this line, ordered the investigation by Mr. Kingdon.



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That's just what you will do if you use a "Matchless" Huller on the job. It's the one huller that will hull all the Clover or Alfalfa you can get to it without sacrificing the quality of the work. Here's the reason! We use square steel brads in our hulling cylinder. This construction has every advantage over rasps of spikes, because no set of spikes will knock the seed out of the damp pods. Rasps gum up and are easily destroyed. Our system of separation is unique and effective. This consists of a series of rotating troughs with perforation in the bottom, with provision for adjustment to meet the various conditions of clover. The Patented Steel Scrapers attached to the bottom of these troughs thoroughly scrape the separator bottom and insure a steady and positive delivery of the pods to the hulling cylinder, regardless of the condition of the clover. This construction enables you to hull seed under conditions in which no other huller can operate; enables you to hull earlier in the morning and later in the evening than with any other—this insures a longer day, thus increasing your earning power. Give us an opportunity to prove to you right on your own farm that the "Matchless" is the speediest and cleanest huller on the market. WRITE FOR CATALOG TODAY, or call at our nearest Branch House.

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PLAN BIG IRRIGATION PROJECT IN NEW YORK

VAGARIES of the winds in the vicinity of Sturgeon Point along the south shore of Lake Erie a few miles from Buffalo, and particularly their influence in diverting the course of rain bearing clouds, has brought about the necessity of having a government representative visit the district and report on what may be done in the matter of irrigation.

Milo B. Williams, irrigation engineer of the United States department of agriculture, has been assigned to Buffalo to join with W. L. Markham, manager of the Erie county farm bureau of the Buffalo Chamber of Commerce, for the purpose of going over the Sturgeon Point—Derby section. They will seek to devise some sort of an irrigation system for the district, which is devoid of rain for periods of weeks during the hot days of the summer.

Spencer Kellogg, A. R. Mann, F. C. Truby and the other extensive holders of agricultural estates are prepared, it is said, to install an extensive irrigation plant, if the report of the engineers is satisfactory.

This will, if carried out, be the first irrigation project of any extent in the east and the very first of any size in the state of New York.

CANADA IRRIGATION COMPANY FAILS

Despite several other receivership proceedings affecting it, which are already pending, the San Antonio Land & Irrigation Co., Ltd., whose principal office is in Toronto, filed a petition in bankruptcy in New York with liabilities \$9,030,934 and nominal assets \$758,354. The assets consist of accounts \$412,417, of the Medina Valley Irrigation Company and the Medina Townsite Company, interest due \$339,397, on bonds of the Medina Valley Irrigation Company, machinery and fixtures, \$4,581, cash in banks \$1,672, cash on hand \$287, and right to an accounting in 57,137 acres of land in Texas when sold by the trustee in whom the legal title is invested, after the first mortgage of £1,600,000 held by the Empire Trust Company to secure an issue of bonds has been paid. It was stated in the petition

that it has no office in the United States, but all of its property is in New York City. Of the liabilities \$7,704,217 are secured and \$1,326,717 unsecured. It is a Canadian corporation for acquiring and selling lands for irrigation purposes. F. S. Pearson is president. It was incorporated in April, 1911, with capital stock of \$8,000,000 to acquire 60,000 acres of land in Texas near San Antonio, and bonds for \$8,000,000 were issued. Among the secured creditors are the Empire Trust Company as trustee, \$6,192,482; Empire Trust Company, \$260,208; Bank of Scotland of London, \$612,046; Canadian Bank of Commerce of Toronto, \$540,000, and Keystone Land and Cattle Company of San Antonio, \$99,479. Among the unsecured creditors are J. H. Dunn, of London, \$847,660; Dunn, Fischer & Co., London, \$252,367; Guaranty Insurance and Investment Company, London, \$103,253, and Canadian Bank of Commerce, \$93,713. F. R. Swift was named receiver. The U. S. Court in Texas recently ruled that the state court receiver has full authority.

Mr. J. W.
Lough, Scott,
Kan., writes:

"My 60 H.P.
Charter Type
"R" Oil Engi-
ne burns
about 100
gallons of oil
every 15 hrs.,
costing 2½c
per gallon
laid down in
Scott."



This flow of water is pumped by Mr. Lough's
60 H. P. Charter Oil Engine

Submit your irrigation problem and we will help figure it out for you.

Operates on Distillate, Kerosene and Gasoline, fuels that are obtainable at all times.

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"The Perfect Outdoor Bed"
For Porch, Lawn or Camp

The Enterprise Tent-Cot will protect you from all the discomforts and dangers of sleeping out. You sleep 17 inches and windows are fitted with both storm and mosquito curtains that can be raised and lowered at will of the occupant. For anyone afflicted with lung trouble there is nothing equals the Tent-Cot. It also has a splendid appearance and can be set up on your porch, lawn or roof and taken down when not in use. Can be set up in a space 30x78 inches and only requires about 30 seconds to operate. It is ideal for hunters, fishers and campers as it eliminates all the annoyance of "making camp." With a Tent-Cot you carry your camp with you under your arm and sleep safe and sound any place.

SPECIFICATIONS—Length of cot open, 6 ft. 6 in.; width of cot, one person, 28 in.; width of cot, two persons, 44 in.; height of bed from ground, 17 in.; height of tent over cot, 32 in.; size of cot folded, for 1 person, 23x36; size of cot folded, for 2 persons, 44x36; weight, 1 person, 29 lbs.; weight, 2 persons, 44 lbs.; frame is of hard maple, painted green; covering is of heavy waterproof canvas in colors, tan or olive green.

PRICE—Tent-Cot 28 in. wide, open 1 side, \$9.00; Tent-Cot 28 in. wide, open 2 sides, \$9.50; Tent-Cot 44 in. wide, open 2 sides, \$11.50.



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OPEN AND FOLDED



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Exclusively by

ENTERPRISE BED COMPANY, HAMMOND, INDIANA

FIRST STATE-FINANCED PROJECT IS OPENED

THE first state-financed irrigation project in the United States is being settled up rapidly. It is the Tumalo project, near Laidlow, Oregon. Seventeen thousand five hundred acres have been thrown open to entry under the terms of the Carey act, at \$40 an acre. The terms are one-tenth cash and the balance in ten years.

The Tumalo project passed through many hands into direct state administration. It was formerly known as the Columbia Southern project. Private enterprise did not demonstrate efficiency in capitalizing the project or in bringing it to completion. Settlers on the lands waited for years for adequate water service.

During January, 1913, the Oregon Irrigation Congress met in Portland. Settlers from the project came before the congress and pleaded for aid in securing a state appropriation with which to complete the project. Sympathy was awakened. The en-

dorsement was given. The legislature appropriated \$450,000.

Under the state appropriation the diversion dam on Tumalo creek was entirely rebuilt and the water turned thereby into a new feed canal. The construction of Tumalo reservoir covering 1,400 acres of land was found necessary because the flow of the creek is not sufficient during the dry season to supply directly all the water needed for irrigation purposes. The creation of the reservoir involved the construction of a heavy masonry and concrete dam and a large level area partially cultivated will be inundated.

Irrigable, arable lands within the project boundaries are found excellent for grains and hardy vegetables. Stock raising should be successful. The altitude renders spring and autumn frosts likely and there have been frosts during summer months. There should be less frost as the land is cultivated.

Reclamation Service Contracts

The Reclamation Service has executed the following contracts for the construction of lateral A extension, Shoshone irrigation project, Wyoming:

With R. M. Lynn of Lovell, Wyo., schedules 1, 2, 3 and 4, contract price \$4,382.

Treet Bros. & Jolley of Lovell, Wyo., schedule 5, contract price \$9,651.50.

James O'Connor of Council Bluffs, Ia., has obtained the contract for reconstruction work on the Dodson south canal at Dodson bridge, Milk River project, Montana. The contract price is \$33,895. Schedule 2 of the same work was awarded to the Security Bridge Company of Minneapolis, Minn., at a price of \$3,060.

The Pacific Tank & Pipe Company of Portland, Ore., has contracted to construct about 3,000 linear feet of wood stave pipe in connection with the Sunnyside irrigation project, Washington. The contract price is \$7,263.

The Security Bridge Company of Minneapolis, Minn., has obtained the contract for construction of earthwork and structures in connection with the Nelson reservoir, Milk River irrigation project, Montana. The work involves something over 67,000 cubic yards of excavation, some concrete work, the placing of 57,000 pounds of reinforcing steel, paving, ripraping and timbering. The contract price is \$28,459.90.

Names Commissioners

Governor Byrne of South Dakota has appointed Homer M. Derr of Pierre and S. E. Wilson of Hot Springs as state representatives on the interstate irrigation committee, organized by Secretary of the Interior Lane to make recommendations for revising and unifying federal and state irrigation laws.

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IN the past, tractors good enough for you to buy have been too big for your farm.

Now comes the light 12-25 Mogul oil tractor, bringing ideal power for small and medium size farms.

Here are points in which the 12-25 Mogul meets your needs: It weighs less than six horses, yet it does the work of twelve. It is built from a radically new design, compact, simple and convenient, to handle as much work as many other tractors nearly twice its weight. It runs on the cheapest and most convenient fuel. It is a one-man tractor and can be operated all day long from a comfortable seat in the cab. It can be handled as easily as an automobile. When equipped with our new, efficient, inexpensive self-steering device, the operator may leave the cab at any time to make necessary adjustments of plows, etc.

The Mogul 12-25 is the tractor for use on the average farm everywhere. Let us tell you where you may see one. Write us for catalogues.

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Headers, Mowers
Rakes, Stackers
Hay Loaders
Hay Presses

CORN MACHINES

Planters, Pickers
Binders, Cultivators
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COLONIZE BELGIAN WAR VICTIMS IN COLORADO

THOUSANDS of Belgians who have lost their homes as a result of the European war will settle in Colorado. Belgian capitalists have acquired title to a large tract of land and water rights in the Arkansas river and tributary streams and will at once begin the construction of an immense irrigation project on the south side of the Arkansas river between Las Animas and Lamar. The project will include about 50,000 acres of land and it is said that \$1,250,000 is involved in the deal. The capitalists propose to colonize their holdings with immigrants from Belgium and to convert the tract into sugar beet farms and dairy ranches.

The deeds to the land and water rights are in escrow in a Pueblo bank and have been accepted by the Belgian capitalists, it is said, who are arranging for payment and as soon as the money arrives and the deeds are surrendered the contract will be let for the completion of reservoirs and irrigation canals and laterals. It is said that a large force of men will be put to work and the project completed as rapidly as possible.

It is hoped to bring a portion of the colonists to the land in time for the planting of crops for the 1915 season. The deal has been under way for the past several months and was being considered before the war in Europe was declared. The war retarded the closing of the deal, but it is said that all details have now been arranged and that the matter is practically assured of being carried out this winter.

It is proposed to divide the big tract of land into five, ten and twenty-acre tracts and to dispose of it to bona fide settlers. In this way the land will provide homes for from 5,000 to 10,000 Belgian families. Only experienced beet growers and dairy farmers will be given opportunity to colonize the tract.

MONTANANS WOULD BAR JAPS

The Montana Farmers' and Producers' Association, at a recent meeting in Billings, Mont., adopted a resolution introduced by delegates from the Huntley government irrigation project, that the association appeal to the legislative assembly of Montana to pass a law at its coming session, forbidding the purchase or holding of real estate by aliens in Montana, and that said law be similar to the Webb anti-alien law of California. The action followed charges that many Japanese are drifting into this sugar beet district, and leasing land for the purpose of raising beets.

THE TEMPTING WEST

A resolution calling upon the government to lessen its activity in irrigating in the West, "because it attracts farm labor from the east," was presented to the National Grange at Wilmington, Del., recently. It was laid on the table.



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Indianapolis, Ind.

Kansas City, Mo.

BRIEF NOTES FROM IRRIGATION PROJECTS

Texas

The Anahuac Canal Company of Texas, which has been organized at Galveston with a capital stock of \$100,000, will construct an irrigation canal in the Anahuac district. Dredging machinery will be required.

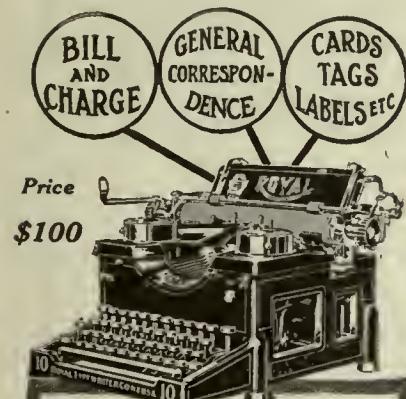
The Texas state board of water engineers has granted the application of the Val Verde Irrigation Company of Del Rio to divert and appropriate 10,255 acre feet of water a year from the Rio Grande river, based on the use of $2\frac{1}{2}$ acre feet per acre, for the purpose of irrigating 4,102 acres of land in Val Verde county. Other applications heard and granted by the board are as follows: J. B. Mayhugh of Hunt, sufficient water from the Guadalupe river to irrigate $2\frac{3}{4}$ acres; R. E. McDonald of Ingram, sufficient water to irrigate $11\frac{1}{2}$ acres from the Guadalupe river; Everett Love of Laredo, sufficient water to irrigate 310 acres from the Rio Grande river in Webb county; Klein Bros., of Guadalupe county, water to irrigate four acres of land from the Guadalupe river.

Interest in the question of the im-

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FOR SALE—One $7\frac{1}{2}$ H. P., V. S. Oil Engine, located in El Paso Texas. Was used as a sample, good as new. Price quoted on application, R. R. STREET & CO. INC., 541 W. Washington Street, Chicago, Ill.

WANTED—Practical Engineer to take charge of Canal System in Idaho. Acreage 100,000. Also state experience and salary wanted. J. L. DAUBE, c/o Irrigation Age, Chicago Ill.



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does the work of several typewriters in one—it writes, types cards and bills! All this without a dollar for "special" attachments. The one machine does it all.

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for our new Brochure, "**BETTER SERVICE**," and a beautiful Color-Photograph of the New Royal Master-Model 10.

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provement of the Colorado river of Texas is increasing. A score or more of men between Austin and the mouth of the river are getting busy procuring the necessary data to present to the state legislature.

Prof. T. U. Taylor, dean of the department of engineering in the University of Texas, who has done a great deal of work for the United States government along the Colorado, and who is perhaps more familiar with the conditions than any other man, says.

"The Colorado river is divided into three sections that need improvement, as follows:

"1. The canyon section from Austin to San Saba. Impounding dams can be constructed that will store the flood waters and would equalize the flow. This would save the rice crop

in the coast section and render a magnificent result for power purposes.

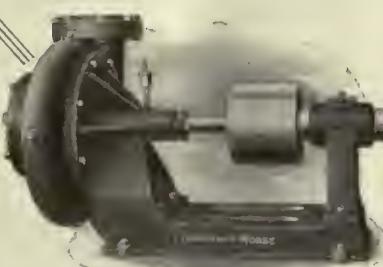
"2. Irrigation from the Colorado is now a doubtful proposition on account of the spasmodic and irregular flow of the Colorado. This can all be overcome by holding back the flood waters that now go to waste.

"3. The cleaning of the river channel in the lower section will be a protective feature that will enable the flood waters that do escape to be controlled and will eliminate the damage inflicted thereby."

Bondholders of the San Benito irrigation system are considering the proposition made by the farmers of the San Benito tract to purchase the system and make it a communal enterprise. The farmers made an offer of \$300,000 for the canal and plant as

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The **reliability** of Fairbanks-Morse oil engines and centrifugal pumps in irrigation service makes them the safest of "crop insurance policies"—their **efficiency** makes them the most economical.

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it stands now and indications are that the proposition will be acted upon favorably by the bondholders. A request has been issued by the committee representing the bondholders that proxies be sent in at an early date, so that action can be taken on the proposition.

Montana

The next unit of work to be undertaken on the Flathead reclamation project in Montana will consist of about 38 miles of canals. Bids on the work will be received December 15. The new canals will be located east of the Flathead river between Polson and Dixon, and will pass within nine miles of Ronan.

M. F. Woods of the Powder River Sheep Company of Montana states that the company will have some 600 acres under irrigation next year, all to be used in connection with their sheep business. The Powder River Company's ranch lies on the Powder some four miles south of Powderville, and includes land on both Timber and Stump creeks. The water from these creeks, and from the Powder, has been harnessed, four dams having been built.

Wyoming

The Reclamation Service is investigating the feasibility of construction of a dam on Green river, in Wyoming, below Henry's Fork.

Utah

Application has been made to State Engineer W. D. Beers of Utah by Guy Sterling, consulting engineer, to extend his filing on 7,500 second-feet of water for power purposes and a reservoir site for 3,000,000 acre feet of water at the junction of Green and Colorado rivers.

Construction work on the New Castle project in Utah has been completed. Settlers on the project look with confidence to the possibilities of the project during the immediate future. A 7½-mile canal carries the water from the project reservoir in Grass Valley to the tract.

Articles of incorporation of the Smithfield Irrigation Company have been filed with the secretary of state of Utah. Smithfield, Utah, is the principal place of business. The capital stock is \$35,000, shares of \$10 each. Peter Hansen is president; William Richardson, vice-president; S. J. Thornley, secretary and treasurer.

Nebraska

The Nebraska commission has authorized the McCook Irrigation & Water Power Company to increase the maintenance charges on its water holdings from \$1 to \$2 per year per acre. The company asked permission to set aside \$45,000 per year for operating, maintenance and betterment of ditches.

There are 2,658 acres in Buffalo county, Nebraska, now under irriga-

tion, according to the records of the assessors made up on April 1. Since that date there have been several irrigation plants installed in the county, both of the centrifugal and the chain lift types. These new pumps bring the total number of acres under irrigation in the county to more than 3,000, with the prospect of many more pumps going in next spring.

Strawberries, blackberries and small tracts of raspberries have been set out

and young orchards are now seen in many places where water can be had when necessary. The men putting out these crops have complete confidence in the success of their enterprise, and without doubt will be successful through the proper use of irrigation. The Kearney cannery factory has been kept going by the crops from irrigated tracts, and but for these would not have been able to secure a sufficient quantity of corn and tomatoes.

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Oregon

Work on the Morson Land Company's irrigation project near La Pine, Ore., which was resumed this summer, is progressing rapidly, and it is expected that the west side will be completed early in the spring. The company's sawmill is working full time getting out timber for the flumes.

The adjudication of the waters of Trout creek in Crook county, and Burnt river in Baker county, was ordered and the state engineer instructed to proceed with the preliminary surveys and investigations, at the fall meeting of the Oregon water board. About 100 proofs of appropriation of water submitted under state engineer's permits were approved, and certificates ordered issued, and fifty extensions of time allowed for the completion of construction work under similar permits. Among the extensions of time granted was an extension of three years to the Rogue River Valley Canal Company, within which to complete the reservoir and diversion works for their 55,000 acre project in Jackson county. Mr. Mealey of Medford, the company's attorney, stated that litigation had held up the development of the project to such an extent that three years more time would be required for its completion.

Following the refusal of State Engineer John H. Lewis to certify as reclaimed certain lands in the Central Oregon reclamation project in eastern Oregon, the state desert land board passed a resolution asking that the U. S. government give patent to the land in question. The land is located on the Central Oregon canal and consists of about 11,000 acres. It is a Carey act project and according to the terms of the agreement the government issues patent to the land on the receipt of the certification of the state engineer that the land is reclaimed. Mr. Lewis refused to give the necessary certification on the ground that the canal, owing to loss through seepage, does not supply the 1.8 feet of water required in the company's contract with the settlers. The action of the desert land board followed the receipt of a petition signed by many of the settlers asking that the land be certified as reclaimed so that they might secure their patents.

The Powder Valley Irrigation Company will resume work on the Thief Valley project near Baker, Ore. J. A. Almirall said the company is planning to build the toe of the Balm creek dam next spring and thus put under irrigation at once 2,000 acres north of Keating. While 2,000 acres is only a small part of the large tract of land that the company intends eventually to throw open, the resumption of work, under present conditions, is welcomed by the Baker people because it shows that the company intends to carry the work to completion.

Washington

The opening of the south half of

the Colville Indian reservation is expected early next summer. These lands comprise the last big chance in the state of Washington for settlers to obtain government lands and as they are fertile and valuable, the rush to obtain a tract will undoubtedly be great. There has been considerable controversy over the timber lands on this reserve, as the department insists upon putting them into an Indian forest reserve, while the business interests of the state have been holding out to have them sold according to the opening act and have about 700,000 acres of merchantable timber placed upon the tax rolls of Ferry and Okanogan counties.

Partly as a result of the dry summer just past, the Puyallup & Sumner (Wash.) Fruit Growers' association has been considering irrigating their berry fields. It was thought that with sufficient cultivation the berries

could do without irrigation, even during the dry summers, but President Paulhamus and other large growers have decided that a little water at the right time would make an appreciable difference in the crop. It is said the entire valley is underlaid with water, and that by several growers going together, wells could be sunk and the water pumped to the surface. The Puget Sound Traction, Light & Power Company may furnish the power needed to run the pumps.

Permanent construction plans formulated by the directors of the Union Gap Water Users' Association for the improvement of the big ditch that waters a large acreage on Parker Heights, Wash., were given the decided approval of the stockholders in an almost unanimous vote for the issuance of \$90,000 bonds. There is a large amount of land under the ditch now unwatered, which it is felt will



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require water in the near future, and with these demands in mind steel flumes will replace wornout wooden flumes, the ditch will be relined and the grade changed in several places, and right of way will be purchased where it has not already been secured. The bonds will be payable in twenty years, drawing 6 per cent interest the first ten years and becoming payable in installments the last ten years.

The Yelm irrigation project near Tacoma, Wash., is about completed. Costing about \$100,000, the Yelm project will increase the value of the 3,000 acres which it is to water to more than \$100 an acre, or giving an increased value of between 75 and 100 per cent. Land, therefore, which now sells at not more than \$50 an acre will be sold at \$100 and perhaps more, although the promoters of the irrigation project—the farmers themselves—hope to attract new settlers to the land and furnish them the land at fair prices. The Yelm project was first mooted in 1910, but no actual work was done. In March, 1912, teams and men started at work digging a main canal to irrigate some of the prairie land. About four miles was dug and it was seen the progress would be too slow and expensive. In October of the same year a steam shovel was purchased and put to work. The main canal is 11½ miles long.

Colorado

A consolidation of the Omer Irriga-

gation Company and the Van Skike Ditch and Reservoir Company of Colorado, has been effected and arrangements made for financing the deal which will insure the irrigation of about 25,000 acres of land near Fowler. The plans of the consolidation include the expenditure of \$350,000 for the completion of a gigantic reservoir on Apishapa creek and the building of canals and laterals for carrying the water from the reservoir to the land to be irrigated. Construction work on the reservoir and canals will be started early this month. The consolidation will mean the end of all litigation. The new company is known as the Omer-Van Skike Irrigation Company. The plan of financing the project is a new one and does not call for a bond issue. In lieu of bonds, promissory notes are issued which operate as trust deeds on the land of each individual land owner under the project. These notes are issued to a syndicate of eastern and local capitalists. The land to be irrigated is among the most fertile in the Arkansas valley, suitable for melon growing, sugar beets, alfalfa and other products.

The federal government is progressing rapidly with its survey of the topographical map which is to be used by Uncle Sam to determine the extent and final cost of a system of drainage to be established in the San Luis valley. When the system is finally completed it will mean the investment of millions of dollars in this

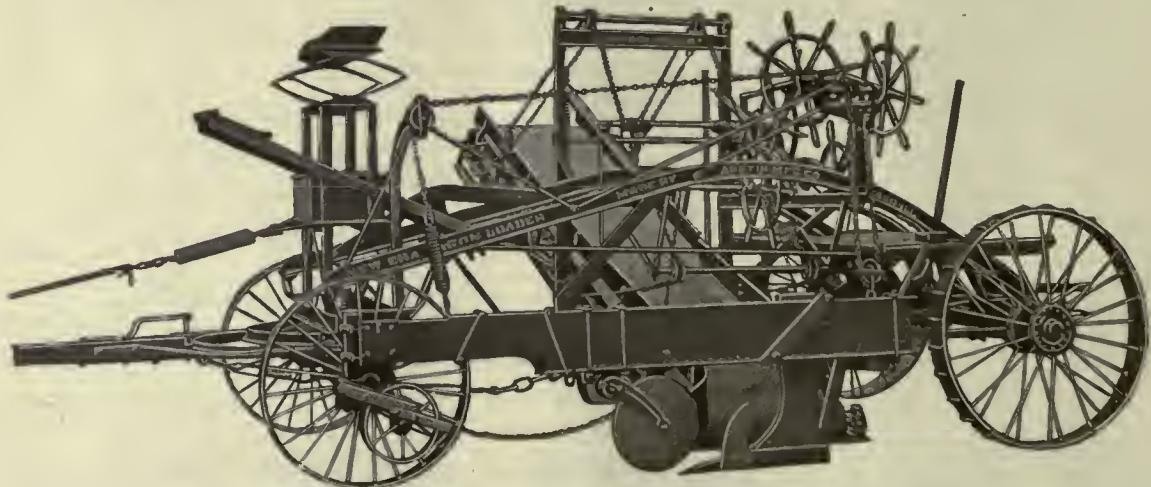
valley, known to be one of the most fertile in Colorado.

California

The report being prepared on the Iron Canyon project on the Sacramento river in northern California is to be finished and turned over to a board of review this month. This project would involve irrigation, power and flood regulation features. The storage area recommended is 700,000 acre-feet, which is to be secured by means of a dam with a maximum height of 100 feet and provided with gate capacity of 100,000 second-feet. The irrigated area will be 250,000 acres. The present flood flow of the Sacramento river at Red Bluff is about 300,000 second-feet, and by the use of the Iron Canyon storage unit, it is stated in the report, this flow could be kept down to a maximum of 100,000 second-feet.

As a result of negotiations between the Sierra & San Francisco Power Company and the boards of the Oakdale and South San Joaquin Irrigation districts in California it is possible that an arrangement will be reached by which the big San Francisco corporation will supply the immense quantities of storage water required by the irrigation districts, when new acreage is put under cultivation. The company is planning new storage basins which will cost in the neighborhood of three or four million dollars, in the mountains above Oakdale. They now have storage for about 16,-

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000 acre-feet and the dam at Strawberry, nearly completed, will provide as much more.

From 2,000 to 3,000 acres will be sown in rice in Willows county, Cal., next spring. Rice fields yielded better than 50 sacks an acre this year.

The project of the Northern California Irrigation Company, formerly known as the Pit river project, is progressing rapidly, and as the reports of the engineers in the field come in, the wonderful possibilities of this enterprise become more apparent. The preliminary surveys anticipated that about 100,000 acres of land would be brought in, but the survey now being made shows that this estimate was far too low. The project will water at least 300,000 acres and the power possibilities will be at least twice as great as at first supposed. In addition to watering this vast area and making available 200,000 electric horsepower energy, the plans also contemplate the creation of a series of storage reservoirs that will practically control the flood waters of this vast drainage area at all seasons of the year.

Construction work on the second unit of the Goose Valley Irrigation Company's project is progressing rapidly. The original unit embraced 70,000 acres, most of which will be devoted to forage crops, while the present undertaking, which is known as the West Side project, will water 45,000 acres of land suitable for peaches, pears, apples and alfalfa. The impounding dam which is being constructed to form the main reservoir is 66 feet high, 200 feet long at the bottom and 600 feet at the top. This forms a reservoir that will store 65,000 acre-feet of water, from which the two main canals will be supplied. The cost of construction will be approximately \$1,000,000. The cost of the water to the land will be \$25 an acre and a small yearly assessment for upkeep.

The Turlock city council is planning to install a new pump in time for next year's irrigation season. The city is rapidly outgrowing its present pumping facilities, and last season there was a considerable shortage of water. Water Superintendent G. H. Taber has recommended the installation of another pump with a capacity of 3,000 gallons per minute and the boring of a new well.

The work of excavating the Byron-Bethany Company's irrigation ditch near Byron, Cal., has begun. A large force is engaged in the work, including many scrapers and teamsters. The contract for building laterals is to be let to some of the stockholders.

Imperial Valley voted nearly 10 to 1 in favor of the \$3,500,000 bond issue for the purchase of the California Development Company's irrigation system. Part of the system is in Mexico and will necessitate the ownership of stock in the Mexican corporation

by the Imperial irrigation district board of directors. The water supply comes from the Colorado river.

stated that 22,000 acres will be brought under irrigation in a few years.

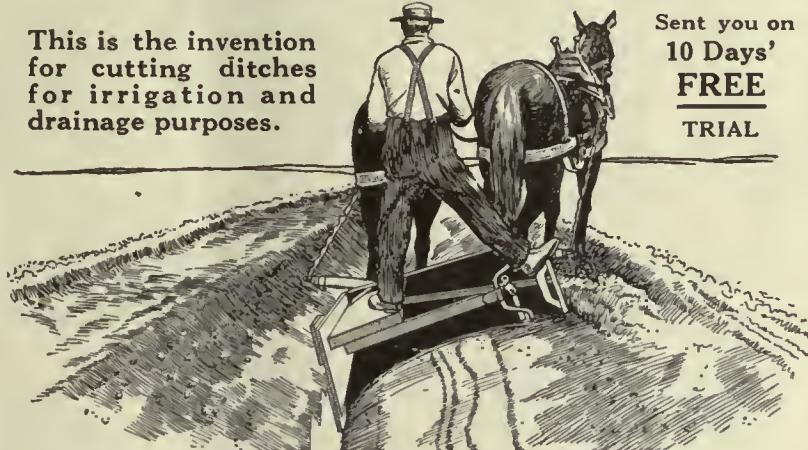
The Chicago Park, Forest Springs and Union Hill districts of California have launched a movement with the idea of organizing into a water district under the Wright act, for the purpose of voting irrigation bonds to construct 138 miles of canal. By such a system of water distribution it is

The Modoc Irrigation Company of California has acquired the rights of the Surprise Valley Water Company. The new company, capitalized at \$1,000,000, has assumed the \$85,000 obligations its predecessor contracted in its efforts to consummate this great project.

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TRIAL



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of the big, heavy, clumsy machines, and will be sent on ten days' free trial with money-back guarantee. Write today for descriptive catalogue, prices and testimonials. It will be a revelation to you!

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Preliminary surveys are being made for property owners of the foothill district east of Lindsay, Cal., to secure estimates on the cost of the control of flood water in the Sierras for the irrigation of the rich Yokohl valley, which includes upward of 15,000 acres of the very finest citrus lands. It has been figured that all expenses of surveys and preliminary estimates will cost the property owners about \$1 per acre, and an association to raise this fund is now in process of formation.

The California Farm & Irrigation Company has incorporated, with capital stock of \$500,000. Directors, J. E. Luby, P. Zucco, M. J. Terranova, A. R. Kapaga, W. Adnay; principal place of business, San Francisco.

The Hallwood Irrigation Company of California has voted to increase its capital stock to \$50,000. The source of the water supply of the company is at Daguerre Point, on the Yuba river.

Establishing a precedent in irrigation matters, Judge Wallace at Dinuba, Cal., handed down an opinion in the case of J. Nahl vs. the Alta Irrigation District, in which the court declared that irrigation companies could not be held responsible for damage to property when an irrigation ditch breaks banks during times of high water and floods the surrounding country. Nahl brought suit for \$22,000 damage. He alleged that this amount of injury was done to his vineyard as a result of a flood during high water two years ago.

New Mexico

R. W. Mitchell, Tularosa, N. M., will install a pumping plant in connection with a proposed system of irrigation.

Canada

Farmers of the district north and east of Lethbridge, Alta., and east of Macleod have organized a campaign to induce the government to undertake an irrigation project. A petition was prepared in which the farmers agree to meet the cost of construction by bonding their land to pay the capital cost of installing the system, with interest at 4 per cent, extending the

time of repayment of the construction cost over a period of forty years.

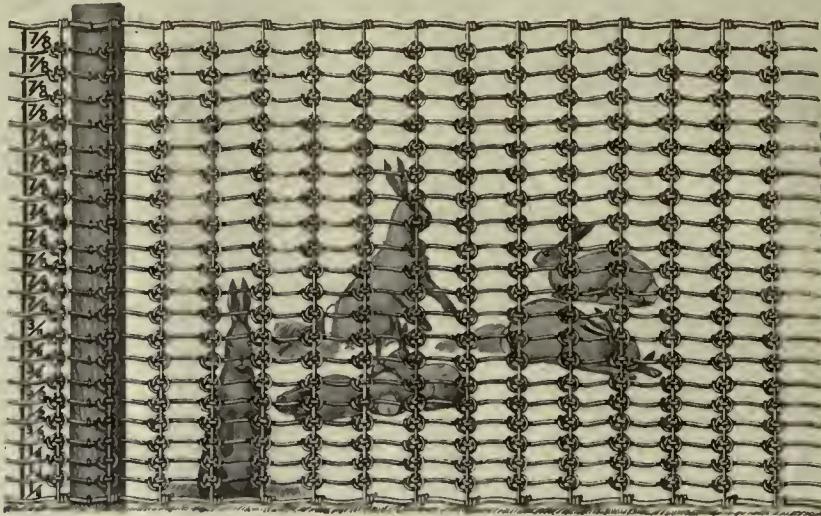
Kansas

Daniel Dyer of Smith Center, B. P.

Walker of Osborne and George Ward of Sharon Springs will be the members of the Kansas irrigation board for the next two years. All are Republicans.

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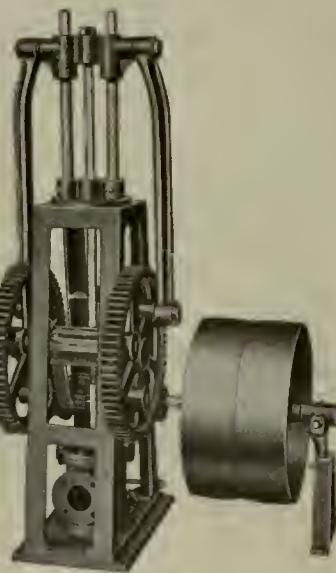
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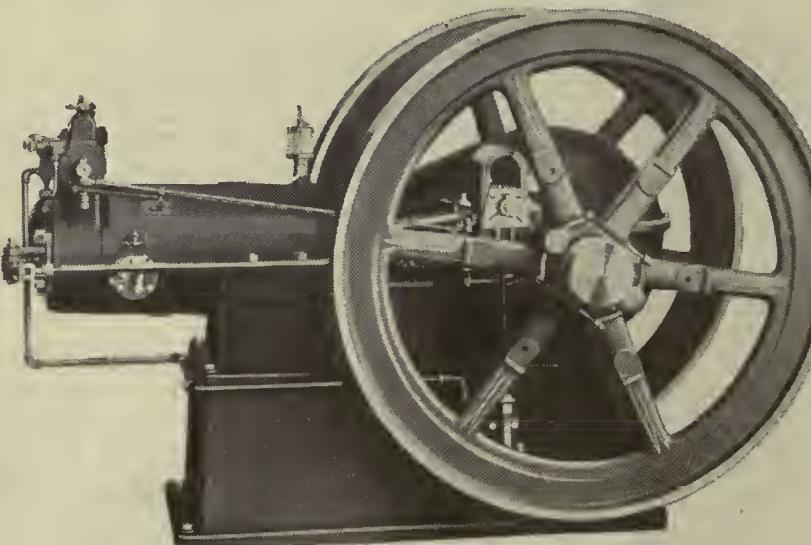
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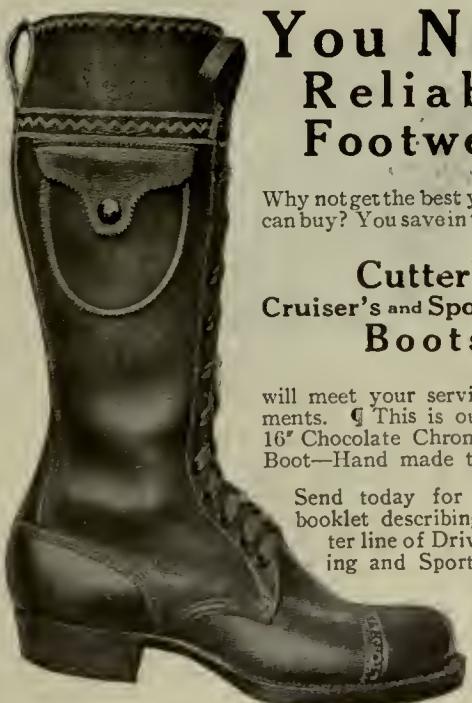
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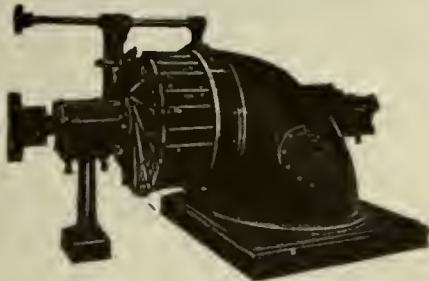
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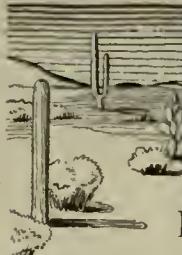


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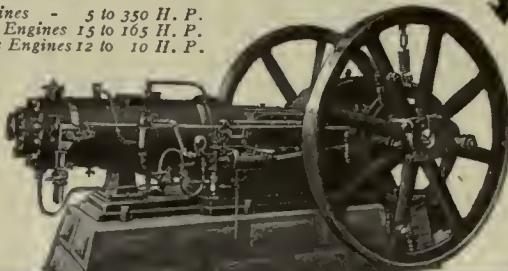
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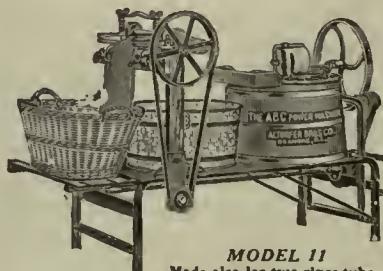
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Thirtieth Year

THE IRRIGATION AGE

VOL. XXX

CHICAGO, JANUARY, 1915.

No. 3

THE IRRIGATION AGE

With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARID AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

D. H. ANDERSON

PUBLISHER,

Published Monthly at 30 No. Dearborn Street,
CHICAGO

Entered as second-class matter October 3, 1897, at the Postoffice
at Chicago, Ill., under Act of March 3, 1879.

D. H. ANDERSON, Editor

ANNOUNCEMENT.

The "Primer of Hydraulics" is now ready; Price \$2.50.
If ordered in connection with subscription \$2.00.

The Irrigation Age finds a great deal of satisfaction in the removal of Frederick A Long Hard Battle Is Won Haynes Newell as director of the United States Reclamation Service. With Newell out of the way, we believe the solution of many of the problems on the Federal projects will prove easier and be solved with more justice to the settlers.

Newell, as the head and front of the Service bureaucracy, cold-blooded, self-satisfied, with little or no sympathy for the settlers; determined to make the water users pay all the bills, which he and his assistants had created, no matter how unjust or improper these bills might be, presented a serious menace to what we consider the rights of the men and women who are trying to create homes in the desert country.

The Age has fought Newell and the powerful bureaucracy, which he built up, month in and month out. It has been a long, hard fight against a man who knows all the arts and wiles of the politician and the bureaucrat and who had the backing of powerful political interests. For years we waged this fight in behalf of the Federal water users almost singlehanded.

The battle is over. We are glad. We are satisfied with the result.

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Associations has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Interesting to Advertisers

It may interest advertisers to know that The Irrigation Age is the only publication in the world having an actual paid in advance circulation among individual irrigators and large irrigation corporations. It is read regularly by all interested in this subject and has readers in all parts of the world. The Irrigation Age is 30 years old and is the pioneer publication of its class in the world.

O. E. FARNHAM.

Writes Magna
Charta of
Federal
Water Users

There is a name that should be written high upon the roll of honor of the Federal Water Users.

Mr. Farnham has written the Magna Charta of the settlers on the Federal irrigation projects.

He has struck at the very foundations of the Reclamation Service bureaucracy—the incontestability of the decisions and edicts of the Secretary of the Interior and the Service.

The opinion of the United States circuit court of appeals, written by Judge Sanborn, in the case in behalf of the Belle Fourche Valley (S. D.) Water Users' Association, which Mr. Farnham prepared and prosecuted against some of the brainiest lawyers in the Reclamation Service, establishes the right of the water user to seek protection of the courts, just as any other citizen is permitted to do. With confidence born of long bureaucratic rule, the Reclamation Service boldly denied that the settler had any such right. Seeking to hide behind the cloak of the United States government, the bureaucrats declared themselves immune from prosecution for or scrutiny of their acts, no matter how illegal those acts might be.

They contended that they could assess what-

ever charges as cost of a project or for operation and maintenance of a project that they might see fit, and the settler could not do anything except pay the bills. If he refused to do this, they claimed the royal prerogative to shut off the water, which gave life to his land, thus robbing him of all his possessions and then drive him from the land itself. They scoffed at the sacred contract between the government and the water users.

On and on they went with their riot of rule or ruin. Patiently the settlers bore acts of injustice and persecution. At last they could stand no more.

Mr. Farnham, who is secretary of the Belle Fourche association, as well as secretary of the National Federation of Water Users' Associations, proposed suit for injunction to restrain the illegal acts of the Reclamation Service and to prevent the ruin of many settlers. His proposal was greeted with little enthusiasm because of the fear that perhaps the Reclamation Service was right in its constant preaching that there was no power which could overrule its acts. Every citizen has a deep respect for his government, no matter how badly some of the servants of the government may treat him. Finally a limit to the patience of the settlers was reached, and Mr. Farnham was told to do the best he could with the meager resources of the settlers against the high priced lawyers of the Reclamation Service, backed by the unlimited funds at the disposal of the bureaucracy, which quickly realized its very life was being attacked. Mr. Farnham was permitted to have some legal aid, but as a very close student of Reclamation law and as an actual water user and an official of the association, naturally it was upon him that the major part of the work devolved. He did nobly, as a careful reading of Judge Sanborn's opinion will show.

The Belle Fourche water users are not yet through with their battle for rights as citizens. No doubt this case will go to the Supreme court. It should, for these newly established rights of the water users should be written firmly and incontestably into the law of the land by decision of the Supreme Court of the United States. The Reclamation Service will appeal the case in all probability.

All this means heavy financial outlays. Every Water Users' association should come to the aid of the Belle Fourche settlers immediately with such financial assistance as they can afford. The Belle Fourche people should not be permitted to become crippled or to be halted in this valiant fight because of lack of funds. The Irrigation Age urges every Water Users' association to act promptly and liberally in this matter.

Because Judge Sanborn's opinion is the biggest piece of news for the settlers on the Federal project and for others, who are interested in national irrigation affairs and irrigation law, The Age prints this opinion in full in this issue. Read it.

**Mr. Lane
Sees a
Great
Light**

Secretary of the Interior Lane says in his annual report to the President:

"While it is matter of the largest concern that the Government should be wise in determining what its policies for the future shall be,

it is, I respectfully submit, a matter of no less moment that its administration of the law that already is shall be responsive to the needs of the people. I would therefore present to your eye in succinct form a picture of the effort that this department is now making to so administer existing law as to stimulate confidence in the Government and a cheerful acceptance of its policies.

"It can not be unknown to you that there is throughout the country, more especially in the Western States—which because of their ambition are naturally impatient of obstruction—a very real fear of what is called 'the bureaucracy of Washington.' This is said to be a 'system' or organized machine, the spirit of which is to oppose action or to effect negative action. It is visualized as either cynical or malevolent, altogether out of sympathy with those who needs must come to the Government for some form of help, and so wound round and round with the red tape of officialdom as to resemble a barbed-wire entanglement which, if not absolutely impregnable, is only to be passed through after much suffering and toil. It is a matter of no immediate concern how much basis there is for this belief. The presence of the belief makes it a real problem, and the destruction of the belief a necessity, if the Government itself is to remain an object of pride and its beneficent efforts understood and appreciated."

Secretary Lane evidently has been reading the Irrigation Age.

We believe the Secretary has seen a great light. We hope that his actions in the future will be such as to remove the conditions which have created the feeling throughout the West which the Secretary has been forced to recognize.

As a western man, the West expected much from him and had great confidence in him. That these expectations were not realized is not the fault of any man except the Secretary, himself. There is still time to remedy the bureaucratic evils, against which The Age has voiced the feelings of the West in almost every issue. We trust Secretary Lane

will prove himself a true Westerner and a friend of government by the people by striking hard at the bureaucratic conditions.

**Help
Save the
Monterey
Cypresses**

The Monterey (Cal.) cypress grove is in peril. The grove is one of the real heritages of the nation. It should be kept for posterity. H. A. Greene, of Monterey, and others, are striving to save this grove. You can help. Here is Mr. Greene's appeal:

"Hereby is submitted a statement setting forth the main points of a matter in which you should be deeply concerned.

"In California there exists a group of ancient trees, the Monterey cypress (*Cupressus macrocarpa*), believed to be the parent of all the cypresses of the world.

"In this original grove are living trees that were old at the beginning of the Christian era.

"The species has ceased to exist elsewhere in the wild, only here on the rugged ocean shore near Monterey.

"For over forty centuries some of these trees have withstood the rigors of countless storms, the effect of which has been to produce most wonderful branch contortions.

"Unlike the last remaining grove of another pre-historic tree, the Cedar of Lebanon, in Syria, the Monterey Cypresses are not protected; for here the insidious Monterey pines are starving out old trees and, assisted by herds of cattle, are destroying reproduction.

"Many thinking people have, at last, become aroused to take action in the matter (although a former attempt failed), particularly since the owners of the grove have signified their intention of sub-dividing the land into building lots, as they have done with the adjoining property.

"A plan to get possession of 'Cypress Point' and turn it over to the national government is being formulated, and you are expected to do your part in saving the trees for posterity.

"An aesthetic and phytogenetic value, as well as a consideration of the importance of perpetuating the source of seed from the type form of this most valuable tree, should be sufficient excuse for you to devote time in helping us.

"It has been deemed advisable to enlist the assistance of a large number of influential people in different parts of the world, for in this manner we can better impress the owners of the property (Pacific Improvement Company) with the importance of making the grove a national monument and the officials at Washington who will be asked to accept the trust.

"We have hopes of securing the property without cost, but failing, we must raise the money necessary.

"To give room for reforestation the reserve should contain about 100 acres, and in addition a right-of-way for an independent road extending to Monterey. Upon the line of the proposed road is

growing a small group of another cypress, known as Gowan's (*Cupressus goveniana*), which flowers in winter instead of summer as is the habit of the Monterey Cypress. It is proposed to include this remarkable grove, for like reasons, in the park.

"While Gowan's Cypress is found elsewhere in central California, only here is it growing in forest form.

"Besides, growing among and around the 'Goveniana Grove' is a rare pine, *Pinus muricata*.

"Will you kindly forward this statement to some person likely to become a helper in this worthy undertaking and ask him to do likewise; also request that he write his views on the subject."

This appeal should touch the heart of every tree lover in America. Do what you can to aid in saving these trees.

**A New Kind
of Conservation
That is
Worth While**

The United States can find many lessons of vast usefulness in the European war. No lesson which the war can teach, is greater than the one in food conservation, which Germany presents.

Surrounded on all sides by foes, cut off from exports by navies and governments, who make contraband laws to suit their own conveniences, Germany is probably the best fed of all the warring nations today.

This is so because Germany, recognizing that she must depend entirely upon her own resources, is taking remarkable steps to make every inch of agricultural ground in the empire produce; to obtain full food value from every crop; to avoid any waste and to encourage agriculture and the utilization of farm products.

The United States would do well to send a skilled commission to Germany to study this new conservation—a conservation that gives the people something instead of robbing them of their just rights as does the Pinchot propaganda, now honored by the name conservation. The government would do well to put some of this German conservation into effect in this country. We are growing so rapidly that it is the one kind of conservation which the United States need.

Take care of your orchard heaters. Unless you protect them with a coat of paint or asphaltum, they will rust rapidly in two or three years and quickly become mere junk. Orchard heaters cost money.

Save and apply all of the barnyard manure that is produced on your farm. It is difficult to get garden land too rich. In case there seems to be more nitrogen from heavy application of manure than the other elements, apply acid phosphate and sulphate of potash to balance the fertility constituents.

The Federal Water Users



A Department Devoted to the Interests of the Farmers on the Government Irrigation Projects

EDITED BY GEORGE J. SCHARSCHUG

NEWELL DEPOSED AS HEAD OF SERVICE

THE shake up of the Reclamation Service has begun. Frederick Haynes Newell has been deposed as director but is retained as a consulting engineer. Secretary of the Interior Lane has combined the offices of director and chief engineer, with A. P. Davis filling the combined positions. Davis has long been chief lieutenant of Newell, but other members of the Reclamation Commission have expressed themselves as believing that Davis will prove a very good man for the Service, when freed from the influence of Newell.

The removal of Newell is also considered a distinct victory for the National Federation of Water Users' Associations.

Secretary Lane evidently did not feel that either Davis or any of the engineers in lesser positions in the Service were competent to supervise and manage the actual construction of the government irrigation projects. Therefore, he went outside the Service

ranks and named Sidney B. Williamson as chief of construction. Williamson's duties, it is announced, will consist of expediting construction work on the projects and in promoting efficiency among the men employed by the Service. He will spend most of his time in the field.

Williamson was formerly division engineer of the Panama canal. He was in charge of the Pacific division of the canal construction work and is reported to have proved an efficient man. When the canal was about completed, Williamson resigned from the government service to enter the employ of J. G. White & Co., Ltd., of London, England. Williamson's salary has not yet been announced.

A number of engineers and other officers of the Reclamation Service have been dismissed or transferred in the shake-up. More heads are likely to fall, it is stated, although not officially.

SETTLERS MUST PAY THEIR REPRESENTATIVES

IF the water users have a representative on the supervising board for revaluation of the government irrigation projects, he must either serve without pay or be compensated by the settlers. At least such was the recent announcement of a member of the Reclamation Commission in a letter concerning a prominent water user, who was suggested by a western senator as the third member of this all important board. The water user promptly volunteered to do this work, despite the great sacrifices on his part, which it would necessitate in giving up his time without any compensation, because he felt the settlers should have representation on the board. His name, it is understood, has now been submitted to Secretary of the Interior Lane. Whether Mr. Lane will see fit to name this water user or some other settler is a question still unanswered.

It was announced recently that practically all Secretary Lane's pronouncements concerning the proposed revaluations were more or less unofficial and therefore subject to change. It was hinted that because of objections and suggestions by the settlers, different plans for the revaluations might be adopted.

It has also been announced that the water user member of each local revaluation board must be paid by the settlers, if he is paid at all. The other two members will be government payroll men and

will draw at least their regular salaries and suitable expense money.

The cost revision plan continues to meet with opposition on various projects. A letter from the Salt River project in Arizona says:

"After Secretary Lane announced his plan of revising the cost of the projects, the farmers held meetings in most of the school districts and passed resolutions urging the officials of the Water Users' Association to turn down Secretary Lane's plan. The Associated Land Owners were organized for the purpose of protecting the rights of the water users. Despite all the protests, our Board of Governors, which is controlled by the large land owners and is nothing more than a tail to the Reclamation Service, voted to accept Mr. Lane's plan. The farmers consider Secretary Lane's plan unfair, because he chooses five to one on the boards, which are made up of Reclamation Service men, who will naturally uphold the Service expenditures."

"I. D. O'Donnell and Gen. Wm. R. Marshall, on the final board of review, have already expressed themselves on the cost of the projects.

"Carl Hayden, our Congressman, was the first to defend Secretary Lane's plan. About the only excuse he gave was that he knew Secretary Lane would be fair, notwithstanding the fact that Secre-

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U. S. COURT SUSTAINS THE WATER USERS

Federal Project Settlers Win Most Notable Victory; Get Court Rights.

WATER USERS on the Federal irrigation projects are American citizens. They have rights—just like any other citizens.

The Reclamation Service is amenable to the courts if it does illegal acts or seeks to injure a settler.

The acts and decisions of the Secretary of the Interior are not final—like those of the Czar of Russia.

The contract between the government and a Water Users' Association is binding and entitled to respect, no matter how displeasing such contract may be to a bureaucracy that is trying to cover up mistakes, costing \$40,000,-000 or more, by assessing new charges upon the settlers on the projects.

These points and a number of others are made by Judge Sanborn of the United States circuit court of appeals in an opinion, just handed down, in which he refuses to order the district court to vacate an injunction restraining officers of the Reclamation Service from cutting off water of settlers who refused to pay excessive operation and maintenance charges, or evicting them from their homesteads.

The opinion is the most remarkable victory ever won by the water users. It promises to prove of tremendous value not only to the settlers on the Belle Fourche (S. D.) project, whose Water Users' Association brought the suit, but to settlers on every other Federal irrigation project.

The suit is being prosecuted by O. E. Farnham, secretary of the National Federation of Water Users' Associations and secretary and attorney of the Belle Fourche association. He was assisted by Chambers Kellar and James G. Stanley of Lead, S. D. R. P. Stewart, United States district attorney for South Dakota, and Ethelbert Ward and A. R. Honnold, special counsel of the Reclamation Service, represented the Service.

Here are the big law points which Judge Sanborn makes in his opinion:

A corporation with which, as the representative of its shareholders who are parties accepted by the United States as holders of water rights in a project under the Reclamation Act of June 17, 1902, 32 Stat. Chap. 1093, page 388, the United States makes a contract for the benefit of such shareholders relative to the supply of water to and the dues to be paid by the shareholders, and which covenants in the contract to collect dues for the United States and guarantees the payment thereof, is a proper party plaintiff in a suit to enjoin officers of the United States from collecting unlawful charges from the shareholders, turning the water

from their lands, and cancelling their water rights and homestead rights because they fail to pay such charges.

The decisions of officers of an executive department of the United States of questions of law are not conclusive upon the courts.

The questions whether or not the charges alleged to be illegal and the acts and threatened acts of executive officers to deprive the shareholders of a Water Users' association of water and to cancel their water rights and homestead rights for failure to pay such charges, are questions of law which a court of equity is empowered to determine in a suit of such an association against such executive officers, although the Secretary of the Interior or other executive officers have already decided them.

A suit against executive officers of the United States to enjoin them from committing acts unauthorized by or in violation of law to the irreparable injury of the property rights of the plaintiff is not a suit against the United States, nor is it or the injunction sought objectionable, either on the ground that they interfere with the property or the possession of the property of the United States, or on the ground that they compel specific performance of its contracts.

Judge Sanborn's opinion, which every water user should study carefully, follows in full:

The appellant, Frank C. Magruder, is the manager of the Belle Fourche project, and the appellant, R. F. Walter, was the project engineer and is the supervising engineer. They were defendants below, and the plaintiff was the Belle Fourche Valley Water Users' Association, a corporation organized under the laws of South Dakota to represent and act for the holders of water rights in the project, to collect the lawful dues from them and to guarantee the payment of these dues. The Belle Fourche project is a project for the storage of water and the irrigation of land under the Reclamation Act of June 17, 1902, and the acts amendatory thereof. (32 Stat. Chap. 1093, page 388.) This is an appeal from an order refusing to set aside a restraining order and granting an interlocutory injunction against the defendants forbidding them to exact from holders of water rights in the project charges alleged to be illegal and from depriving them of the use of the water, of their rights to the water and of their rights to their land because they failed to pay such charges.

The appellants assail the order on three grounds—that the association is not a proper party plaintiff, that the court below had no power to



O. E. Farnham, secretary of the National Federation of Water Users' Associations and attorney for the Belle Fourche (S. D.) Water Users' Association, who has just won a most remarkable victory for settlers on the Federal irrigation projects.

grant any relief upon the facts stated in the complaint, and that on the evidence the order was erroneous. Counsel for the appellants argue that the association was not a proper party plaintiff because it had no interest in the suit and was not one of a numerous class having a common interest in the subject of the suit within the meaning of Rule 38 in Equity. But Rule 37 in Equity provides that a party with whom and in whose name a contract has been made for the benefit of another may sue in his own name without joining that other. On October 25, 1905, the United States made a contract with this association for the benefit of those who held or should thereafter hold water rights under the Belle Fourche project to the effect, among other things, that only those who were or should become shareholders of the association should be accepted as entrymen of homesteads on the public domain included within the project, or as applicants for rights to the use of water provided for irrigation thereunder, that the payment for water rights to be issued to the shareholders of the association should be divided into not less than ten equal payments, the first whereof should be payable at the time of the completion of the proposed works, or within a reasonable time thereafter, that the cost thereof should be apportioned equally per acre among those acquiring such rights, that the association would collect and pay to the United States and did guarantee the payment of that part of the costs of the works that should be apportioned to each of its shareholders and that parties otherwise eligible might, on the designation of the Secretary of the Interior, become members of the association. In the rules and regulations promulgated by the Secretary through the Director of the United States Reclamation Service we read, "The execution of the contract between the Water Users' association and the Secretary of the Interior may be regarded as the completion of the organization of the Water Users' association. . . . The execution of this contract formally fixes the relation of the association to the government as the representative of the water users as a medium of communication between the water users and the government." It is to prevent the violation of the law applicable to the construction and execution of the foregoing contract and the alleged irreparable injury to the shareholders of the plaintiff and to the plaintiff that may result from such violation that this suit was instituted. The contract was made in the name of the corporation for the benefit of its shareholders, who number about six hundred, and the association was clearly the proper party plaintiff under Rule 37 in Equity, and also because as contractor to collect and as guarantor of the payment of the lawful charges against its shareholders for the cost of the works and the use of the water and as the holder of the first lien upon the property of these shareholders under the laws of South Dakota, 1909, page 155, upon their water rights respectively, for the repayment of their deferred payments which it should pay, it had a vital interest in preventing the levy or collection of unlawful charges against them, or their deprivation of their water rights or their property because they failed to pay such charges.

Did the amended complaint state facts sufficient to invoke the jurisdiction and power of a court of equity to grant relief? In the discussion of this question the allegations of the complaint must be taken to be true. Material averments of the complaint were that these were the facts: The shareholders of the plaintiff had applied for water and had been accepted as water users under the Reclamation Act, the contract of October 25, 1905, and written applications in accordance with its terms. They were either the owners of lands whose title had been vested in them or homesteaders upon public lands irrigable under the project and the owners of water rights for use upon such lands. The project was conceived prior to 1905 and since that time the government has been constructing, but has never completed the works. The contract of 1905 provided that the payments for the water rights to be issued to the shareholders should be divided into not less than ten equal payments, the first of which should be payable at the time of the completion of the works or within a reasonable time thereafter. Before these works were completed and for each of the years 1908, 1909, and 1910, the defendants demanded of the shareholders payment of an installment of \$3.00 per acre of their alleged irrigable land on account of the construction of the works and the payment of 40 cents per acre of such land on account of the operation and maintenance of the works and before the works were completed for each of the years 1910 and 1911 they demanded the payment of \$3.00 per acre of their irrigable land for construction and 60 cents per acre of such land for operation and maintenance. The lands of the shareholders on account of which these payments were demanded amounted to about 12,000 acres for the year 1908; about 12,000 acres for the year 1909, about 35,000 acres for the year 1910, and about 47,000 acres thereafter. Notwithstanding the demand of these charges, water sufficient to irrigate these lands was not furnished in 1908, 1909, 1910, or 1911. The shareholders occupied these lands, prepared them for crops and seeded them, but the crops generally failed from lack of water and the shareholders generally lost much of their labor and expense. The defendants demanded of the shareholders 60 cents per acre of their irrigable land for operation and maintenance for the year 1913. This charge was made up in part of charges for services and other expenses not incurred or made in connection with the Belle Fourche project. Many thousands of dollars had been charged against the shareholders on account of the salaries of a large and expensive administration force annually as a part of these operation and maintenance charges. The defendants were attempting to collect of the shareholders as a part of these operation and maintenance charges about \$78,000 as betterments which were and are in reality a part of the expense of construction and are included within the \$3.00 per annum per acre for the ten years amounting to \$30.00 per acre, to which amount many of the shareholders by their accepted applications limited their liability for the construction of the works. During these years many of the shareholders paid some of the foregoing charges although they deemed them illegal

because only by such payments could they get water from the project and they paid each year to get sufficient water to enable them to raise crops. But in the year 1913 many of them had become financially exhausted by repeatedly preparing their land for crops which failed for lack of water and by their payment to the United States of some of the charges which have been described and yet many of the charges remained unpaid. Thereupon after they had prepared their lands for the crop of 1913 and after the water had been turned on to the lands and the crops were growing the defendants threatened and were about to turn the water from the lands of these shareholders unless they paid the operation and maintenance charges for 1913, and the defendants further threatened and were about to recommend for cancellation and to cause the cancellation of the homestead entries and the water rights of the

shareholders who had not paid all the charges against them because they had failed to do so. The turning of the water from the lands would have ruined the crops of 1913. The cancellation of the homestead entries and the water rights of the shareholders would have driven

them with their few domestic animals away from their homes. The relief sought was an injunction against the turning of the water from the lands, against collection of the charges for construction before the completion of the works, against the collection as operation and maintenance charges of expenses for betterments, against the collection of operation and maintenance charges for the year 1913, and against the cancellation of the homestead entries and water rights of the shareholders because these various charges have not been paid.

Counsel for the appellants argue that this suit should be dismissed and the injunction should be dissolved because the facts which have been recited present no cause of action for any relief in equity. Let us see. The complaint is that the defendants without authority of and in violation of law demand of the holders of water rights charges for construction that are not due, charges for operation and maintenance composed in part of items for betterments and in part of items for expenses not made in connection with the Belle Fourche project for which they are not legally liable and that the defendants are about to deprive the shareholders of the use of the water and of their water rights and homestead rights because they do not pay these charges. There can be no doubt that these acts and threatened acts of the defendants are and will be

not only unauthorized by but contrary to law. But counsel contend, nevertheless, that these facts give a court of equity no jurisdiction to grant relief to the shareholders or the plaintiff because the Secretary of the Interior had and exercised the discretion to determine that all these charges and acts were lawful. But the rights to the homesteads and to the water rights of the shareholders were substantial, valuable and against all, but the Congress of the United States, vested rights. Counsel cites authorities to the effect that the United States may withdraw lands subject to homestead and pre-emption at any time before patent. But that power, whatever its extent, is vested in the Congress of the United States alone, not in the executive officers of the United States. The former may under some circumstances make laws to withdraw such lands from pre-emption or homestead although

pre-emption or homestead rights have been initiated. But the officers of the executive department of the government may not. They are subject, not superior, to existing laws and they may not lawfully destroy or unjustly affect the water rights, or homestead rights, or other valuable rights of this

nature in violation or disregard of the laws of the land. *Hemmer vs. United States*, 204 Fed. 898, 904, and cases cited.

It is a question of law whether the proposed destruction of the homestead rights and water rights of the shareholders and the refusal to permit them to use the waters of the project because they do not pay the charges alleged to be illegal is or is not authorized by law. And a decision of a question of law by the officers of the executive department is never conclusive upon the courts. *Wisconsin Central R. R. Co. vs. Forsythe*, 159 U. S. 46, 61; *United States vs. Grand Rapids & I. R. Co.*, 154 Fed. 131, 136; *Northern Pacific R. Co. v. Sanders*, 47 Fed. 604, 609-612.

It is the function and duty of the officers of the judicial department of the United States, a function and duty which they may not renounce, to exercise their own independent judgments in the determination of the questions whether or not acts of executive officers are authorized by law even though such officers have already decided the questions. *Deming v. McClaughry*, 113 Fed. 639, 640, 641, 51 C. C. A. 349, 350, 351; *Hartman v. Warren*, 76 Fed. 157, 162, 22 C. C. A. 30, 36; *Webster v. Luther*, 163 U. S. 331, 342; *United States v. Tanner*, 147 U. S., 661, 663; *Merritt v. Cameron*, 137 U. S. 542; *United States v. Graham*, 110 U. S. 219; *Swift Company v. United States*, 105 U. S. 691. The facts stated in



Filling a metal silo with kafir. Courtesy of the Santa Fe Railway.

the amended complaint were ample to invoke the jurisdiction of the court below to determine the question whether or not the defendants were authorized by law to collect the charges it was alleged they demanded and whether or not they were authorized by law to destroy the water rights and homestead rights for the failure of their owners to pay these charges.

Another objection to the complaint is that it evidences a cause of action against the United States. This contention is presented in numerous forms, such as that the defendants are the officers of the United States, and their acts are the acts of the United States, that an injunction against their acts would constitute an interference with the use and possession of the property of the United States, the water of its reservoir, and would compel specific performance of its contracts. If the acts of the defendants done and threatened were authorized by law they might be the acts of the United States against which a court of equity would grant no relief. But if the averments of the complaint are true, and in deciding the question now under consideration they must be assumed to be so, these acts are unauthorized by and contrary to law. They are, therefore, not the acts of the United States and a suit to enjoin their performance is not a suit against the United States, or a suit to interfere with its property, or a suit to compel specific performance of its contracts. It is a suit to enjoin officers of the United States from unlawfully interfering with and diverting its water from those persons lawfully receiving and entitled to receive it, from unlawfully preventing the United States from discharging its duties and performing its contracts to the irreparable injury of the plaintiff and its shareholders. That an executive officer is committing or about to commit acts unauthorized by or in violation of law to the irreparable injury of the property rights of the plaintiff is a good cause of action against such officer for injunctive relief. A suit against him for such a cause is neither a suit against the United States nor is it or the injunction against such acts of the officer objectionable either on the ground that it interferes with the property of the United States, or its possession, or compels the specific performance of its contracts by the latter. *American School of Magnetic Healing v. Mc-Annulty*, 187 U. S. 94, 110, 111; *Philadelphia Co. v. Stimson*, 223 U. S. 605, 619, 620; *Garfield v. Goldsby*, 211 U. S. 249, 261; *Pennoyer v. McConaughy*, 140 U. S. 10, 12, 17; *Baker v. Swigart*, 196 Fed. 569, 571; 199 Fed. 865, 866; *Swigart v. Baker*, 229 U. S. 187, 192; *United States v. Cantrell*, 176 Fed. 949, 954.

The only other objections to the complaint are that it fails to show that the plaintiff or its shareholders will suffer irreparable injury from the unauthorized and illegal acts of the defendants and that it does disclose the fact that they have an adequate remedy at law. The remedy at law which counsel assert the plaintiff and its shareholders have consists of actions at law against the United States for the damages they have sustained by their deprivation of water and by the cancellation of the water rights and homestead rights of the shareholders because they failed to pay the illegal

charges. But the remedy at law which precludes relief in equity must be as prompt, efficient, and adequate as the remedy in equity. To determine the amounts of the unauthorized charges for operation and maintenance may and probably will require the examination of the accounts of the receipts and disbursements on account of the entire project. To determine the amounts, if any, owing by the shareholders may and probably will require the examination of the accounts between each of the complaining shareholders and the project. The consideration and settlement of issues dependent upon the taking of accounts composed of many items is one of the great heads of equity jurisprudence and the probable necessity for such an accounting is in itself sufficient to sustain the jurisdiction of this suit by a court of chancery. *Castle Creek Water Co. v. City of Aspen*, 146 Fed. 8, 13, 14, 76 C. C. A. 516, 521, 522. Nor is the remedy of an action, or several actions at law for damages that will be sustained by the infliction of the wrongs alleged on account of the collection of the unlawful charges, or the destruction of the homestead rights and water rights for a failure to pay them as prompt, or as efficient, or as adequate, as the prevention by this suit in equity of the collection of the unjust charges and the enforcement of the illegal forfeitures, and the adjudication in this single suit of the legal rights and duties of all the parties and all the shareholders by a court of equity which, with its power to apply to the questions at issue the learning and experience of its chancellor and of a trained accountant as a master, is so much better equipped than a jury to find and render a just decree upon such issues. The plaintiff and the shareholders have no adequate remedy at law for the wrongs charged in this complaint.

Do the averments of the complaint set forth facts which show an imminent danger of irreparable injury to the plaintiff and its shareholders from the acts of the defendants? Those averments disclose these facts: The shareholders of the plaintiff are farmers each with a small number of domestic animals, with modest homes and limited means trying to cultivate arid lands which they have been induced to occupy by the representations of the defendants that they would be supplied with water from the project to raise crops upon these lands. The United States made a contract with the plaintiff and with many of these shareholders, with all of them who applied for water rights before 1911, that water would be supplied to them in consideration of their agreements to pay for the construction of the works after their completion, and to pay their just share of necessary operation and maintenance charges. The defendants have demanded and collected construction charges not due, operation and maintenance charges unnecessary and unauthorized, and have failed to furnish the requisite water to enable these farmers to raise crops for several years until some of them are financially exhausted and cannot pay many of the charges, and for their failure so to do the defendants threaten to deprive them of the use of the water and to take steps to destroy their water rights and their homestead rights. The plaintiff, the associa-

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TAMING THE GREAT FREE BOOTER OF THE WEST

A Remarkable Discussion of the Silt Problem of the Colorado River

By F. C. FINKLE, CONSULTING ENGINEER, LOS ANGELES, CAL.

Mem. Amer. Soc. M. E., Assoc. Mem. Amer. Inst. C. E., Mem. Amer. Waterworks Assn.

THE Colorado river is by far the most important stream in the Western part of the United States. Without making comparison in detail with any of the other large rivers in the West, suffice it to say, that everything considered, including climate and soil conditions of the area which may be irrigated from this river, its value is very much greater than that of any other Western stream.

The Colorado river has a drainage area above Yuma of approximately 225,000 square miles, which lies in seven states. Its principal tributaries are the Green, Grand and Gila rivers.

The amount of water supplied by the Colorado river has been gauged at Yuma, Ariz., since the year 1894, and in round numbers the mean annual discharge at this point is equal to about 10,000,000 acre feet, sufficient water to cover 10,000,000 acres to a depth of one foot.

It is only within the last 20 years that the real value of the Colorado river has become known to the world. Previously, irrigation was practiced to a greater, or lesser, extent from its tributaries in Colorado, Utah and other states, drained by the upper tributaries of the river.

It is only since the discovery was made that the great Imperial Valley in California could be irrigated by the waters of the Colorado river that its real value has become apparent. Investigations looking to possibilities of irrigating Imperial Valley were commenced as early as the year 1891.

I began at that time conducting an investigation of the lower Colorado river. Surveys to determine the feasibility of diverting the Colorado river were made, and reports were prepared, giving an approximate idea of what might be accomplished.

It was not until the year 1899 that sufficient financial aid was secured to begin actual work on the undertaking. It has, however, been done by entirely new people, the first promoters having become discouraged during the world-wide financial panic of 1893.

In order to understand the situation on the lower



A section of the Newcomb flume on the Huntley Federal project in Montana. Courtesy Klauder Mfg. Co.

Colorado, it is necessary to draw a word picture of the Imperial Valley and its relation to the river. The greater part of the Imperial Valley is situated at a considerable elevation below sea level. The lowest point is in the Salton Sink, now known as Lake Imperial, which is 287 feet below sea level.

The greater part of the Valley in the United States varies from sea level down to the elevation of Lake Imperial. In Mexico it rises to 24 feet above sea level at Volcano lake. There are other tracts of desert land outside of Imperial Valley proper, lying in the United States, and situated at elevations ranging from sea level to 100 feet above, or slightly more.

The present intake of the main canal leading to Imperial Valley is a little more than 100 feet above sea level, but the topography is such that diversions from it within the United States are not practicable until a point near sea level is reached.

It is interesting to consider historically the formation of the present topography in the Imperial Valley and along the lower Colorado river.

Where the river at present enters Volcano Lake through the channel of Bee river, the elevation is 30 to 35 feet above sea level. The regular channel of the stream, which has not been occupied by water below the inlet to Bee river since the year 1911, passes over a delta entering the upper end of the Gulf of Lower California. At the present time the flow passes through Bee river into Volcano Lake and thence through Hardy's Colorado into the Gulf of California.

Before the existence of the Imperial Valley the Colorado river entered the Gulf of Lower California at a point several hundred miles south from its upper end, near the vicinity of Hanlon's Heading, where the intake of the present irrigation system is located. The silt carried by the water of the stream formed a delta encroaching laterally, and further and further into the Gulf, until it finally formed a dam entirely across the Gulf, along that portion of it lying immediately south of the International boundary line between the United States and Mexico.

After the delta or dam had separated the gulf into two parts, one an inland sea, lying in that portion of the United States now Imperial Valley, there is no doubt that the stream continued to shift alternately into the ocean and alternately into this inland sea. During this period of time the silt deposits made the fertile soil, which now comprises the Imperial Valley.

It is probable that shortly before the dawn of civilization in the West the Colorado River assumed its present channel, leading to the Gulf of Lower California. There was then considerable elevated land, lying between Imperial Valley and the Gulf and extending in the direction of Volcano Lake. Evidences are conclusive to show that the stream has maintained this course with but slight interruption during the last 100 years. During this time there have been some diversions of the river into the inland sea, but these were not sufficient to maintain it. The inland sea disappeared through evaporation, except a small part fed by some of the channels of the Alamo river, Bee river, etc., leading in that direction.

The water cut off from the gulf, having evaporated, has left the large areas, known as Imperial Valley, forming a basin below sea level, with only a small lake in the deepest impression. When first viewed by the people of California and Mexico, it was so found and this is the condition in which it was more than 20 years ago, when the first plans for its reclamation were given consideration.

It is therefore safe to state, that the creation of the valley is due to the silt carried by the water of the river, and we shall further see that this silt has played, and still continues to play, an important part in the irrigation projects of the valley. It will also become apparent that the importance of the silt problem has never been fully understood and, with all the progress made during the last 15 years in dealing with the subject, its importance is nevertheless underestimated.

The first diversion was made into a channel of the Alamo river, which terminated in Imperial Valley, and thus afforded an easy method for conveying the water to a point where it is diverted out of the Alamo at Sharp's Heading for distribution in the Imperial Valley.

In the earlier plan for the utilization of the Colorado in Imperial Valley the writer suggested its diversion into Bee river and Volcano Lake, and thence to be distributed by canals over the Imperial Valley. This plan had the disadvantage of locating the intake, as well as the entire main canal system, in Mexico. But it possessed the advantage of having a settling basin in Volcano Lake, where the troublesome part of the

silt could be eliminated from the water before turning it into the distributing canals.

The Alamo river, which was finally utilized as a main canal by the promoters of the irrigation system, who were not at that time informed as to the other plan, has its intake in the United States, close to the International boundary line, and passes entirely through Mexican territory on its way to Imperial Valley.

The diversion of the Colorado into the Alamo, which since then has become the main irrigation canal, soon began to develop difficulties on account of the presence of silt. Before proceeding with the discussion of these difficulties, and the manner in which they were overcome, a brief statement as to the condition of the Colorado river water with reference to silt will not be out of place.

The appearance of the water is a dark red to brown, due to the character of the silt. From this it

has taken its name, the Spanish word *Colorado*, meaning red. The Arizona experiment station on the lower Colorado has investigated the amount of silt carried by the stream and in this way has determined that it delivers on the average from 35,000 to 40,000 acre feet of silt per annum.

The amount of silt carried varies greatly at

different times, being highest when the river is in flood, and may be roughly stated to range between 80 to 3,500 parts per 100,000 parts of water by weight, or from the one-thirtieth to the twelve-hundredth part of volume of water by weight. On an average it is fair to say that the Colorado river carries from nine to ten tons of silt in each acre foot of water.

In accordance with the well known law governing the transporting power of water, the volume of silt carried depends on the velocity of the stream. Under variable conditions as to the velocity it soon became apparent that irrigating canals would at times accumulate silt, as it is impossible to construct them on a sufficiently steep grade, with safety to the banks, to insure the carrying of all of the silt delivered, when the Colorado river is at its flood stage.

Whenever the water assumes a velocity in the canals less than in the river, the lessening of the transporting power induces the deposition of silt. These difficulties soon became apparent in the Alamo river, used as the main canal. The deposits first occurred in the upper reaches of the main canal, until the level was raised to such an extent, that diversions into it from the stream were no longer possible.

It must here be remembered, that the Colorado is a navigable stream as far as the Potholes above Yuma



Weir on New Hamakua Ditch at Kukuihaele, Hawaii.

and that no dam, for diverting its water at the head of the Imperial Canal is permitted by the War Department of the United States, which has charge of the navigable rivers. Without such a dam the silt in the canal soon made it impossible to divert water, except during high stages of the river.

The first canal intake had to be abandoned, and a new cut leading into the Alamo below the point, where the deposit of silt was deep, had to be made. But the second intake soon shared the fate of the first, and had to be abandoned for a third one. This third intake was constructed without any safe headgate to regulate the water, and in 1905 it washed out, until the whole Colorado river passed through it into the main canal, finding its way into Lake Imperial through the Alamo river and New river. This disastrous overflow of the valley required two years to curb at a cost of many millions of dollars, with large incidental losses, which facts have been inadequately described in the engineering publications, and about which engineers have read more or less.

After the break was closed, a concrete headgate was constructed at the present site of the intake, and with certain changes this improvement has continued in use up to the present time. However, the silt difficulty was not remedied by the present concrete headgate, as this only served to give better control of the amount of water diverted, when the Colorado river was high. The silt still continued to settle in the intake and in the canals. The Imperial Valley experienced a water shortage, due to the fact that, as soon as the Colorado reached a certain level, sufficient water would no longer flow into the intake of the canal.

Losses in crops amounting to hundreds of thousands of dollars resulted in the years 1908, 1909 and 1910, during which time the level of the main canal was gradually rising, on account of the silt deposited. The canal was so wide, that it could not be cleaned out by means of ordinary appliances, as in the case of small irrigation canals and ditches. Those in charge were unable to devise any method by which to remove the silt, and on account of this and other difficulties, the company became bankrupt, and was placed in the hands of a court receiver.

The culmination came in 1910, when less than one-fourth of the needed amount of water could be diverted during the month of July. The receiver of the company secured permission from the War Department to construct a pile trestle in the Colorado above the intake, for the purpose of forcing water into and through the canal.



An artesian well used for irrigation near Alamosa, Colo. Courtesy Denver & Rio Grande Railway.

This was done at heavy cost, by driving piles and dumping large rocks into the bottom of the river above the trestle. Thus temporary relief was obtained during the latter part of 1910. The receiver of the company assumed that it would be necessary to repeat this operation each year, which would incur an expense far beyond the receipts obtained from the sale of water at 50 cents per acre foot

delivered.

Thereupon an order from the court to increase the rate 60 per cent was sought by the receiver. This was contested by the consumers under the water system in a court action, on the ground that this method of operating would not be successful, as the deposits of silt would still continue to increase, until the channel and intake would be completely filled.

During the trial of the case this was demonstrated to the court, and another method, for ridding the intake and canal of silt, was submitted for the consideration of the court by the representatives of the water consumers. Before the conclusion of the trial, however, the receiver of the company became convinced that this method should be tried, and a compromise resulted, which permitted the water rate to remain at the old rate of 50 cents per acre foot, while the new method was being tried.

The writer represented the water consumers as expert in these proceedings and discussions, and was selected to design the equipment planned for the purpose of handling the silt. This plan was merely the operation of suction dredges in the canal, whenever necessary to pump the silt out to maintain the proper level of the main canal. The case was compromised and the suction dredge Imperial was constructed and placed in operation in the spring of 1911.

The result was to quickly eliminate the silt, which had accumulated in the canal, and an abundant supply of water was delivered during the entire year of 1911. The dredge Imperial, after being constructed for the water consumers, was first turned over to the receiver and placed in operation on April 23, 1911, and from that time to June, 1911, it pumped out a total of 122,105 cubic yards of solid material from the canal, lifting it to a height of 35 feet at a cost of 4.8 cents per cubic yard.

By this time the water in the river had receded, but the silt had been removed sufficiently to assure all the water needed and, after the removal of more than 500,000 cubic yards during the summer of 1911, the intake and canal had been restored to their proper width and original level and grade.

Subsequently another small dredge was con-

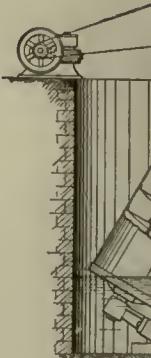
You Can't Keep a

Grimes Irrigation Pump Factory No. 2

The Site Has Been Selected, All Details Have Been Completed, and Construction Starts at Once on a \$10,000 Plant at LOVELAND, COLO., for the Manufacture of the GRIMES Irrigation Pump.

This Loveland Factory Will Supply the Demand of the Northern Colorado Field and Will be Kept Busy for Some Time on Orders Already in Hand.

Heretofore This Particular Field and the Entire Western Territory Have Been Supplied From Denver.



THE GRIMES IRRIGA

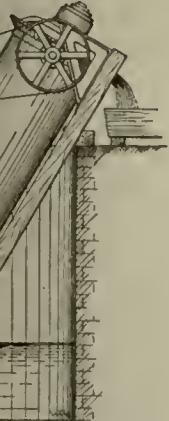
1022 First National Bank Building,

Good Pump Down!

How's That for a Pump
Only 8 Months Old?

The GRIMES Pump Was Not Placed on the Market Until March of This Year. This No. 2 Factory Shows the Prompt Recognition of GRIMES Merits and Superiorities.

The Rapidly Growing Demand Which Requires Such an Early Increase of Our Output Facilities for Only a Limited Section Simply Emphasizes the Truth of all That We Have Ever Said About This Practical, Economical and Ever-Reliable Implement of Present-Day Irrigation Farming.



ON PUMP COMPANY

DENVER, COLORADO

THE IRRIGATION AGE.

structed by the receiver, known as the Dredge El Centro. This was placed between the concrete gate and the river to remove deposits and bars forming above the headgate. Ever since 1910 these dredges have been operated in the main canal and records show that, during the year 1913, 903,000 cubic yards of silt were pumped from the main canal by means of these two dredges.

This solved the silt question, as far as the main canal and intake were concerned, but trouble was experienced in the smaller lateral canals, which had to be kept open at great expense. The solution of this was finally worked out by the use of small dredges operated from the bank to clean these smaller canals.

The smaller dredges are of two kinds, known as the Stockton and Austin Dredges. They are run on planks laid along the banks of the canals, and move forward as the dredges work down stream. They deposit the material excavated on the opposite bank by means of dipper excavators or endless elevators. Both types of dredges have done the work successfully, but at a slightly different cost.

Imperial Water Company No. 1, which irrigates more than 100,000 acres, is the largest sub-company, which takes water from the main canal in the capacity of consumer. There are also many smaller companies taking water for an area aggregating approximately two and one-half times as much as the territory irrigated by Imperial Water Company No. 1. Even with this, not much more than one-half of the irrigable area in Imperial valley is at present under cultivation, as there are approximately 500,000 acres in the United States, which will ultimately be irrigated from the Colorado river in the Imperial Valley.

So far as the silt question in the main and lateral canals of the Imperial Valley are concerned, it may be stated, that these methods have satisfactorily solved it, and it is now possible to operate the system economically and without interruption in service. Since all the dredges work while water is flowing through the conduits, the serving of water continues, while the canals are cleaned, and the remaining portion of the silt carried by the water is deposited on the land. This amount is variable, depending upon the extent to which the velocity in the canal is decreased before the water is delivered to the land.

Ordinarily it may be said that, if the mean velocity of the water flowing in the canals is three feet per second, or more, no appreciable amount of silt is deposited. But

it is impossible to maintain this velocity, owing to the varying demands for water, and the necessity for checking the flow, in order to make deliveries. This is given as a good average, but the growing and irrigation season in Imperial Valley continues throughout the whole year, which makes a great deal of difference, because the silt content of the Colorado river varies in different months.

The injury from silt in the irrigation system has been neutralized by dredging, which has been carried on at a much lower cost than was originally expected. Now remains the problem of overcoming the deposits of silt in the river channel itself, which are likely to occur to such an extent, that it will again overflow into Lake Imperial.

The bed of the river below Hanlon's Heading, where the water is diverted for Imperial Valley, varies greatly in width and the velocity at various points shows wide fluctuations. Under these conditions silt is continuously deposited, and the tendency of the flow is to shift away from points in the channel, which have thus been raised by silting.

The Reclamation Service has done much in recent years to maintain the channel as uniform as possible, but being interested in the Arizona side, on which the Yuma project is located, this made it natural for them to do more for the purpose of preventing the river from making incursions into Arizona than into California. However, the work of the Reclamation Service on the Arizona side has been of a very beneficial character.

The receiver of the California Development Company, bankrupt owner of the Imperial Valley water system, has devoted much of his energy and resources to protecting Imperial Valley since the closing of the break in 1907. The resources and facilities, however, have been insufficient to properly handle the situation, and in 1910 the Colorado river left its channel, going into Bee river, and has since flowed continuously into Volcano Lake.

After filling Volcano Lake to the level of the outlet into Hardy's Colorado, the water flowed through this ancient channel into the Gulf of Lower California.

Volcano Lake is situated at the terminus of Bee river, one of the former channels of the Colorado. It is a large extent of flat country made by deposits of silt in a portion of the former gulf to its present level of approximately 25 feet above sea level. This lake has two outlets, one being New river flowing into Imperial Valley and terminating in Lake Imperial and the other being Hardy's Colorado, flowing in an opposite direction in-



Preparing rice field for cultivation in Hawaii.

to the Gulf of Lower California. The occupants of the Imperial Valley now interested in irrigation, have erected a levee along the north line of Volcano Lake to prevent its water from entering the Imperial basin through New river.

It is evident, that as soon as the Colorado began to flow into Volcano Lake, the decrease of velocity in the Lake caused silt to settle rapidly, and this has continued from 1910 to the present time. This process, if not interferred with, will eventually raise the level of Volcano Lake, so that water cannot be confined in it by means of levees.

After this has occurred, the question as to where the water will break out is one, on which opinions may differ, but it may be conservatively stated, that it is just as likely to break over into Imperial Valley as in any other direction.

When the Colorado began to flow through Bee river in 1910, apprehension was justly felt by settlers in Imperial Valley. The cause of this change of channel was the raising of the Colorado river bed, below Bee river, through deposits of silt. This situation was deemed very serious and too complex for the interests of Imperial Valley to handle alone, and the government of the United States interested itself to the extent of approximately \$1,000,000 appropriated for turning the Colorado back into its own channel, by closing the inlet of Bee river. This work was begun in the early part of 1911, and continued throughout the greater part of the year, without success.

Much controversy has existed as to why the government and its engineers failed to successfully re-divert the Colorado from Bee river into its own channel. The various discussions of this have heretofore ignored the main points involved. The attempt was made to turn the water back by means of levees, and this method was not open to criticism, but there are two elements, which must have been overlooked.

The first one of these was the fact that the channel of the river below the break was heavily silted. The writer, who was at that time consulting engineer for the Mutual Water Companies in Imperial Valley, controlled by the consumers of water, and not by the receiver of the California Development Co., gave careful consideration to and examined the channel after the attempt to close the break had failed.

Observations showed that the bed of the Colorado river had been raised by silt, partly produced before the break, by reason of the wide stream below that point, partly during the period of changing into Bee river, on account of the diminishing flow causing a lower velocity in that part of the Colorado and partly after the bed had become dry, causing vegetation to spring up and the wind to carry sand and dust, which lodged against the growth of vegetation.

No measurements were taken to determine how much to lower the Colorado river channel at this point, before the levee across the upper end of Bee river was begun. Neither was the levee located as close to the inlet of Bee river, as would have been possible, but was placed a considerable distance down stream, which made it necessary to build higher, than if it had been placed at the very outlet of the Colorado river into Bee river.

The failure to close the break does not demonstrate that the attempt would not have been successful had the matters here referred to been investigated, and the work ordered accordingly. There is no doubt that

the failure to close the break was due to the excessive pressure, on account of the high level to which the water had to be raised against the trestle and rock dam across Bee river. Had the required height been only a few feet less there is no doubt that the attempt would have been a complete success. But there is a limit to the pressure of silt which a pile trestle and rock dam on Colorado river will stand, and the limit was but slightly exceeded.

If a large dredge had been operated in the main channel of the Colorado river below the break both before and during the installation of the pile and rock dam in Bee river, the height to which the water must be raised would have been diminished and the closure would have been effected.

Careful computations show that locating the dam higher up Bee river, and doing the necessary dredging at that time, would have decreased the height to which the water would have to be raised, where the pile trestle and rock dam was placed, by not less than four feet, and possibly as much as five feet. There is no doubt that the difference would have been sufficient to keep the pressure on the rock fill within safe limits, so that it would have been successful and permanent.

Since 1911 no further attempt has been made to restore the Colorado to its own channel and the whole stream has ever since been flowing through the Bee river into Volcano Lake. The increase of elevation in Volcano Lake, from the silt settling within it, has already caused trouble, and in the spring of 1914 the Volcano Lake levee broke, sending a large volume of water into Imperial Valley. This overflow only affected a section of country in Mexico, as it entered the channel of New river before reaching the United States.

Nevertheless, it caused considerable apprehension on account of the volume of water in New River, which threatened to undermine the irrigation flumes and bridges across that stream. Immediate alarm was caused by this break and all interested began to assist in the repair of the Volcano Lake levee to prevent the water from flowing north into Imperial Valley. This work was successfully done, and the river is at present kept under control in Volcano Lake, and flows through Hardy's Colorado into the Gulf of Lower California.

The real problem being confronted, however, is to give recognition to the fact that, unless something of a permanent nature is undertaken, the area covered by Volcano Lake will soon be raised so high that no levee will confine the water along the north and keep it from entering Imperial Valley. While there is no cause for immediate alarm, as it is still possible to raise the levees higher by properly extending them, yet it is better to take the matter up and provide a plan to avoid any further catastrophe, than to wait until something occurs to equal the overflow which occurred from 1905 to 1907.

Just what the details of such plans are to be it is impossible to announce without a further study of the situation, but enough is known to assert that it will have to be both dredging and building of dikes.

It is not even certain that at this time it will be best to have the river returned to its original channel below the inlet of Bee river. It has flowed for nearly five years through Bee river into Volcano Lake, during

(Continued on page 91)

UNEMPLOYED TO BUILD 1,000,000 ACRE PROJECT

TO provide work for the unemployed and to develop resources of the state, the California conservation commission has begun a reconnaissance of three million acres of land along the Colorado river, now held by the federal government in San Bernardino, Riverside and Imperial counties.

The reconnaissance is to be completed before the coming legislature shall have adjourned and a report to the legislature will be made. Roughly speaking, the land extends southward some 80 miles from a point north of Needles in a strip about 47 miles wide along the Colorado river.

Under the Carey Act, the state may take up 1,000,000 acres of this land. The plan is to construct an irri-

Southern California's Increase in Irrigable Lands in Past Two Years

THE following table gives an idea of the vast amount of good lands that still await reclamation in Southern California and the progress that has been made in reclaiming and irrigating these lands. The increase in irrigation acreage during the past two years is as follows:

	Increased Total Acreage Acres 1915 Irrigated
Santa Barbara and Ventura	7,000 56,656
Los Angeles and San Gabriel River.....	10,000 177,656
Santa Ana River.....	12,000 225,407
San Diego County.....	5,000 24,880
Colorado Desert and River.	60,000 339,600
Mojave Desert	10,000 25,489
	<hr/> <hr/>
	104,000 849,486

It is estimated that during the past two years 70,000 acres have been irrigated at a cost of \$15 per acre and 34,000 acres at a cost of about \$100 per acre, making a total expenditure for irrigation of \$4,450,000.

The total amount of agricultural land in Southern California is estimated at 6,070,325 acres and the estimated area that ultimately will be irrigated is 1,949,600.

gation system for the reclamation of the land with the labor of the unemployed. Those who refuse work and wages on the reclamation project are to be treated as vagrants and sent to the rock pile.

After the development work has been done the land will be opened to settlers on time payments.

In order to baffle speculators who might attempt to profit by filing on the land in question, the commission will request the government to withdraw 1,000,000 acres immediately.

Although the district will be dependent for its supply on the Colorado river, there will be no conflict with the Imperial Valley system, which draws from the same source.

U. S. COURT SUSTAINS WATSON CULVERT PATENT

MANUFACTURERS of corrugated culverts in the United States, operating under the Watson patent, have just been informed by their attorney, Wallace R. Lane of Chicago, that the United States Court of Appeals for the second circuit, having final jurisdiction, has just handed down a mandate reversing the lower court and holding the Watson corrugated culvert patent valid and infringed by a culvert installed by county commissioners in New York.

The suit over the infringement of the Watson patent has been a historic controversy, very remarkable in patent litigation, and of keen interest to all those who have any direct or indirect connection with United States patents. It has been before the courts for many years and the advantage has seemed to be first with one side and then with the other. This decision of the United States Circuit Court of Appeals is a final outcome. Circumstances are such that no appeal can be taken.

The decision says in part:

"The Watson patent has been so thoroughly discussed in the opinions of the District Court and of this court that it will serve no useful purpose to repeat in detail what is there said regarding the patent and the disclosures of the prior art. The

patent is for a corrugated metal culvert. It is unusually plain and simple.

"In brief the claim is for a sheet metal culvert composed of connected cylindrical sections having circumferential corrugations extending to the extremities of the sections. Each section terminates, at one end in a flared, and at the other end in a contracted portion of a corrugation, so that two sections may interlock, the ends being held in place by bolts or similar means. The corrugations greatly strengthen the culvert and the doubling of the corrugations at the joints braces and adds stability in the structure.

"In short, the patented culvert is cheap, strong, durable, easily transported, quickly laid down and easily repaired.

"We cannot believe that the man who gave such a structure to the world should be denied the title of an inventor.

"The fact that Watson, during the early years of his patent was almost invariably repulsed by those interested in the art because they thought his device empirical, inefficient and perishable, is persuasive to the conclusion that his improvement was not obvious.

"In view of the phenomenal success of the

patented pipe after the public became aware of its advantages and the strength and durability which it has developed after years of trial, we are of the opinion that any doubt as to patentability should be received in favor of the patent.

"The practical and commercial success of the Watson culvert is so clearly shown that we find it difficult to believe that a mere mechanic could have produced a culvert which has so revolutionized the art—a culvert which has shown a durability which no one at the time of the invention thought possible.

"We have here not only the circumstances that the new device has commended itself to the public and gone into extensive use. This sometimes happens because of judicious advertising and clever business methods.

"The early history of the patentee's experience is illuminative. For years after the issue of the patent he labored unsuccessfully to introduce his culvert. The persons whom he urged to try his device, persons engaged in road building and underdraining, declined to do so because it seemed to

them very doubtful whether it would endure, and opposition was overcome only after he had actually built a few culverts and demonstrated their capacity to remain efficient after years of use. This circumstance indicates that simple though it is, the Watson culvert is a device which would not have suggested itself to the ordinary road-builders.

"Infringement is clearly shown, the two structures are almost identical and the only differences are of form and not of substance. The defendant passes the rivets through the metal at a point farther from the ends of the section by less than an inch than in the complainant's structure. The difference is trivial and nothing functional is accomplished thereby.

"The decree is reversed with costs and the cause is remanded to the District Court with instructions to enter a decree for the complainant in the usual form."

The manufacturers of corrugated culverts under the Watson patent make them out of Armco American Ingot Iron.

URGES U. S. GUARANTEE OF RECLAMATION BONDS

SENATOR WESLEY L. JONES, of Washington, has introduced a Reclamation District bill (S. 6827) in Congress. The measure, which may prove of vast importance to the West, as well as to the whole nation, was discussed recently by Senator Jones as follows:

"This bill is a proposition looking to the reclamation of arid, semi-arid, swamp and overflow lands by district organizations formed under state laws. In brief, it provides for the guarantee by the United States of the interest upon bonds issued by such districts. These bonds are to run for a period not exceeding forty years and bearing interest at not exceeding 4 per cent. The government is given ample security for repayment on account of any interest it may have to advance under its guarantee. There are millions of acres of unproductive but most fertile swamp and desert lands in the United States.

"If these lands are to be reclaimed it will have to be done under some method other than through the Reclamation Act. The money available for the reclamation fund, which cannot be used for swamp reclamation, from the receipts of public lands, is decreasing. It is not enough now to take care of the projects under way, and it will be years before they are completed unless some other means are provided, and there is no prospect for the taking up of new projects out of this fund. It will be difficult to get additional appropriations through congress for this purpose.

"The experience of private capital has been so disastrous in connection with irrigation development that not much can be expected from this source under present conditions.

"In our state of Washington and probably throughout the country generally, future reclamation development must come through large projects requiring in the aggregate the expenditure of

vast sums of money before any return may be expected. The Palouse project will require from \$5,000,000 to \$10,000,000. The Horse Heaven project from \$20,000,000 to \$30,000,000 and the Quincy project from \$40,000,000 to \$50,000,000. All these are in the state of Washington. Such sums cannot be hoped for from Congress, and the lands under these proposed projects and the various other proposed projects throughout the country must lie idle and waste or some other means of reclamation be provided.

"When the war in Europe is over, if not before, money will be available for this work if a reasonable return can be assured. There will be thousands of industrious people seeking homes and these lands are about the only ones that can be made available. We should prepare to take advantage of the situation that is bound to exist. This is the time to do it. We should not wait until the actual emergency actually arises, but should prepare now to meet it when it comes.

"This bill is a suggestion to work upon. With long time and a low rate of interest farmers and settlers can take these lands when water is available, build up homes, meet their payments and prosper. With a reasonable return guaranteed capital will come forward and be invested. This plan will relieve the treasury and insure capital a reasonable return, give settlers long time and a low rate of interest, put the projects under the supervision of the Secretary of the Interior and make the Reclamation Service a consulting and advising body, place the local management and control in the hands of the local people, make the United States liable only for the interest and give it ample security.

"L. M. Rice and Judge Carroll B. Graves of Seattle have prepared this bill and to them is due the credit for whatever merit there may be in it."

MAKE YOUR ORCHARD A GAME BIRD PRESERVE

FRANKLIN A. DE VOS, editor of the Omak (Wash.) Chronicle, in the Yakima country, is a friend of the birds. And after investigation he has found the friendship of the birds is something worth having, particularly if one owns an orchard.

"The local project a wild bird game preserve! How would that strike you, Mr. Orchardist?" says Mr. De Vos in a recent issue of his paper.

"Have you ever taken the trouble to investigate the true value of having a domesticated flock of game birds living in your orchard? Leave out the beauty and novelty of the situation, which are both fine, and get the facts about the dollars and cents value of these little wild friends of yours.

"You will never find a more careful or steady fruit tree inspector than a bunch of quail, prairie chickens or pheasants will prove to be. They are the natural enemy of all the bug and worm pests your trees are heir to, and it is their business to get all of them because it is a large part of their living. They are on the job about fourteen hours a

day and would cost you but a few cents apiece each year.

"This may sound fishy to some folks, but we know of a fourteen-acre bearing orchard in the northern part of this county that has really never been given a thorough spraying in its life because the owner has been a friend of an ever increasing flock of wild birds. This man could easily figure up in dollars and cents a magnificent profit for these little feathered friends of his. Fruit tree inspectors say that this orchard is one of the best and cleanest in the county and the owner has a standing offer to eat, worm and all, any worm infested apple that can be found on the ranch. He sold nearly three carloads of fruit this year and has eaten nothing but good fruit so far.

"Who will agitate this preserve idea and help to get the birds to making their homes in local orchards? Get a flock of tree inspectors of your own and see that they are cared for and protected anyhow."

WIPES OUT STATE LINES IN WATER RIGHTS

STATE boundaries have no bearings on water rights and the state has no special claim on the water of the rivers which spring up within its boundaries, according to a decision rendered recently by United States District Judge R. E. Lewis in Denver. The decision involves practically all irrigation projects in Colorado and has a wide bearing on similar cases in all other irrigation states.

The decision was given in the case of the Pioneer Irrigation Company of Nebraska against John E. Field, state engineer, his assistants and all users of water from the Republican river in Colorado.

The plaintiffs claim priorities on the river antedating many of those held by Colorado irrigators, who have been taking water from the stream before it passes out of the state.

The court decreed that the Colorado users must leave twenty-nine feet of water in the river where it crosses into Nebraska.

"Should the Supreme court of the United States uphold this decision," Attorney General Farrar, of Colorado, who has been active in the case, said, "it will mean a loss of millions of dollars to Colorado and the suspension of more than half of the larger irrigation projects of the state."

The Colorado officials and Charles L. Allen, attorney for the water users, contend not only that they had the right to all the water they could take out of the stream in their own state, but that, because of the inevitable seepage and return flow of the water used, the same amount would go farther and could be used over and over again, if it was taken out nearer the head of the stream, than if allowed to run over into Nebraska across the arid territory, where much of it would be lost by evaporation or be wasted through being unused.

The question is specially vital to Colorado, according to Farrar, because all of her streams flow over into adjoining states.

On its final settlement will depend the fate of many irrigation enterprises on the Arkansas, the Platte, the Laramie, the Grand, the Rio Grande and the Las Animas rivers.

REVALUATION OF PROJECTS

(Continued from page 72)

tary Lane's order, appearing in the September number of the Reclamation Record, said that the Board of Review would definitely and finally decide the cost of all the projects.

"Will R. King, attorney for the Reclamation Commission, visited the project. He also held that Secretary Lane would be fair. A public meeting was called to meet Mr. King. His attention was called to the fact that the order said that Secretary Lane had delegated the power to the Board of Review to definitely and finally decide the cost of all the projects.

"Mr. King replied that this was a mistake, and should have read: 'Secretary Lane will definitely and finally decide the cost of all the projects.' Also, Mr. King's attention was brought to the fact that Secretary Lane's public notice, recently sent out, did not apply to this project. The question was asked him if that was a fact. He stated that it was. The question was asked him why he did not recall those notices. He said he would. As usual with the Reclamation Service, it is a case of back up when they see that they are caught. No doubt the intention was to catch as many sleeping as they could."

BUNTON JOINS GOULDS CO.

F. L. Bunton, who for the past two and one-half years has been manager of the Chicago office of the Heine Boiler Company has severed his connections with that company to become Manager of the Chicago Office of The Goulds Manufacturing Company, 3801-3811 S. Ashland avenue, Chicago, Ill., manufacturers of pumps and hydraulic machinery.

Previous to his connection with the Heine Boiler Company Mr. Bunton was for eight years, manager of the Philadelphia and St. Louis offices of the Allis-Chalmers Company.

He is a member of the American Society of Mechanical Engineers and is well known in the machinery and allied trades.

The Goulds Company also announces the opening of a new office in Atlanta, Ga. This office will be located in the Third National Bank Building and will be in charge of O. B. Tanner, district manager.

NEW HESS BOOK INTERESTING

The new illustrated book and catalogue of the Hess Flume Company, 2166 15th street, Denver, Colorado, will prove a valuable addition to the library of hydraulic engineers. The forty pages are filled with data that the engineers require for ready reference. Hess Smooth Interior Flumes are given a prominent place in the book with illustrations of a few of their many novel and large installations. Tables of velocity and discharge, Church's graph for $n=011$ (printed by courtesy of John Wiley and

Sons, Inc., New York), and the latest and most economical designs of sub-structure, wood and steel, side hill constructions, and ditch lining, show that the publishers had the interests of the engineers in mind while preparing the copy.

Price lists and tables are given for their other products, including water meters, head gates, reservoir gates, corrugated culverts, riveted steel pipe, gate valves, watering troughs and metal garages.

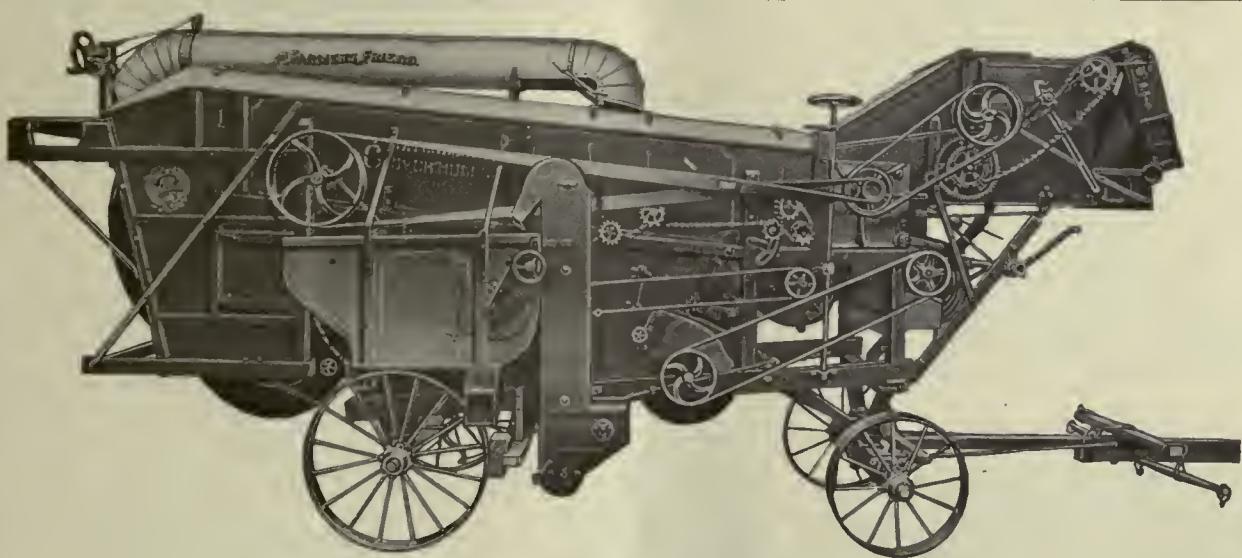
The book also contains full description, explanation and illustrations of the Hanna Self-Registering Water Meter, for measurement of water in open channels. This device will prove of great interest to engineers of mining, power and irrigation systems.

IRRIGATION CONGRESS TO TRAVEL

A travelling meeting of the International Irrigation Congress, covering some of the most interesting cities and districts in California, is being arranged for next year.

The plans call for a one day session of the congress in Sacramento on a Monday some time in September, 1915, followed by a three days' trip to towns up the Sacramento valley, concluding on Wednesday night with a visit to the state farm at Davis.

Thursday the congress will proceed to Fresno, where it will split into two parties, covering Hanford, Visalia, Merced, Turlock, Modesto and Manteca. Friday the congress will reassemble in Stockton and the next day go to San Francisco.



HULL YOUR SEED QUICKLY, PERFECTLY and ECONOMICALLY With a
"MATCHLESS" CLOVER and ALFALFA HULLER

That's just what you will do if you use a "Matchless" Huller on the job. It's the one huller that will hull all the Clover or Alfalfa you can get to it without sacrificing the quality of the work. Here's the reason! We use square steel brads in our hulling cylinder. This construction has every advantage over rasps of spikes, because no set of spikes will knock the seed out of the damp pods. Rasps gum up and are easily destroyed. Our system of separation is unique and effective. This consists of a series of rotating troughs with perforation in the bottom, with provision for adjustment to meet the various conditions of clover. The Patented Steel Scrapers attached to the bottom of these troughs thoroughly scrape the separator bottom and insure a steady and positive delivery of the pods to the hulling cylinder, regardless of the condition of the clover. This construction enables you to hull seed under conditions in which no other huller can operate; enables you to hull earlier in the morning and later in the evening than with any other--this insures a longer day, thus increasing your earning power. Give us an opportunity to prove to you right on your own farm that the "Matchless" is the speediest and cleanest huller on the market. WRITE FOR CATALOG TODAY, or call at our nearest Branch House.

THE AULTMAN & TAYLOR MACHINERY COMPANY, MANSFIELD, OHIO.

Sole Builders of Aultman-Taylor "Starved Rooster" Line of Machinery.

BRANCHES: Minneapolis, Minn.; Portland, Ore.; Lincoln, Nehr.; Kansas City, Mo.; Wichita, Kan.; Decatur, Ill.; Indianapolis, Ind.

VICTORY FOR SETTLERS

(Continued from page 76)

tion, has guaranteed the payment of the legal charges against its shareholders and has a lien on their rights for such charges that it pays and it depends upon assessments on its shareholders to maintain itself and discharge its duties. The injury to these farmers by their threatened loss of their rights to the water and the land by turning them and their families with a few domestic animals from their homes and their hopes of a comfortable living therein, may not be measured by the few dollars in damages they might recover after the delay and expense of trials by jury to recover the salable value of their rights to the land and the water which have been depreciated and are being constantly depreciated in value by the alleged acts of the defendants, nor could the damage to the association be fairly measured or recovered by such actions at law. The irreparable injury to the plaintiff and the shareholders by the acts of the defendants is fairly shown by the allegations in the amended complaint and that complaint presents facts sufficient to state a good cause of action and to invoke the established power of a court of chancery to grant equitable relief. The suit may not be lawfully dismissed on account of the insufficiency of the complaint.

In the consideration of the questions thus far discussed the presumption has necessarily been indulged that the averments of facts in the amended complaint are true. But counsel for the defendants contend that they are not true and that the evidence before the court below at the time the injunction was granted established this fact so clearly that the court below ought to have dissolved the restraining order and to have denied the injunction. The restraining order was made by the state court on July 19, 1913. On August 6, 1913, after the removal of the case to the court below, the defendants gave notice of a motion to dismiss the suit and to dissolve the order which was heard on August 28, 1913, and resulted in an order that the plaintiff might file an amended complaint and the defendants might renew their motion. On October 8, 1913, the amended complaint was filed. Thereupon the defendants renewed their motion and

the plaintiff made a motion for an additional restraining order. These motions were heard on the complaint, the affidavits presented by the respective parties and the arguments of counsel for three days commencing about November 30, 1913, and then the court granted the order for the injunction which is challenged by this appeal. The complaint was verified on information and belief by the secretary of the association and by one hundred and twenty-four of its shareholders. It was supported by thirty-seven other affidavits. In opposition to this evidence the defendants produced the affidavits of the defendants Magruder and Walter. About forty exhibits, consisting of the contracts between the United States, and the plaintiff, the articles of incorporation of the plaintiff, the forms of the applications used by the shareholders, the circulars and notices respecting the project issued by the Secretary of the Interior and his subordinates were also introduced in evidence. When the case was heard below the defendants had not answered the complaint so that as a pleading its allegations stood admitted. The defendants, Magruder and Walter, however, in their affidavits denied all the averments of material facts in the complaint

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ine burns
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above the ground under a storm-proof covering that enables you to use the Tent-Cot every night in the year, and all the doors and windows are fitted with both storm and mosquito curtains that can be raised and lowered at will of the occupant. For anyone afflicted with lung trouble there is nothing equals the Tent-Cot. It also has a splendid appearance and can be set up on your porch, lawn or roof and taken down when not in use. Can be set up in a space 30x78 inches and only requires about 30 seconds to operate. It is ideal for hunters, fishers and campers as it eliminates all the annoyance of "making camp." With a Tent-Cot you carry your camp with you under your arm and sleep safe and sound any place.

SPECIFICATIONS—Length of cot open, 6 ft. 6 in.; width of cot, one person, 28 in.; width of cot, two persons, 44 in.; height of bed from ground, 17 in.; height of tent over cot, 32 in.; size of cot folded, for 1 person, 28x36; size of cot folded, for 2 persons, 44x36; weight, 1 person, 29 lbs.; weight, 2 persons, 44 lbs.; frame is of hard maple, painted green; covering is of heavy waterproof canvas in colors, tan or olive green.

PRICE—Tent-Cot 28 in. wide, open 1 side, \$9.00; Tent-Cot 28 in. wide, open 2 sides, \$9.50; Tent-Cot 44 in. wide, open 2 sides, \$11.50.

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which tended to show illegal charges, demands, or threats by them, or any of the defendants, except the allegations of the demand for the payment of construction charges prior to the completion of the project from those who applied for water rights prior to January 24, 1911. They asserted in their affidavits that these shareholders had, by a contract they made through the association with the United States, on that date and by their subsequent action, estopped themselves from relying on the contract of October 25, 1905, and their applications regarding this matter. The defendants Magruder and Walter testified that no illegal or excessive charges for operation and maintenance had ever been demanded either on account of expenses not necessary or relevant to the operation of the Belle Fourche project, or on account of betterments. They denied threats of cancellation of water or homestead rights on account of failure to pay such charges. In addition to the averments of the amended complaint the plaintiff produced the affidavit of its secretary that the defendant Magruder had been violating the restraining order by giving notices to shareholders dated October 25, 1913, that they would suffer the penalty of one cent per acre per month for the unpaid operation and maintenance charge for one year after July 21, 1913, of two cents per acre per month for two years of such unpaid charges, three cents per acre per month for three years of such unpaid charges, and so on, that in compliance with a request for an itemized statement of the expenditures to be charged against the project the defendants furnished one in December, 1911, or January, 1912,

which contained an item of \$78,000 for betterments, and that the plaintiff had been furnished with statements of expenses incurred in detached offices not connected with the project. The plaintiff insisted that the provision of the contract of January 24, 1911, between the plaintiff and the United States, which provided for a modification of the stipulation of the contract of October 25, 1905, to the effect that the charges for construction should fall due after the completion of the contract upon which provision the defendants relied in part for the estoppel they claimed, was unauthorized by the shareholders and produced a copy of the resolution of the shareholders on which the contract of January 24, 1911, was founded, which seems to give no such authority.

From this brief statement of the course of this suit and of the evidence before the court below it appears that the order for the injunction was not made hastily, but after elaborate argument and deliberate consideration, that there had been no answer made to the complaint, that there were many issues of fact involved and their decision was conditioned by conflicting testimony. The discussion which appears in the earlier part of this opinion and the legal questions suggested by the evidence leave no doubt that the questions of law to be ultimately determined in this suit are grave and difficult and the situation of the parties disclosed by the complaint and the affidavits was such that it might well have appeared to the court below that the injury of the plaintiff and its shareholders would be certain, great, and irreparable if the injunction should

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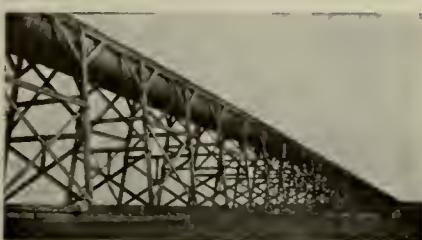


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not be issued, while the inconvenience and loss to the defendants would be inconsiderable if the injunction was granted. Now the question in this court is not whether or not it would have issued or would issue the injunction upon the evidence before it. The granting or dissolution of an interlocutory injunction rests in the sound judicial discretion of the court of original jurisdiction, and when that court has not departed from the rules and principles of equity, established for its guidance, its orders in this regard may not be reversed by the appellate court without clear proof that it abused its discretion. It is to the discretion of the trial court, not to that of the appellate court, that the law has entrusted the power to grant or dissolve such an injunction, and the question here is, Does the proof clearly establish an abuse of that discretion by the court below? American Grain Separator Co. v. Twin City Separator Co., 202 Fed. 202, 206, 120 C. C. A. 644, 648, and cases there cited.

The controlling reason for the existence of the right to issue an interlocutory injunction is that the court may thereby prevent such a change of the conditions and relations of persons and property during the litigation as may result in irremediable injury to some of the parties before these claims can be investigated and adjudicated. A preliminary injunction maintaining the existing situation may properly issue whenever the questions of law and fact to be ultimately determined in the suit are grave and difficult and injury to the moving party will be certain, great and irreparable if the motion is denied, while the loss and inconvenience to the

opposing party will be inconsiderable and may well be indemnified by a proper bond if the injunction is issued. City of Newton v. Levis, 79 Fed. 715, 718, 25 C. C. A. 161, 164; Love v. Atchison, T. & S. F. Ry. Co., 185 Fed. 321, 332, 107 C. C. A. 403, 414; King Lumber Co. v. Benton, 186 Fed. 458, 459, 108 C. C. A. 436, 437; Carpenter v. Knollwood Cemetery, 188 Fed. 856, 857; Henry Gas Co. v. United States, 191 Fed. 132, 136, 111 C. C. A. 612, 616.

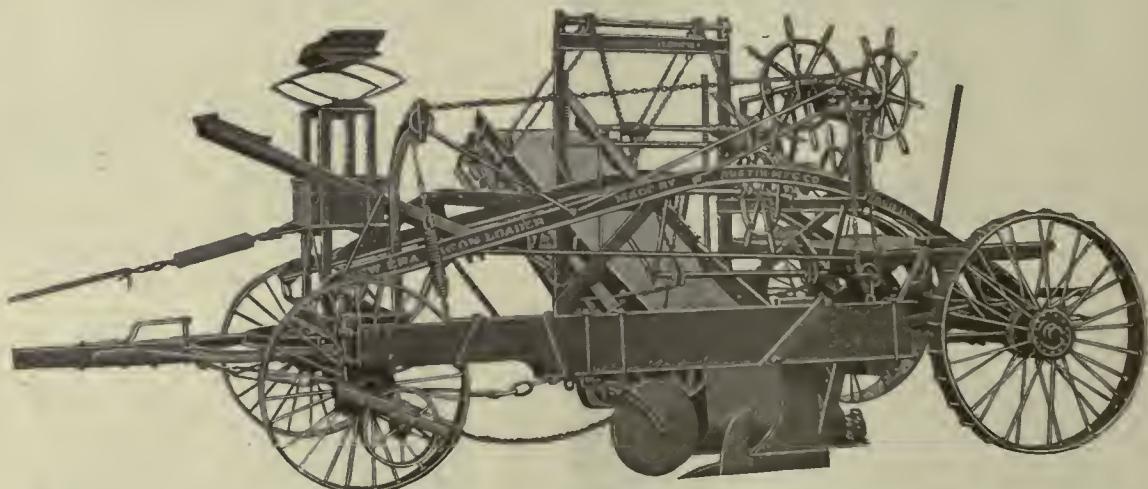
A careful reading and thoughtful consideration of the amended complaint, of each of the affidavits and exhibits in the light of these established principles of equity, have convinced that there is no such proof in this case of an abuse of discretion by the court below by its issue of the injunction as would warrant a reversal of its order. The order from which the appeal was taken must accordingly be affirmed.

And it is so ordered.

BENSON HEADS IRRIGATION BODY

E. F. Benson, of Tacoma, was re-elected president of the Washington Irrigation Institute at the recent meeting in North Yakima. Other officers are Robert Insinger, Spokane; Marvin Chase, Seattle, vice-presidents; O. L. Waller, Pullman, and H. M. Gilbert, North Yakima, trustees, three-year term. Roy Warnick, of North Yakima, was re-elected secretary-treasurer by the executive committee. The institute will meet in North Yakima next year.

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Write for fully descriptive catalogue showing machines adapted to all kinds of special work

TAMING THE GREAT FREE BOOTER

(Continued from page 83)

which time much silt has been deposited in various places, and the conditions have been changed to such an extent that the plan, which was feasible in 1911, may be well nigh impossible at this time. As to this, an opinion cannot be expressed without careful consideration of the whole situation. As such a study will require considerable field work and time it should be undertaken speedily to avoid the dangers of delay.

The writer has had sufficient experience with the Colorado river and the problems resulting from it, to feel certain that the question can be solved so as to render the Imperial Valley permanently safe against future overflow. Further, it is certain that the cost will not be unreasonable, much less prohibitive, if the work be properly planned and carried out under competent advice and supervision.

In view of this knowledge of the situation, it can be asserted that the Colorado river silt will eventually become a blessing instead of a menace to the Imperial Valley. It is a blessing because annual fertilization of the land irrigated by the water from the Colorado river will always preserve its fertility, in fact make it perpetually as good as virgin soil.

No plan for dredging to handle the silt will ever remove so much of it from the water that it will be insufficient to reach the land for enriching the soil. Thus Imperial Valley may be likened to the Valley of the Nile, whose overflow annually restores the land and for which reason it may be so intensively cultivated.

Some idea of what the Imperial Valley may eventually become, can be obtained by comparing it with

the Valley of the Nile in Egypt, for, if anything, Imperial Valley has the advantage and will be able to produce more and support a larger population in proportion to area than the Valley of the Nile.

Before this becomes a reality, however, the silt troubles of the Colorado must be understood and corrected so that silt will no longer settle and be able to remain in places tending to deflect the stream into the Imperial Valley, which, as we have already seen, lies below sea level.

The problem is a large one and must be met with complete co-operation on the part of all concerned, including those interested in and residing in the Imperial Valley, by the State of California and by the United States.

KLAUER CATALOGUE VALUABLE

The new flume catalogue of the Klauer Manufacturing Company is a well gotten up document. Not only does it contain a lot of information valuable to engineers and irrigators concerning Klauer flumes, but it also provides a lot of instructive matter on hydraulics. This is arranged so simply that any one can understand it. The booklet contains "hydraulic measures" and rules for computing flume capacity. There are also valuable figures on wood structures for carrying flumes.

Editor of THE IRRIGATION AGE:

I am very much pleased with THE AGE and the Primer which I have received, and don't intend to be without THE AGE from now on.

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Saves You Money the Year 'Round

THAT sounds good, doesn't it? Well, that's just what an AULTMAN-TAYLOR GAS TRACTOR will do for you right on your own farm. It has done it for thousands of other good, hustling farmers and it will do it for you. It will save you money plowing and do a better job than is possible with horses. It will save you money harrowing, discing, harvesting, threshing, seeding,

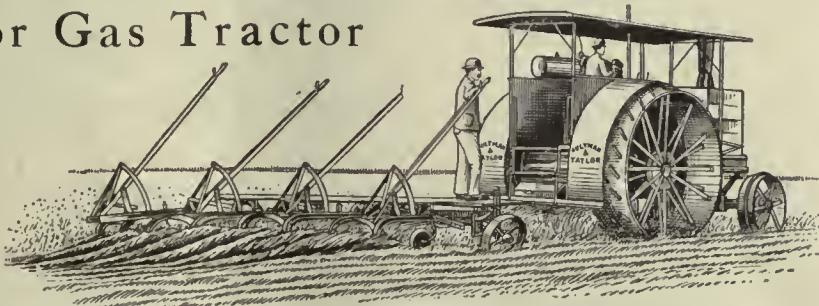
Aultman-Taylor Gas Tractor

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and then you can farm better, cheaper, and with more satisfaction. You can get your seed bed ready when the ground is in prime condition. You can sow when conditions are just right, and you can gather your crops when they should be gathered. All this, and lots more can be done quicker, cheaper and better than you can do it with horses. You'll be astonished at what can be accomplished with this great tractor. No other tractor can give you such wonderful results—such entire satisfaction, for the simple reason that the Aultman-Taylor Gas Tractor is particularly adapted to the power needs of the farm—built for this particular work at no spared pains or expense. It's the tractor that makes good everywhere at all kinds of work. The Aultman-Taylor burns either gasoline or kerosene under all loads. Go see this great tractor work. There's

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BRIEF NOTES FROM IRRIGATION PROJECTS

California

A bid of \$530,010 for the \$585,000 worth of bonds unsold from the recent issue of \$610,000 by the Modesto irrigation district of California has been accepted by the directors of the district. The bid was submitted by E. H. Rollins & Sons of San Francisco. The price accepted is 90.6 cents on the dollar, which the directors considered advantageous, in view of the condition of the money market at this time. Payments, according to the bid, will be made as follows: February 15, 1915, \$50,000, and \$50,000 on the 15th of each month for the six months following. This issue of bonds, amounting to \$610,000, was voted by the irrigators less than a year ago, the money being necessary for the permanent improvement of the upper works of the system.

Rapid progress is being made in the \$250,000 irrigation district project around Meridian, Cal. The foundation for the pumping plant is finished and the pumps will soon be installed. Three pumps, one 15-inch, one 30 and one forty, will be used. Two motors, one of 250-horsepower and the other of 300-horsepower, will operate the pumps. They will send water through more than forty miles of ditches. When the project is completed it will mean that one of the largest areas in northern Sutter county will be opened to cultivation. The climate has always been favorable, but the land, owing to its location, has always been either flooded with water or too dry.

A project is under way to bring a very large part of the land in Honey Lake valley of California under irrigation. The main canal will start from near Susanville, will be six miles in length and will cost about \$75,000. There will be sixty miles of laterals to serve consumers.

H. H. Henderson, engineer in chief for the Anderson-Cottonwood irrigation district around Anderson, Cal., has submitted his general report to the board of directors. The district, he finds, includes 32,000 acres of land. His estimate of cost, which includes all the preliminary expenses, the cost of rights of way and the best type of construction, is \$350,000.

Work is progressing on the improvement of a 480-acre tract of land at Rameriz, Cal. The first twelve wells have just been completed at a depth of sixty-five feet. The wells will range in depth from sixty to eighty feet and will be equipped with electrically-driven newest type pumping plants. The water supply, which is derived from the underground flow of the Yuba and Feather rivers, is practically inexhaustible. The lift is less than fifteen feet, which insures water at a minimum pumping cost.

A convention of the Irrigation Districts' Association of California recently adopted a resolution favoring legislation that will prevent the exclusion of lands from irrigation districts on the ground that such lands are not available for agricultural purposes. This action was taken as a result of suits now pending whereby the Southern Pacific Company is attempting to have its rights of way excluded from the Oakdale and South San Joaquin districts.

A syndicate of Boston capitalists has begun development work on an irrigation system for an 8000-acre tract lying north of Montague, Cal. The land will be subdivided into farms, ranging from forty to sixty acres in size, and sold to settlers. Two other projects, involving 28,000 acres,

are under way in Shasta valley, and plans are being made for the appropriation of 35,000 inches of water from available sources for the irrigation of an immense tract in the southern part of the valley. Water for irrigation purposes is available from Shasta river, Little Shasta creek and Willow creek.

Receiver E. C. Phoenix of the American River Irrigation Company of California is considering applying to the state railroad commission for permission to raise its irrigation rates which at present are \$3 to \$4 per acre. The present rates are said to be insufficient to assure profitable operation of the system.

Colusa, Cal., advises report that R. E. Blevins, J. F. Mallon and Will Har-

Pumping 24 hours a day for weeks at a time

is the service this Fairbanks-Morse Oil Engine gives in an Arkansas rice field during irrigation season. Such reliability is necessary to protect your irrigated crops. A Fairbanks-Morse Engine is real crop insurance.



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You can now get one of these splendid money-making, labor-saving machines on a plan whereby it will earn its own cost and more before you pay. You won't feel the cost at all.

\$24 BUYS THE NEW BUTTERFLY

No. 2 Junior—a light running, easy cleaning, close skimming, durable lifetime guaranteed separator. Skims $\frac{9}{16}$ quarts per hour. We also make four other sizes up to our big 600 lb. capacity machine shown here—all sold at similar low prices and on our liberal terms of only \$2 down and a year to pay.

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Over 20,000
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ian have made a deal with the California-Idaho Land Company, an adjunct of the Sacramento Valley Irrigation Company, to give Colusa county the largest rice field in the West. The deal, which has been pending for some time, covers 4,000 acres, eight miles northwest of Colusa.

Planning to irrigate by gravity a large section of hitherto uncultivated land, the Mount Signal Water Company soon will begin construction on a new canal system around Dixieland, Cal. Surveys for the new system already have been made and canal lines adopted. Dixieland, which is on the main line of the San Diego & Arizona railway, is in the heart of the section which will be opened up by the new system.

Miller & Lux holdings in Kings and Kern counties, California, as well as tracts of the Carmel Cattle Company, owned by Miller & Lux, are to be reclaimed after half a century of use as range lands. Thousands of fertile acres in the Hanford and Coalinga districts and in Kern county will be irrigated, developed and placed on the market by the Kern Valley Reclamation Company, capitalized at \$340,-881.60, fully paid in. It is stated that the new company expects to develop water over the entire tract, large storage reservoirs are to be built, distribution systems constructed and the entire holding, aggregating 30,000 acres, will be placed under water and made productive. Directors of the company are J. L. Nickel of San Francisco, P. H. Clarke of Los Angeles, W. L. Mitchell of Alameda, David Brown of Alameda and C. Z. Merritt of Oakland.

Pumping plants to irrigate 15,000 acres west and southwest of Chico, Cal., will be installed on the banks of the Sacramento river on the big Phelan ranch, two miles west of Chico. D. J. Murphy, superintendent of the ranch, has announced the rice growing experiment on forty acres of the ranch a success and says that the proposed pumping plant will irrigate considerable more than the 3,000 acres which Phelan will plant to rice next year.

There is a new irrigation project under way near Susanville, Cal., that will cost approximately \$75,000. The headworks of the new system will be the dam just south of Susanville. The water will be carried in a main canal as far south as Jolinstionville. The main canal will be about six miles in length and there will be approximately sixty miles of laterals. The preliminary surveys have been made and contracts representing several thousand acres of land have been signed. It is expected that the system will be supplying a goodly portion of the land by early spring.

Scott McArthur is the leading spirit in the enterprise.

A. L. Colton, who owns the greater part of Castile canyon, near San Jacinto, Cal., has spent considerable money and time on improving his

ranch. He recently completed a fine irrigation system, having laid 2,000 feet of cement pipe over the orchards. Besides this there is considerable distance where a cement ditch is laid.

Utah

State Engineer W. D. Beers of Utah is urging the appointment of a commission composed of representatives from varied interests and professions

which have to deal with water in its manifold uses, to study conditions and make recommendations to the incoming legislature. He says titles to land at present are reasonably secure, but titles to water are indefinite and insecure.

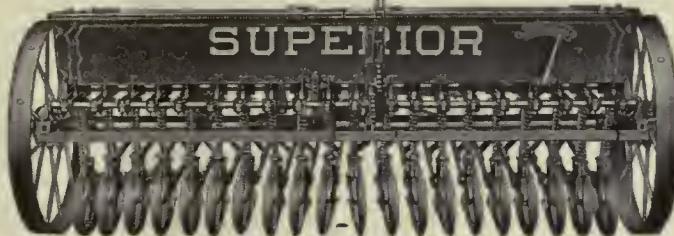
Farmers around Lewiston, Utah, are planning the installation of a pumping plant to lift water from the Bear river. The irrigation system will

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This statement has been made by many recognized Alfalfa experts—men who know what they are talking about.

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THE SUPERIOR 20 X 4 SPECIAL ALFALFA AND GRASS SEED DRILL

There are 20 discs on this machine set 4 inches apart. The construction is such that all the seed is sown at an even depth, and an equal amount of seed in every furrow.

None of the seed is wasted, when drilled in the ground with a Superior Alfalfa and Grass Seed Drill

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Saves More Than Two Dollars an Acre on Seed Alone

Send for Superior Alfalfa Drill folder and read the strong warranty

Go to your local dealer and ask to see the Superior Special Alfalfa and Grass Seed Drill. If he will not supply your needs, we will.

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FREE—A copy of "Boyd's Farmers' Alfalfa Guide," price 10c, will be mailed free to any reader of Irrigation Age who will write for the book and mention Irrigation Age.

cost between \$50,000 and \$100,000. The stock will be subscribed by the farmers.

Texas

Farmers around Denna, Tex., have voted to organize an irrigation district embracing 40,000 acres.

Terms for the purchase of the San Benito canal system by an irrigation district proposed to be formed on the San Benito tract, fixing the purchase price at \$350,000 in irrigation district bonds, at par, have been agreed upon by Thomas N. Dysart of St. Louis, representing the bondholders of the San Benito Land and Water Company, and the committee representing residents of the San Benito tract. The farmers will give the bondholders \$500,000 in bonds and in addition to the project will receive \$150,000 in cash to be used in betterments.

A. W. Jones and E. W. Jones, Del Rio, Tex., will install a pumping plant to irrigate 150 acres of land.

The Gravity Irrigation Association of the Lower Rio Grande valley of Texas is urging Congress to provide funds for the establishment of a gravity irrigation system in the lower Rio Grande valley. Branch associations have been formed in fourteen towns in the valley. The association is pledged to these measures:

The building of a gravity canal to irrigate all available lands possible in Cameron, Hidalgo and Starr counties.

To secure the passage of the Shepard resolution appropriating \$50,000 for a survey of the Rio Grande from its mouth to Fort Quitman for the location of reservoir sites for the storing of storm and flood waters for irrigation purposes.

To secure a treaty with Mexico providing for the partition and equitable distribution of the waters of the Rio Grande, the declaring of the Rio Grande a non-navigable stream, as well as providing dams and reservoirs for the storing of storm and flood waters thereof for irrigation purposes.

To secure, if possible, federal aid in this enterprise, and in the event of failure to secure such aid, the formation of a gigantic irrigation district, covering the lands sought to be so irrigated so as to carry out the objects and purposes of the organization.

Washington

An adverse report has been made by the United States government on the proposed Glade high line canal, which contemplated the reclamation of 50,000 acres in Franklin county, Washington.

The report shatters the hopes of a number of desert land entrymen with claims it was hoped might be watered by these ditches. Annual proofs of expenditures by entrymen for nearly four years, based upon payments made to the Glade company, have been practically nullified. The general plan of the Glade company was to take water from the Columbia

about twelve miles northwest of Pasco, to cover with ditches some 50,000 acres. The status of the Glade company has been in doubt since 1911, but in the meantime the company, under the management of Albert S. Byres, has collected thousands of dollars from entrymen.

The Highland Water Users' Association, Kennewick, Wash., has been

organized with a paid-up stock of \$40,000 by John Ross, W. B. Wuth, R. H. Nicholson, W. D. Craver and G. H. Taylor. John J. Ruskin is the attorney.

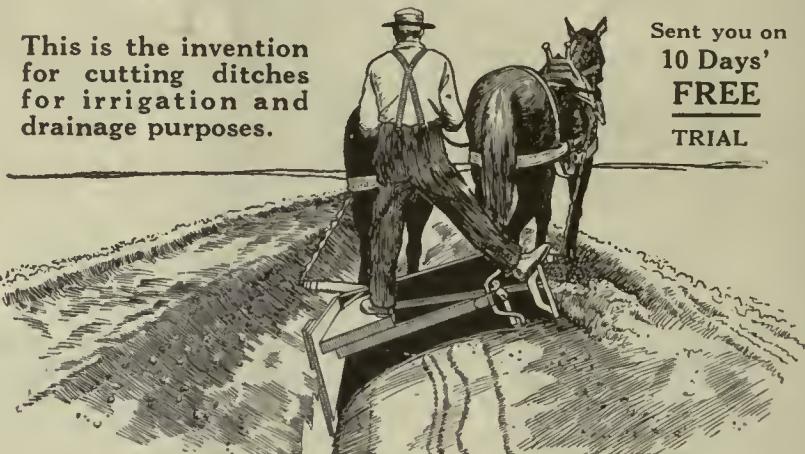
The sale of the assets of the Hanford Irrigation Company of North Yakima, Wash., has been set by Judge Frank H. Rudkin of the federal court

(Continued on Page 95)

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for irrigation and
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Sent you on
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TRIAL



Does Work of 100 Men and Cuts Cost of Ditching Way Down

THE ABOVE ILLUSTRATION shows you the new method of cutting ditches with the remarkable little Martin Ditching and Road Grading Machine, invented by an Owensboro, Kentucky, farmer, for lessening the cost of draining wet land and cutting ditches and laterals, as well as for cleaning out old ditches and laterals.

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CAN USE WATER WHEN NEEDED

Holders of first water decrees are entitled to water for irrigation at any time of the year they need it. This is the substance of a decision by the Colorado Supreme court in the case of Charles W. Comstock, state engineer, versus the Laramie & Weld Reservoir Company. About five years ago the company brought suit against Comstock and holders of first decrees, asking the court to establish an irrigation season with an arrangement by which reservoir companies could fill their reservoirs between October 1 and April 15. The lower court created such a season, fixing the dates from October 15 to April 15.

The Supreme court reversed the finding of the lower court and declared that the proposition that there is a season for direct irrigation is fundamentally wrong and in conflict with the provision of the state constitution to the effect that every natural stream within the boundaries of Colorado

IRRIGATION NOTES

(Continued from Page 94)

for January 23. E. F. Benson, receiver, will conduct the sale, which under the terms of Judge Rudkin's decree, must bring at least \$380,000, with at least \$45,000 in cash, to cover the outstanding receiver's certificates, attorney fees and costs. The balance may be in bonds of the company. The sale is expected to satisfy judgments secured by the American Power and Light Company totaling \$497,945, and by the Dexter-Horton bank, totaling \$332,150.

New Mexico

The San Simon valley, situated in southwestern New Mexico and southeastern Arizona, near the Mexican border, is to be reclaimed by a reservoir system of irrigation. Two creeks are to be dammed. The project is being promoted by J. B. Blake and J. Q. Johnson of Lordsburg, who report they have the money to go ahead with the scheme. The total cost will be approximately \$1,000,000 and 40,000 acres will be reclaimed.

Arizona

The Alfalfa Farms Company, an Indiana corporation, has taken hold of the reclamation of 7,000 acres of land in Lonesome valley by means of water to be impounded in Granite creek dam six miles northeast of Prescott, Ariz. One hundred men are at work on the dam.

S. H. Woodruff, Los Angeles, Cal., and associates, are having surveys made and plans drawn for a system of irrigation for 20,000 acres in Arizona. A pumping plant will be installed.

Colorado

Articles of incorporation have been filed by the Arkansas Valley Land and Investment Company of Pueblo, Colo. The company is incorporated for \$400,000. It will construct the Arkansas valley ditch, the headgate of which is just above Boone. The officers of the company are Henry A. Morris, Frank Taylor and Samuel Robinson. They and R. W. Corwin and D. B. Wiley are the directors.

not heretofore appropriated is free to the public, with no restrictions as to season whatsoever.

USE PRIMER AS TEXT BOOK

Editor of THE IRRIGATION AGE:

The Primer of Irrigation is a very fine little work and I get a great deal of practical information out of it. I would advise some of the farmers in the humid districts to also read it as it has its practical application to both the arid and the humid districts. A very fine work, easily understood and would make a fine text book in the agricultural schools.

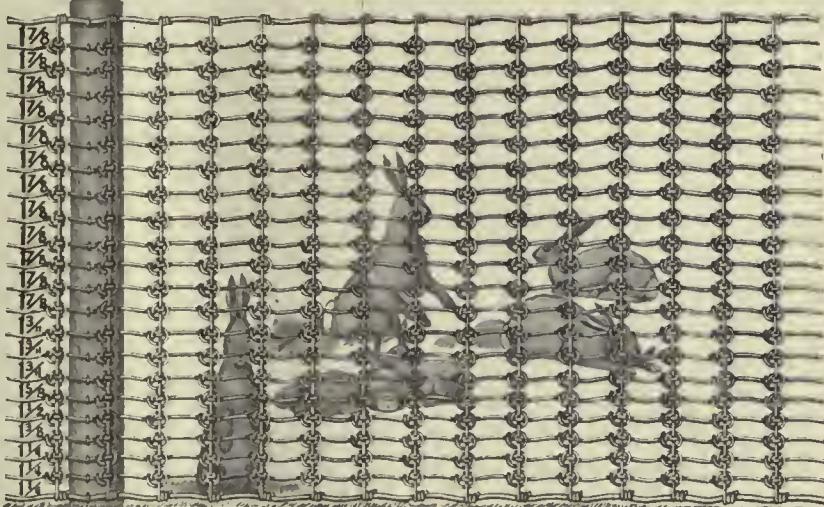
W. S. CRAIG,
President Citizens National Bank, Navasota, Tex.

Two sons of Julian Uribe, vice-president of the Columbian house of representatives, are to be employed in the Reclamation Service to gather experience for building irrigation projects in their own country.

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IRRIGATE MICHIGAN BERRIES

While western Michigan has an annual rainfall that is approximately 30 inches, still there are certain crops that can be irrigated with profit. This is especially true of the strawberry, because this fruit is largely water, and when it commences to ripen it seems impossible to get more moisture than what the berries can take up. In fact, the more water that can be led to them, the bigger the berries, and the bigger the profits.

Several strawberry growers in western Michigan have worked out different systems of irrigation. W. F. Tindall at Boyne City has a system that is usually successful. He has overhead pipes, with which it is possible for him to spray practically his entire strawberry patch. The pipes are arranged so that they can be turned. He first sprays in one direction and then turns over the pipe and sprays in the opposite direction. The water is supplied by a pump operated by a gasoline engine.

The general rule is to do the spraying at night,

sending the spray one way the first half of the night, and the other way the last half. When the sun rises in the morning the ground is well wet down and the strawberry plants soon soak up the water, and the berries in consequence are larger than what they otherwise would have been.

IRRIGATION IN LOUISIANA

One hundred acres of Moller farm, near Pineville, La., is to be irrigated. A dam has been completed, making a pond a mile long, twenty-five to fifty feet wide and ten to twenty feet deep. This is filling with winter rains, which will furnish ample water to irrigate a much larger acreage than the one hundred acres contemplated.

Machinery has been ordered for the plant and will soon be in position. The water will be elevated by a gasoline engine to a smaller reservoir at an elevated position on the farm, and the irrigation will be accomplished by gravitation.

IRRIGATION NOTES

(Continued from Page 95)

Oregon

Two thousand acres of new ground on the Umatilla (Ore.) Federal project will be seeded this spring.

The formal opening of the Tumalo (Ore.) project, completed by a special state appropriation of \$450,000, was marked by interesting ceremonies and a banquet. Satisfaction was expressed by all the speakers because of the completion of the project and the class of work done. All agreed that in the completion of the project a new epoch had been opened in reclamation work.

"I am in favor of construction by the state rather than by the United States Reclamation Service," said Governor West, "on account of the slowness of action on any matters where Washington is concerned. The only way to actually complete work of this character is for the state to assume these problems, and we must understand now that the development of these Carey Act projects is strictly a state problem."

Jackson county (Ore.) farmers have launched a campaign for the organization of an irrigation district in the Rogue River valley. The movement followed a rather disastrous summer for the owners of unirrigated orchards.

The Oregon desert land board has voted to turn over to the Central Oregon Irrigation Company \$29,321 in notes given by that concern to the board to guarantee the completion of its contract for the reclamation of certain lands in the vicinity of Bend. The action was taken on condition, however, that the company cancel its right to all lands in its project now open for entry and sale which were not embraced in the patent lists previously submitted to the government.

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WHEN you put in an irrigating plant of your own, the most important thing to get is an engine that will run your plant at any time you want water. Make the safest selection and buy an I H C oil and gas engine—Mogul or Titan.

An I H C outfit delivers the most power on the smallest fuel consumption. It uses the fuel that is cheapest or most convenient for you to buy. In case of accident you can get repairs in a few hours.

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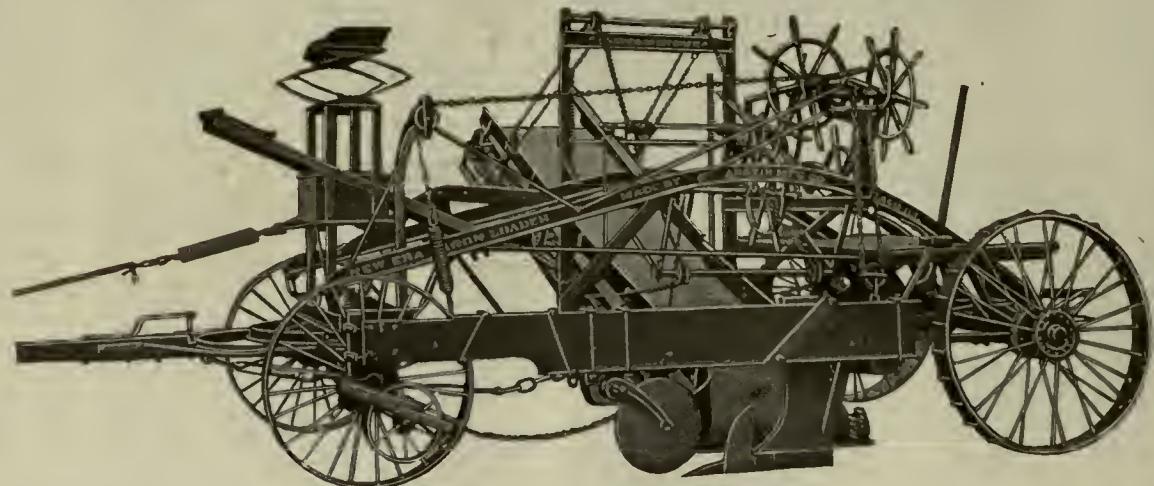
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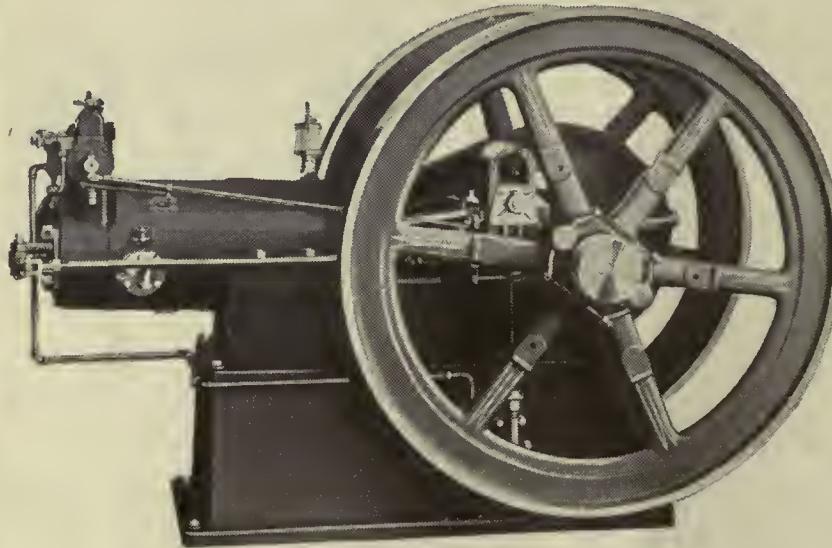
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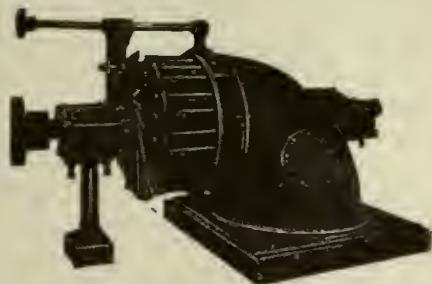
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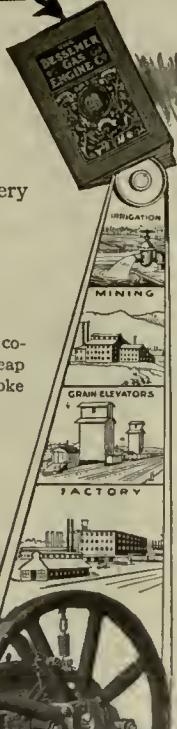
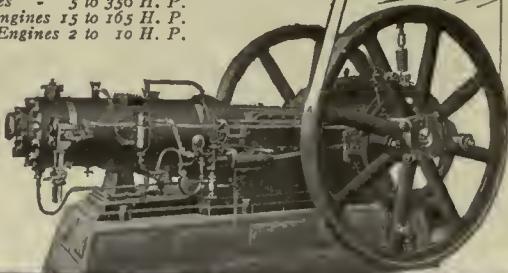
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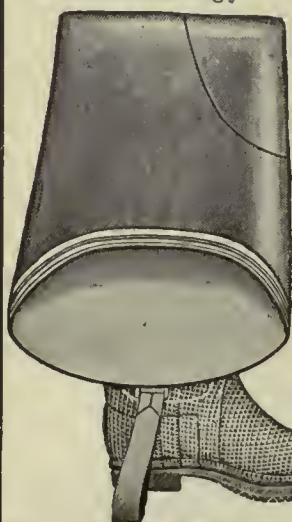
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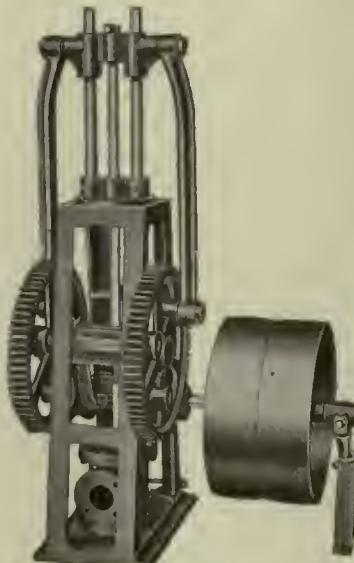
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THE IRRIGATION AGE

VOL. XXX

CHICAGO, FEBRUARY, 1915.

No. 4

THE IRRIGATION AGE

With which is Merged
The National Land and Irrigation Journal

MODERN IRRIGATION
THE IRRIGATION ERA

ARID AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL
MID-WEST
THE FARM HERALD
THE IRRIGATOR

D. H. ANDERSON
PUBLISHER,

Published Monthly at 30 No. Dearborn Street,
CHICAGO

Entered as second-class matter October 3, 1897, at the Postoffice
at Chicago, Ill., under Act of March 3, 1879.

D. H. ANDERSON, Editor

ANNOUNCEMENT.

The "Primer of Hydraulics" is now ready; Price \$2.50.
If ordered in connection with subscription \$2.00.

Politics Again Halts Aid for the West Once more politics is interfering seriously with the development of the West. And not only the West, but the whole nation, must suffer as a result.

Because of the desire of the Wilson administration to keep down expenses, Secretary Lane has abandoned his plan to advocate before this session of congress the issuance of \$100,000,000 worth of irrigation bonds to raise funds for the construction of more reclamation projects in the West. The Secretary blames the war for his sudden attack of "cold feet" concerning this proposition. The political reasons for his change of attitude are, however, written most plainly all over his action.

It would not be necessary to go to Europe to sell these government securities. We have no doubt but that the government could dispose of every dollar of the bonds west of the one hundredth meridian.

With this much money available, a dozen or more big projects could be started. This would mean work for thousands of unemployed throughout the West. Completion of the projects would mean homes for thousands of substantial citizens, added wealth to the nation, and a further enlarge-

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Associations has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Interesting to Advertisers

It may interest advertisers to know that The Irrigation Age is the only publication in the world having an actual paid in advance circulation among individual irrigators and large irrigation corporations. It is read regularly by all interested in this subject and has readers in all parts of the world. The Irrigation Age is 30 years old and is the pioneer publication of its class in the world.

ment of the great irrigated bread basket of the nation, which stands ever as insurance for the whole nation against starvation should country-wide drouth or war come upon us. While there is no question but that millions of government funds have been misspent in irrigation work, THE IRRIGATION AGE still contends that there is no better investment which the United States can make than that which it makes in bringing worthless lands to a productive state.

We are sorry that Secretary Lane has permitted political exigencies to override his earlier expressed convictions in favor of the \$100,000,000 bond issue.

And yet this is not the only instance where Secretary Lane seems to be proving himself a much better administration Democrat than a friend of the West. His dribbling methods of handling the proposed revaluation of the projects smacks sorely of politics. When he announced his views on revaluation in his now famous letter to the Water Users a year ago, Secretary Lane seemed to have some pretty well defined ideas. Now he does not seem to know whether he is afoot or on horseback.

If conducted fairly, the project revaluations will prove of very great benefit to the settlers. Vast charges which now hang over their heads must be

removed if the settlers are made to pay only for that work on the projects which represents real value to them and to the projects. It is generally figured that fair revaluations will cut \$40,000,000 off the present charges which the settlers face. Perhaps Secretary Lane wants to let some other administration do this charging off. Of course, the Wilson administration is not to blame for all these valueless expenditures, but the issue is there. It concerns thousands of the best citizens of this nation, and it should be met squarely and promptly and without regard to politics.

Certain Persons May Bump Their Heads If Col. Roosevelt and Gifford Pinchot are trying to create another "Ballinger-Pinchot" affair over the removal of F. H. Newell as Director of the United States Reclamation Service, they are toying with fire, which may burn them very deeply before they get through.

Letters by Col. Roosevelt and Pinchot, commenting on the removal of Newell, were given to the press recently and there are other indications that Newell's friends are intent on at least trying to make a political issue out of the Newell removal by Secretary of the Interior Lane. That even so egotistic a person as Pinchot should hope to restore Newell seems almost impossible.

Despite Col. Roosevelt's professions of friendship for Newell, we doubt very much whether he was fully informed of Newell's acts and of the feelings of the settlers on the Federal projects when he consented to the use of his name in connection with the Newell publicity.

And if he persists in aiding this unholy cause, he is going to bump his head against a very thick stone wall of solid facts.

Newell's removal was due largely, we believe, to his inability to cope with the human problems on the Federal projects, and to his intense unpopularity among the settlers.

Had his work as an engineer been the cause for his ousting, this should have occurred many years ago. Back in 1904 THE IRRIGATION AGE called attention repeatedly to his engineering, and in 1905 the publisher of THE AGE submitted to Secretary of the Interior Hitchcock a statement concerning his acts. For some reason, never revealed, no action was taken on this statement, nor upon subsequent charges made concerning his work.

Secretary Lane was supplied with a wealth of facts about Newell engineering at his conference with Water Users in Washington in May, 1913. Still he failed to act, as had his predecessors.

Finally the storm of feeling among the Water

Users, as revealed by THE IRRIGATION AGE, became so severe that the political and bureaucratic bulwarks of Newell had to give way, and Secretary Lane acted. It was the best thing he has done in the interests of the Federal Water Users and for Federal irrigation.

A Sermon By a Great Business Man "The influence of the war upon our world-wide trade will naturally require a curtailment of production for 1915. Although our prospects in the United States are good, yet with foreign arteries of commerce, of manufacture and of finance temporarily obstructed, it is inevitable that our sales, as a whole, will be diminished for the coming year—how much we cannot now tell. For this reason extra effort must be made, during the coming twelve months, by every employe from the executive officers down to the office boys, to secure the most efficient operation of each department with the least possible expense. Increased efficiency and the strictest economy must be our watchword for 1915. Let each one feel that the eyes of the whole organization are upon him—to hold him responsible for errors that can be avoided; to congratulate and honor him for the success he helps to secure. Let us give attention to the common duties before us—the question of punctuality in meeting our appointments and the disposition of our time so as to get the most out of it.

"The fact that we are moving amid troubrous times need not lessen our expectation of a good outcome for this year. The outlook, in this country, is by no means discouraging. The farmers are prosperous, and from all sides come reports of increased grain acreage. Our foodstuffs are in demand abroad. At home the new Federal Reserve system will lubricate the wheels of commerce, which should be turning with increasing steadiness and swiftness as the spring advances. Unless some condition arises which is not now visible this foundation is a favorable one on which to build a good domestic business for 1915."

The above words are those of the head of one of the greatest corporations in this nation. The excerpt is from a remarkable communication to the employes of the International Harvester Company, which was written by Cyrus H. McCormick.

We reprint the excerpt because there is much in it of real value to every reader of THE IRRIGATION AGE. First, there is that note of optimism which the big men of the nation are seeking to instill throughout the country—optimism which is necessary if we are to enjoy our full meed of prosperity, which certainly must come. Second, there is the

appeal to each individual to make himself more useful and efficient as a part of the great whole. What better advice can any citizen receive as concerns his duties to himself, his employer or employees, his nation? Third, there is a piece of advice which every business man should take to heart, and of which he should make the most. Develop and increase trade right here at home. Do not worry about the markets shut off by war. Sell to the home folks.

As Mr. McCormick so clearly states, conditions are ripe for a big "clean-up" during 1915 right here in the home market. Whether you are a farmer, business man or manufacturer, make the most of this opportunity. Help the oncoming prosperity to arrive more quickly by putting all the push and energy in your system into this year's work.

**Let Us Have
Food
Conservation
in the U. S.**

In the last issue of THE IRRIGATION AGE we urged the administration at Washington to forget the various conservation fads, designed to tie up the resources of the West and hamper its development, and take up real conservation—the conservation of our food supply.

We suggested that a special commission be sent to Germany and to some of the other warring countries to study the remarkable methods being used there to make their food supplies go two to three times as far as it did before the war began.

Since we wrote that editorial, a United States consular report from Germany has brought the story of how the Germans are handling their potatoes. Wastage of potatoes in the United States is far greater than it was in Germany. This should not be. Every ounce of food which the United States produces ought to be made valuable.

This official report on Germany's handling of potatoes is decidedly interesting. We present it to our readers in the hope that it may lead to some ideas that will help to give vigor to a FOOD CONSERVATION campaign in the United States. The report in part:

"More intensive farming, if such be possible, has been planned, as well as greater care in the conservation of products hitherto considered as waste material. For example, potato peelings and beet heads are now retained in the country or even collected in the cities and returned to the farm to be used as cattle feed. While the potato crop has always been an important factor in the food supply of the Empire, special efforts are being made this year to further its conservation. Fortunately, the crop is an abundant one.

"In normal times, on an average from 3,000,000

to 4,000,000 tons of potatoes rot because of their large water content. Efforts have been made in the past to avoid this waste by the erection of drying plants, and Germany has had for some time quite a number of these institutions. Because of the present dependence on its own resources, it has been deemed necessary greatly to increase their number. The government has already offered, by very favorable loans, through the Department of Agriculture, to assist interested parties in setting up factories for drying potatoes, the cost of each one of which is about 20,000 marks (\$4,760). These loans are made with the low interest of 4 per cent, the payment of which is to begin only after October 1, 1916.

"The redemption of the capital is to be made in eight annual installments, the first of which is due in 1917. The government protects itself either by a mortgage or by some sort of security up to the amount paid out and reserves the ownership of the apparatus.

"Every individual who receives such a loan must bind himself to set up the establishment immediately, the purpose of the government being to dry as many potatoes as possible.

"For the sale of the dry potatoes, a large syndicate called the G. m. b. H. zur Verwertung von Trockenkartoffeln (Potato Realization Co.), is to be formed, to which the factory owners are pledged to deliver all their products except what they need for their own use. Every member must subscribe for at least 1,000 marks (\$238) of stock. Just as in the sale of alcohol to the alcohol monopoly, the manufacturer receives, on delivery, a first payment, which is fixed by the committee. The balance of the amount to be paid for the wares is figured out at the end of the year. Only products of good quality are accepted. The content of water, which normally amounts to approximately 70 per cent, can not be more than 15 per cent in the dried product.

"The sale of the produce should be excellent in view of the scarcity of cattle feed. It should increase correspondingly with the consumption of potato flour for baking. Many bakers have already made bread with an addition of from 10 to 20 per cent of potato flour, of which half was made from dried potatoes. In view of the fact that potato flour is about 8 marks (\$1.90) per 100 kilos (220.46 pounds) cheaper than rye flour, this should tend to lower the price of this necessary food product.

"A further considerable conservation of both potatoes and cereals for food purposes has been effected by the decision of the government to cut down the production of alcohol by 40 per cent. This is of especial importance in view of the increase in the price of cereals since the outbreak of the war."

OWNERSHIP AND DISPOSAL OF SEEPAGE WATER

By JAMES G. WHITEHEAD,

President of the Nebraska State Irrigation Association and Banker of Mitchell, Neb.

NO LAW should find a place among our statutes that will not stand the test of ethics. It is not enough to say it is expedient or that by it a disagreeable situation is relieved. It must not, in its operation, deprive any one of his rights or privileges, even though some may be benefited. Any legislative action that brings good to the people,

without harm to any, is wholesome legislation and will be likely to receive the plaudits of honest and thoughtful men. No man should have the right to better his own condition at the expense of his neighbor. His misfortunes he may justly seek to relieve, if he does not, in so doing, take from another that which is his nor lay on him burdens not properly his to bear.

The ownership and disposal of seepage water may be considered from two viewpoints: First, that of the land owner whose land is seeped. Second, that of the land owner who needs water for irrigation or other beneficial use. These two interests may be antagonistic or they may be made common. If the owner whose land is seeped and the owner who needs water are neighbors, they can agree on the development of the seepage water and its disposition, but if the water is to be applied to lands at a distant point and there are several claimants for it the situation becomes complexed.

I shall try to include in this discussion the interest and rights of each party—the one who wishes to get rid of the water and the one who wants it.

The owner whose land has become seeped must find a way to drain it or he has lost the value it had before it became seeped. He is damaged through no fault of his. The application to other lands, which caused his misfortune, was not for his benefit nor of his choosing. The responsibility for such a condition cannot well be discussed in this paper and I shall not attempt it. We are to deal with a condition already existing and seek a remedy.



German land buyers inspecting an artesian well near Littlefield, Texas. Courtesy of The Earth.

The ownership of water in running streams is conceded to be in the state, so that we may consider seep water, as to its ownership as being water on lands before it reaches a running stream. A farm, by reason of the use of water on land above it, becomes waterlogged, small lakes and pools develop, which render it useless for agricultural purposes.

To construct drain ditches to gather the water and carry it off costs money, and no one is more interested in having this done than the man whose farm is seeped. It is easy to get his co-operation in remedying conditions.

Usually where seepage develops the seeped area includes several farms or parts of farms, and it is found economical for the owners of these farms to join together and form a drainage district and construct the main drains jointly, assessing the cost in proportion to the benefit each will receive. It is necessary, in planning the work to be done, that the proposed project as a whole shall be considered and not simply the needs of a single farmer. In this way the greatest amount of good can be accomplished with the minimum of expense.

The prime object is to relieve the land of surplus water and to make it again valuable as farm land. The water thus accumulated and carried off has a value. They are not simply getting rid of a pest—a thing that is of no use to anyone, but rather they are developing a valuable asset if properly used where there is a need for it.

Should those developing it at expense to themselves be allowed to dispose of it in order to partly compensate themselves for the expense of its development?

Is it just that they be partly reimbursed for their labor?

Although they are working to relieve themselves from their unfortunate condition, yet they are making available to someone who needs it, the water necessary to make the production of crops possible, where it was not possible so long as the

water remained in lakes and ponds as it was before. They are doing something that may be made of benefit to others than themselves.

Should those who may be benefited pay some part of the cost?

It would seem that they should, if no one is being injured—that is, if in disposing of the seepage water no one is being deprived of anything he has, if each has all he had before. Clearly one is not aggrieved if a thing that is not his is withheld from him.

The water which caused the seeped condition was originally the water of a running stream and the property of the state. If let alone it would have run down in its natural course. However, it was diverted by an appropriation with the consent of the state board and under its direction. The state at this point relinquished its control to the appropriator, and as soon as it is applied to the land it becomes so much a part of the land that it cannot be identified nor separated from the land except through seepage or evaporation. It has become a part of the land and the property of the land owner to all intents and purposes. At least the state would hardly claim control to the extent of being responsible for any damage it might do after it has been diverted.

If it is the property, or if under the control of the land owner at this time, when does the ownership or control revert to the state? From the reading of the law, it would seem to be when it reaches a running stream, and not before. If in the use of it the irrigator, by reason of the lay of his land, is unable to apply it without causing some of the land which is naturally low to become seeped, or if his neighbor uses more water than his land will absorb and the surplus causes seepage and the seep water is still on his land and in a stagnant condition and has not joined a running stream, then it must still be his and under his control. If this is true of a single individual, then it is true of a number of individuals. They will have the same rights if organized into a district.

If a drainage ditch is constructed to rid the land in the district of the surplus water, which is of no value to them, but which, if collected by means of the ditch which has been constructed, is of value to another who may have land needing the water, then it would seem that they have the right to dispose of it in such a way as to at least partly compensate themselves for the expense of drainage, and this would undoubtedly be true if in so doing they were not depriving any one of what he might justly claim as his. It will now be necessary to inquire as to whether or not others would have a claim on the water thus disposed of.

It is admitted that the water which caused the seeped condition was taken from the stream legally; that it was done under an appropriation approved by the authorities of the state. So far as the flow of the stream is concerned, it is lost after it has been diverted, except that part that will in time return through what we may term the return flow—water that percolates through the ground and comes out in the stream at some point lower down. It does not do this until it has served the purpose of irrigating the land to which it is applied.

If because of the peculiar lay of the land, or because of the formation of the subsoil, it comes to the surface and forms ponds or pools, without reaching some waterway through which it may find its way back to the stream, then it is of no value in the way of increasing the flow of the stream. The stream is in the same condition it would have been in had the water not made its appearance on the surface in the form of seepage. When it was first withdrawn, the flow of the stream was reduced to the extent of the amount taken out, and junior appropriators were advised of the amount taken and their appropriations were granted on the basis of the amount remaining, so that they cannot expect it to be returned, except through the return flow in the manner already stated.

If it is left in the pools or ponds their appropriation is not less valuable than it was when it was made—it is as good but no better. The same amount of water is available that was available at the time of making the appropriation. Apparently there is no harm done if it is allowed to remain on the land where it accumulates, to the down stream or junior appropriator. He is not deprived of any water that he was not deprived of when it was first taken from the stream, and he had no claim on it when it was taken. Obviously, it will not gather itself together and find a way back to the stream. An artificial channel must be made or it will remain as seep water. So the land owner who is unfortunate enough to have such a condition has not only been damaged by having his land ruined by it, but must put himself to expense either to reclaim his land or to protect it against further damage by the seeped area being increased.

If the down stream or junior appropriator is not damaged by its remaining on the land, then he is not damaged by its being removed and applied to other land in need of it. It would seem that it might be used at the nearest point where there is a need for it, without infringing on anyone's rights.

If so, those to be benefited by its use should join with those to be benefited by being relieved in the collection of it and they should have joint control.

Our present state law provides that Irrigation Districts may collect seep water, or they may join with drainage districts in the collection of it and use it as supplemental to their appropriations so long as the total used does not exceed their appropriation. This law does not make less valuable any existing rights, nor add to the value of any without a corresponding cost to the beneficiary.

In conclusion, it seems to me that the ownership and control of seepage water is now, and should be, in the land owner on whose land it is. The only question is, when does he lose the ownership and control, and that would appear to be only when it has been returned to a running stream. It might be a wise plan to more definitely define, by statute, the meaning of a running stream. This would make it no longer a matter of controversy as to when the ownership ceases. If this theory is not correct, then the owner, whoever he may be, should be made to take care of his property. No one should be expected to take care of the property of another without compensation.

PUMP POINTERS FOR THE IRRIGATOR

BY EVERETT B. MURRAY

Assoc. Mem. Amer. Soc. C. E.; Mem. Am. Soc. T. M.; of Kansas City, Mo.

OF pumps for irrigation, the most common and by far the cheapest to operate when the conditions are such that they can be used is the horizontal centrifugal pump. This is made by several different companies that are absolutely responsible and reliable and which furnish data and information concerning their equipment that can be relied on. The purchaser in considering the pumping outfit complete must take into consideration the fact that the power developed by his gas or oil engine is very much reduced when the altitude is increased, and for this reason at elevations of from 2,600 feet up the actual power developed by the engine should be secured from the manufacturer of the engine for the location.

The pump manufacturer will tell you how much power he wants delivered to his pump and, for your own peace of mind, it is advisable to have ample engine power to operate your pump. Centrifugal pumps can be purchased f. o. b. factories from 20 feet head, small size, up to several hundred feet head, large size. The determination of the particular type of pump required depends on the distance the draw down of the water is below the surface of the ground and the quantity which it is desired to lift.

For depths from 5 to 30 feet the ordinary horizontal pump either set on the surface for the shallow depth or in a pit from 5 to 15 feet deep for the greater depth with the engine sitting at the surface of the ground belted to the pump at an angle of 45 degrees is probably the cheapest installation where such a pump pit can be built and curbed without too much expense. In this case the pit would be, say 15 feet deep with the pipe 6 to 8 inches in diameter, extending 15 feet and having a proper strainer at the lower end to let in the water and keep out the sand.

Equipments of this kind can be purchased complete for from \$175 to \$1,000 for the pumping engine f. o. b. factories, depending on the exact conditions, which should always be stated and considered. If it is impossible to properly install pump and curb pit as mentioned above, a vertical centrifugal pump can be used with the pulley vertical and 3 to 4 feet above the surface of the ground.



Diversion Dam in the Belle Fourche River on the Belle Fourche Valley (S. D.) Federal Irrigation Project. Courtesy Chicago & Northwestern Railway.



A Cattle Ranch on the Belle Fourche Project.

This pump requires frame work of ample size and strength to properly align the shaft and hold the bearings rigid. It is advisable, if possible, to have the pump itself submerged when first started. If it pulls the water down below the pump in operation this can be done and will operate satisfactorily in almost any section up to at least 20 feet; in other words, the pump pit can be dug within 20 feet of extreme draw down of water and the pump still discharge its full capacity of water.

When the depth exceeds 30 feet, there will be an additional expense of shafting, bearings and discharge pipe on the vertical pumps and, although

the cost of the pump itself is the same, the equipment that goes with it, and especially the horsepower of the engine required to discharge the water against a higher total head, necessitates a more expensive equipment. I would not recommend either a horizontal or vertical centrifugal pump for daily service to handle water from over 60 feet below the surface of the ground.

Within the past 6 or 8 years Turbine centrifugal pumps, manufactured by three or four prominent companies in this country, have been brought out which successfully elevates water from depths, in the case of one or two of them, as low as 200 feet below the surface. These pumps can be lowered into the cased pits 12, 15, 18 or 24 inches in diameter and for this reason are called 12, 15, 18 and 24 Turbine centrifugal pumps. They are operated by pulley at the surface and have a shaft extending to the impellers which are usually placed below the water level. This shaft is enclosed in an encasing pipe filled with oil to properly lubricate it and to prevent sand and foreign matter from wearing the bearings of the pump.

You will notice that this particular type of pump is recommended for depths from 60 feet and over or for depths up to 60 feet where on account of quicksand or for other reasons it is impossible to properly curb a dug well and install either a vertical or horizontal pump set below the surface driven with a belt.

In regard to price, the vertical centrifugal pumps will cost anywhere from \$500 to \$1,500, de-

pending on the size, depth and capacity. This particular type of pump is used extensively in the irrigated sections of Texas and is beginning to be used in western Kansas in what is called the deep water sections.

Regarding the horsepower required to operate centrifugal pumps, the larger the pump the better efficiency. The very small pumps, say with one inch discharge, handling about 25 gallons a minute, cannot be considered as giving better than 30 per cent of the power handled to the pump. The larger type, from 3 to 6 inches discharge, will give from 45 to 60 per cent, and the still larger pumps with from 6 to 10 inches discharge, handling from 1,100 to 3,000 gallons a minute, will give as high as 75 per cent efficiency.

I would suggest that the purchaser of an irrigation outfit, referring especially to the engine and pump, should purchase of a reliable, responsible manufacturer who has a known reputation as a firm that is financially able to back its guarantee in every case. I mention this fact for two reasons; first, because farmers as a rule cannot afford to lose the price of an investment of this kind, and second, that if an installation is put out in a new section of the country, it will be watched very closely by parties interested and if it fails it will give the subject of irrigation in that particular section a black eye for several years.

In regard to the subject of irrigation, it requires not only the pump, engine and water, but intelligent use of the outfit, together with the water, to get the best results. In territory with which I am personally acquainted, large landowners in developing irrigated land for sale have brought settlers from Canon county, Greeley, and other irrigated sections and have had them produce results with which no farmer not familiar with the handling of water nor an eastern settler could compete. Mr. F. H. Newell, Engineer of the U. S. Reclamation Service, says in a recent article in the *Engineering Record* that the "real defect lies in the failure to appreciate thoroughly the deeper lying economic condition, namely, that the ultimate success of the investor and of the engineer and builder of irrigation works is dependent, not so much upon the mechanical perfection of the scheme, as upon the way the irrigated lands are handled after the works are done."

Referring to the subject of irrigated lands as a whole, where soil is not rocky or alkali and there is an abundance of water available within pumping depth, such land is a most valuable asset and is recommended as such both by banks and loan companies in the irrigated sections.

On small tracts in the Arkansas valley in Colorado and Kansas one acre has been known to produce from \$300 to \$500 in crops. These crops of course were of the early vegetables—celery, tomatoes, or something of that kind. Some of the large Texas irrigation tracts are now furnishing the cucumber, cantaloupe, and a great many of the smaller vegetable seeds for the great seed companies of Detroit, and the production of these seeds is furnishing the owners a revenue of from \$175 to \$250 an acre, net.

In regard to what power to utilize, this is a question which must be decided and determined

upon by the location of the property. For practical purposes, where pumps can be operated by motors, although at a slightly increased cost per thousand gallons, the motor drive is the best when the plant producing the electricity and the power line is a permanent and substantial improvement and can be depended on.

By far the cheapest power, and the one that will run the cost per thousand gallons the lowest, is the crude oil engine. This oil can be purchased in tank cars almost anywhere in Nebraska and Kansas at possibly not over 3.1 cents per gallon, and very often 1 3/4 cents. The cost per acre foot for handling water on the surface of the ground varies under different pumping conditions from 25 cents to \$2.25 per acre. By this cost we mean simply the cost of operating the engine, the labor and maintenance are not included.

The smaller item, of course, is where the water is shallow and a fair sized pump is used so as to make the equipment run as economically as possible. Referring to the higher price appliances to irrigation by the Turbine centrifugal pumps where water is brought from about 200 feet below surface, at least one responsible pump manufacturer guarantees to handle water from that depth for about \$2.00 an acre foot.

If ordinary crops, say alfalfa, will require not over 1 1/2 feet of water during the season, it is very easy to estimate the cost of operating a pumping plant which would increase the yield of the alfalfa from 3 to 5 tons per acre.

It is well also to consider the windmill as a factor in irrigation, in which case a small amount, of water is delivered to the surface, usually into tanks from which water in much larger quantities, say from 200 to 3,400 gallons a minute, is discharged into ditches over the ground. The capacity and discharge of windmill, which is probably not over 5 to 15 gallons a minute, would be absolutely wasted if discharged over the land at this rate, but by impounding it as mentioned above, in considering the almost constant operation of the windmill or in connection with a battery windmill, good results have been secured by this method of irrigation.

In taking up this matter to any extent, it is necessary to figure the cost of getting the water on the land and determining a crop that will bring a fair revenue over and above the labor and expense of pumping the water and making the crop. In many sections of California water is elevated from 200 to 600 feet by deep well plunger pumps, but as this water is used on vineyards and citrus crops that are very valuable, the grower can afford to pay \$6 to \$10 an acre foot for water and still make a big profit from his land and labor. The same type of plant installed in Nebraska for irrigating alfalfa and small grains would be a most unprofitable venture.

It is unquestionable economy to have the situation analyzed before making any investment whatever. The purchaser does not only know then just what he can do before he starts, but he knows just what it will cost and can compare his information with similar propositions and benefit by the experiences of others who have installed similar plants for similar crops under similar conditions.

The Federal Water Users



A Department Devoted to the Interests of the Farmers on the Government Irrigation Projects
EDITED BY GEORGE J. SCHARSCHUG

GETTING FULL PAY FOR THE SETTLERS' WORK

A Remarkable Article on the Usefulness of the Water Users' Association

By GEORGE W. BRUCE

President of the Uncompahgre Valley Water Users' Association of Colorado.

THE field of usefulness for a Water Users' Association on a Federal irrigation project is practically limitless. It has to begin with the force of an existing corporation. Each land owner within the project is already a stockholder, and as such, interested in the welfare of the Association. The Corporation has the additional merit of having the live and continued interest of all the members in the organization from year to year, in the fact that the Association distributes the water for irrigation from year to year, to every stockholder within the project. This feature insures an active interest in the Association, and practically unanimous participation in the annual or special meetings of the stockholders.

The Association should become the clearing house for the people of the valley, both for the purpose of disposing of the surplus products and for the purpose of furnishing needed supplies, builder's hardware and dairy stock. I mean by this, the Association should have house and storage facilities and sell at cost farm lumber, builder's hardware and dairy cows of the best type, and be prepared to take care of surplus potatoes, onions and fruit until the market justified shipping.

In our particular project a beet sugar factory or factories should be built by and owned by the Association and the profit go to the shareholders. The soil of the Uncompahgre Valley is particularly adapted to the growing of sugar beets of large sugar content, and there is a sufficient acreage to support two or three moderate sized plants. There are many reasons why this project should have its own sugar factory, the chief reasons being that it leaves the by-products, syrup and pulp, close at hand for the growers to obtain to feed to livestock. This item alone is profitable and encourages own-

ing and feeding and consequently developing farm lands to a greater production and greater permanent value.

Another industry equally important, and in the minds of some, of greater importance than the sugar factory, would be a milk condensing plant. A plant of this kind, in my judgment, would follow within a year or two the building of sugar factories, and both these industries could be not only realized upon but made very profitable to the people directly interested—the farmers or producers.

Another matter of great importance, in fact, the greatest problem confronting the producers of the valley, is the problem of marketing at a fair price the product of the farms. The General Government and the States, through Agricultural Colleges,

and many of the counties, through advice and assistance of agricultural and horticultural agents, have been assisting in the production of greater yields, losing sight of the equally or still more important question, the economic distribution of farm products. The facts are that the gain in production exceeds that of our increase in population, and it is safe to estimate that this production could be yet materially increased if a remunerative market can be found for the products. "At no time," says Peter Radford, "since Adam and Eve were driven from the Garden of Eden have the inhabitants of this world suffered from lack of production, but some people have gone hungry from the time of creation to this good hour for the lack of proper distribution."

Now the question: How can a Water Users' Association be of service? In the first place, we are organized and incorporated and every acre of irrigable productive land in the valley is subscribed



A Wheat and Corn Crop on the Belle Fourche Valley Federal Irrigation Project, in South Dakota. Courtesy Chicago & Northwestern Railway.

to the project and entitled to and must receive our attention, must receive its full quota of water to insure crops, must pay its just proportion of cost of operation, maintenance and support of the association. It is our duty to see to the fair distribution of the water at the lowest possible cost, the proper use thereof, and to encourage diversified intensive farming that the greatest yield possible be produced.

We can and should go further. We should become the agent or provide agencies for the marketing of the surplus products of the valley, and provide facilities for the economic storing of products in time of excess production, in time of car shortage, and in times when prices are ruinously low. Storage facilities should be provided and owned by the association where potatoes, onions and apples could be stored and cared for at a price but little greater than actual cost. The association, if acting as agent for the products of the valley, could sell direct to consumers through Farmers' Clubs or through an Uncompahgre Valley Products store, or both of these agencies, at the highest price they can get. Farmers' clubs are the rule now in most of the counties of eastern Colorado, western Nebraska, and western Kansas, Oklahoma and Texas—and all this territory is our legitimate market. Much of this territory will never raise its own apples or peaches, potatoes, onions or sugar, and our valley cannot be excelled in the known world in the perfect production of these essential food products.

It is up to the people of this valley to use the resources at hand and to use the brains we have, or if deficient in the ownership of this all-essential quality, organize, co-operate, use the proffered help of the government, or hire experts in these various lines, stand together, produce the best products possible and put them up in only the BEST possible condition and form. We should wake up to the opportunities before us, and get instead of about thirty-five cents out of each dollar our products bring, at least the most of the dollar, and place it in the hands of the producer, where it belongs, and where, under God, and on His productive footstool, unless a more equitable distribution is made, the producer—the man and the family, to whom it rightfully belongs, must go in abject need of the essentials of plain living. Are we going to continue to pay ten, twelve and fifteen per cent for funds to carry on the farm work, mortgage the crops and teams and the plows to obtain these

funds, or are we going to use the credit of this productive valley or secure funds by private subscription and start banks of our own, and fix the rate where borrowing patrons can afford to borrow, and can live; and where the owners are satisfied with a less dividend, but who gain much in seeing a prosperous, instead of a broke and helpless clientele?

The association should own at least three banks in the Uncompahgre valley, for the sole accommodation of farmers, dairy men and stockmen, so that more reasonable rates of interest could be secured. Prosperity must ever remain a stranger to the large majority of farmers, especially of tenant farmers, where interest rates are above seven or eight per cent. Figure up the amount of wealth that will go out of this valley within a period of twenty years, produced by the farmers under the project over and above the meager amount they get for these products, add to this the enormous amount paid to the banks of the valley in a period of twenty years, over and above eight per cent, and the total amount will reach in excess of the cost of our great Uncompahgre irrigation plant.

Are we going to let one-half dozen to twenty buyers and wholesale jobbers, brokers and robbers come into our valley each year, maintain high salaried men in the field, and purchase our products at the lowest figure possible? This figure is fixed by agreement every day between buyers. By maintaining high salaried men on the road, selling our products at the highest price they can obtain, the price to the consumer often runs to a figure three times the amount the producer received. Or are we going to stand as a unit and correct if possible some of the abuses? Railroad rates, both passenger and freight, should be lowered; interest rates should be lowered—and relief in both these particulars can be secured if the right effort is made by the people of the Uncompahgre valley, or any other. On the other hand, unless these wrongs are corrected, we must and will continue to see immigration pouring into those states where banks with

no more capital, surplus and deposits, and in sections no more productive than ours, are loaning funds at seven and eight per cent, where railroads are carrying passengers at two or two and one-half or three cents per mile and carrying freight at less than one-half the rates charged here. Relief?—that depends upon the people.

Is your Water Users' Association doing anything for the settlers? Write to us about it.—The Editor.



One of the Grade Schools on the Lower Yellowstone Federal Irrigation Project in Montana. Courtesy of the Northern Pacific Railway.

"BETTERMENTS" ELIMINATED BY SUIT

"BETTERMENTS" have been eliminated from the water right applications in the Belle Fourche Valley (S. D.) irrigation project.

There has also been a noticeable cutting down of the operation and maintenance forces of the Reclamation Service on the project.

These are two of the developments which have followed the victory of the Belle Fourche water users in the United States circuit court of appeals. It was in an opinion of this court that they established recently their right to go into court as can any other American citizen, and their injunction against extortionate charges and Reclamation Service methods of collection was sustained.

O. E. Farnham, of Newell, S. D., secretary of the Belle Fourche association, and attorney in the water payment suit, says in a letter to the editor of THE IRRIGATION AGE, concerning the suit:

"Regarding a possible appeal by the government officials from the decision of the Circuit Court of Appeals, I am advised that the U. S. District Attorney is of the opinion that an appeal will not lie from a decree of the Circuit Court of Appeals affirming an interlocutory order of the District Court granting a temporary injunction, which position, I think, is well taken. So that this opinion will be the law until a final decree is rendered in our suit after a trial on the merits of the case.

"The changes of policy of the Reclamation Service since we instituted our suit, which have come to our knowledge are as follows:

"The new water-right application forms do not include the item of 'betterments' in the charges to be collected. The government officials practically conceded that we were right in our contentions as to this item in the present litigation.

"There has also been a very noticeable cutting down of operation and maintenance forces on the project, although there is still evidence of considerable extravagance and careless business methods. We are advised, however, that no actual construction work is now charged to operation and maintenance, as has also been conceded by those in charge of the work heretofore. We have not gone into the accounts recently so that we have no definite information as to this matter. In determining whether or not certain work done has been charged to this account or that, it is quite necessary that we have the original time books of the particular officer in charge of that work. We have been advised by the officials that these books are the private property of the particular engineer who had charge of that particular work, and are not acces-

sible to inspection by us. These questions, of course, will be determined in due time.

"About a year ago members of the Reclamation Commission assured us that the Department would be glad to enter into negotiations with us looking to an amicable adjustment of our differences, and we have manifested a willingness to do our part and have repeatedly requested a conference with such representatives or members of the Commission as the Secretary of the Interior might designate to represent him.

"After the passage of the new extension measure and the public notice of Sept. 24, 1914, issued, we received from Mr. W. A. Ryan, Comptroller, a notice, which was published and posted on the project.

"We very promptly took exceptions to his interpretation of the law and so advised him. We felt that congress had seen fit to give us six months in which to make up our minds and it evidently had a good reason for so doing.

"At the same time we again requested an opportunity to confer with the officials and to secure, if possible, a definite understanding as to some matters upon which the new law does not seem to be clear and as to which matters we did not care to surrender our present vested rights by an unqualified acceptance of the extension measure. Following an exchange of communications, we received from Mr. Ryan a letter dated November 16, 1914, stating that Chief Counsel Will R. King would meet with our people, late in December.

"Since then the Service has been working overtime trying to get our water users to file acceptances of the new law, and I understand that to date they have succeeded in securing acceptances from about one-third of the water users on the project. The other two-thirds are awaiting the advice of our Board of Directors.

"After renewing our efforts the past thirty days, we have just been advised that the Commission will confer with us sometime the latter part of March, or I presume about the day after our six months of grace expires in which to file acceptances. A meeting of our Board of Directors has been called to consider this matter. You may rest assured, however, that the interests of the water users will be protected to the best of our ability and with every means the law affords.

"There are a number of questions we desire to have settled under the old law and our contracts before entering into a new arrangement. But they are vital not only to us but to other projects as



Irrigation pumping plant on the ranch of E. S. Lorenz near Goodland, Kan. Delivers 960 gallons a minute. Courtesy The Southwest Trail.

well, and as we are now in court and in a position to secure a just interpretation of the law relating to these matters it occurs to us that we should not execute an unconditional surrender at this time."

In an earlier letter to THE AGE Mr. Farnham says:

"It is needless for me to assure you that I am completely overwhelmed by the compliments paid me by THE AGE. While it is true that much has been accomplished and that the water users will find from now on a different Department to deal with, yet little could have been accomplished by our Association had not its board of directors almost to a man stood valiantly by the course it adopted two years ago; and it must be understood also that behind these self-sacrificing water users was a large majority of the 600 water users and shareholders of the Association. At every opportunity in open mass meetings practically a unanimous sentiment of the water users was expressed in favor of the board's actions.

"There will always be found that minority faction, however, in any important movement regardless of the principles involved and the prize at stake, who are willing to sacrifice the greater and broader good for a temporary personal advantage. So let me suggest that the water users Roll of Honor will not be complete without the names of members of the Board of Directors of the Belle Fourche Valley

Water Users' Association and a large majority of its 600 water users.

"The Board is constituted of the following water-users:

"Samuel H. Martin, chairman, also a member of the 1913 and 1915 sessions of the S. D. Legislature, and Democratic choice for Speaker of the House.

"Hans Sorenson, of Nisland, S. D.

"M. L. Perry, President of the Farmers' Protective League, and Secretary of Grange, at Vale, S. D.; also President of the Butte County Development Association.

"A. L. Gurwell of Arpan, S. D.

"Axel Erickson, of Newell, S. D., formerly President for a number of years of the Miners' Union at Central City, S. D.

"Dr. W. F. Berner, of Arpan, S. D., formerly a practicing physician in Chicago and in Iowa for a great many years.

"W. C. Staiger, of Newell, S. D., also Secretary-Treasurer of the Reclamation Dairymen's Co-Operative Association.

"W. Harry Phillips, of Newell, S. D., formerly cashier of Northwestern State Bank at Newell.

"Geo. A. McCall, of Newell, S. D.

"I can credit to the above named men no higher tribute than you have paid me, but they are entitled to as much."

IRON CANYON PROJECT REPORT ISSUED

AFTER years of talk, inspections and surveys, the United States Reclamation Service finally has issued its report on the Iron Canyon Project in the upper Sacramento Valley of California. It proposes an irrigation system to cover all the West side of the valley from Red Bluff to the Colusa line and also takes in 10,000 acres across the river from Red Bluff. The total acreage in the proposed project is approximately a half million acres. It surpasses in magnitude any project ever attempted on this continent.

The striking feature of the project as outlined is the great dam to be erected across the main Sacramento River at Iron Canyon, seven miles above Red Bluff, designed not only for storage of water for irrigation but as the main factor in the solution of the flood control problem. This dam is said to be feasible for both the rock fill and the masonry types, the former being the choice. But three heights are discussed with available storage above the level of the canal intake of 231,000, 420,000 and 603,000 acre-feet respectively. The estimated cost of the dam at these three heights is \$4,325,000, \$5,000,000 and \$7,575,000, respectively. Against all these estimates is figured the value of the flood control, the water power and aid to navigation, which, in the case of the largest dam, approximate the entire cost of the structure.

Ten separate plans for building the project are proposed, divided into two general classes: those providing protection of navigation interests and those which do not. Eight of the plans include the

dam, the other two contemplating simple diversions farther up stream.

The most comprehensive plan proposes a dam 134.5 feet in height with a capacity of 709,000 acre feet. It is believed that this dam will reduce the maximum flow of the Sacramento at that point from 275,000 to 100,000 cubic feet per second, a reduction in "Peak" of nearly two-thirds.

It is estimated that 70,000 horsepower may be generated at this dam. All the plans which provide for protection to navigation, contemplate a constant flow in the river below of not less than 4,750 second-feet. The value to each are estimated as follows: Flood control, \$5,000,000; navigation, \$1,400,000; power, \$4,067,000.

VOTE ON O. AND M. WORK

Because their present organization was not equipped legally to handle it, Water Users on the Shoshone Federal irrigation project in Wyoming, voted recently against taking over the operation and maintenance work. As soon as the Water Users' Association can be incorporated properly the farmers are expected to reverse their action, as investigation has shown that they can do this work themselves at a reduction in cost of about \$8,000 a year.

F. E. Myers & Bro., of Ashland, Ohio, have issued another of their Poster Calendars for 1915. The poster carries illustrations of the complete line of pumps and other machinery.

PINCHOT OPENS FIGHT TO RESTORE NEWELL

HERE is evidence that friends of F. H. Newell, deposed Director of the Reclamation Service, are endeavoring, through the press, to start another Ballinger-Pinchot affair, with Secretary of the Interior Lane and Newell as the leading lights.

No other than Gifford Pinchot, himself, seems to be the leader of this movement, and he has succeeded in getting the aid of Col. Theodore Roosevelt to touch off the first blast of publicity in a campaign, designed either to restore Newell, or to make a political issue out of his removal.

The *New York Herald*, under a Washington, D. C., date, and several other eastern papers have printed stories around letters, commenting on Newell's removal, which were written by Col. Roosevelt and Pinchot. Here is the *Herald* story:

Franklin K. Lane, Secretary of the Interior, has braved the criticism of Gifford Pinchot and the other conservation enthusiasts who first came into prominence during the Roosevelt administration, by the removal of Frederick Haynes Newell from the office of Director of the Reclamation Service, to which Theodore Roosevelt appointed him thirteen years ago.

Mr. Newell is known as the "Father of the Reclamation Service." He and Mr. Pinchot were prime movers in inducing Congress to pass the Reclamation act, which has resulted in the expenditure of \$90,000,000 under Mr. Newell's direction.

Mr. Pinchot, also an appointee of Mr. Roosevelt, was removed as Chief Forester of the United States by Mr. Taft for alleged insubordination after a sensational public controversy concerning the conservation policies of the two administrations. The famous Ballinger-Pinchot investigation resulted. Mr. Newell has, however, never taken an active part in politics and has remained in his position as Director ever since the organization of the service.

The *Herald* is unable to find that the removal of Mr. Newell is in any way connected with politics. Mr. Lane has not made public any explanation of his act, but there was apparently no open rupture between the two men. Mr. Newell has made no



Irrigating Tomatoes on Dr. L. D. Ewing's Farm at Terral, Okla. Courtesy of the Rock Island Railway.

of the Panama Canal.

If Messrs. Roosevelt and Pinchot make an issue of the removal of Mr. Newell, as seems likely, they may stir up some trouble for the administration.

Secretary Lane, however, has forestalled criticism to a large extent by appointing in Mr. Newell's place as Director of the Service Arthur P. Davis, recognized throughout the world as one of the foremost engineers, a close friend of Mr. Newell and a co-worker with him in the Reclamation Service during the entire period of his incumbency.

Secretary Lane has curtailed the authority of the Director, however, and appointed a commission to take over much of his work. This commission is composed of two officials of the service, including the Director, and three outsiders, all Democrats, appointed by Mr. Lane at large salaries.

Theoretically Mr. Newell is not dismissed entirely from the Service, but merely demoted. He will be a consulting engineer—one of four who are called upon to give advice on problems of construction that are arising constantly. But to those who are familiar with the workings of the Service he is as good as out entirely. As a consulting engineer he will be paid by the day for the work he does. Last year the four consulting engineers had work about half the time. One of these engineers has

statement for publication. It seems probable, however, that friends of Mr. Newell in the Progressive party will make a political issue of his removal.

Theodore Roosevelt and Mr. Pinchot have written letters to Mr. Edward Breck, an intimate friend and distant relative of Mr. Newell, in which they speak of Mr. Newell in the highest possible terms. The *Herald* has received copies of these letters. Mr. Pinchot makes this strong statement:

"Mr. Newell's removal is a blow not only to the efficiency of the reclamation service but to good administration throughout the government service, and especially to the morale of the government servants themselves."

He adds that his removal, "however concealed under the name of administration changes, is inexcusable."

Mr. Roosevelt compares his service to that of Colonel George W. Goethals, builder

resigned and Mr. Newell will take his place.

The three Democrats whom Mr. Lane appointed to membership on the commission are Will R. King, of Oregon, to be chief counsel with a salary of \$6,000 a year; W. A. Ryan, who had been employed on the Interstate Commerce Commission with Mr. Lane, to be Controller with a salary of \$4,000 a year, and I. D. O'Donnell, of Montana, to be Supervisor of Irrigation with a salary of \$20 a day, an allowance of \$6,500 for which is asked in the present estimates to Congress.

Friends of Mr. Lane insist that in order to get the best results from a tremendous government organization the views of

five men are better than one and that although there never has been a suspicion of graft, the expenditure of \$1,000,000 a month would seem to make a general supervision instead of an individual supervision preferred.

As Director of the Service Mr. Newell re-

ceived a salary of \$7,500 a year. Mr. Davis as chief engineer received \$7,000 a year. Under the scheme of reorganization the offices of director and chief engineer are combined, and after March 1 Mr. Davis will receive \$7,500 a year for filling both positions. Until March 1 Mr. Newell will receive the \$7,500 salary, then he will go on the per diem basis, \$25 a day when employed.

The change is not made to effect economy, however. There is created a new office, Chief of Construction. This post will be filled by S. B. Williams, one of the civilian engineers on the Panama Canal, who will receive \$6,500 a year.

Mr. Newell is fifty-two years of age. On graduation as a mining engineer from the Massachusetts Institute of Technology at Boston he went into the West as a member of the United States Geodetic Survey. There he met Mr. Davis, and a friendship started that has continued for more than a decade. Mr. Newell's friends assert that it is much easier for him to turn over the post of Director to Mr. Davis than it would be to any other man.

Under Mr. Newell the Reclamation Service built the highest dam in the world, the Shoshone dam in Wyoming, which is 328 feet high and 300 feet across the top. It forms a lake of ten square miles of water 150 feet deep, irrigating 150,000 acres of desert.



Irrigating Judge F. L. Martin's Orchard at Hutchinson, Kan.
Courtesy of the Rock Island Railway.

Under construction now is the Arrow Rock dam, in Idaho, which will be 351 feet high. Another one nearly finished is a dam across the Rio Grande in New Mexico, which will make the largest reservoir in the world, holding enough water to cover the State of Connecticut ten inches deep.

Probably the most spectacular of Mr. Newell's achievements is the Roosevelt dam, in Arizona, which is 284 feet high and 1,080 feet long on top, supplying 180,000 acres of the richest land in the world with water to make it possible to till. This dam is so wide that there is a roadway across the top. From a power plant operated there four cities

are supplied with electricity. The water held in check would cover the State of Delaware a foot deep.

In his letter to Mr. Breck concerning Mr. Newell's removal, Mr. Roosevelt says in part:

"For fourteen years I have followed at first hand the work of Mr. Frederick H. New-

ell. * * * During the eight years I was President he was one of my right hand men. It is too often the case in the United States that the men who are most prominent—who attract most attention—are inefficient or even vicious public servants, whereas the men who do the best work—work, I think, rather better than the work done by the public servants of any other nation—pass almost unnoticed and without any adequate reward.

"Mr. Newell belongs to that small group of invaluable public servants of whom the most prominent representative is Colonel Goethals. Public attention has been attracted to Colonel Goethals, although it is extremely unlikely that he will ever get any material reward such as his services if rendered to a nation like Germany or England, would infallibly bring; but public attention has not been attracted to Mr. Newell. * * * He has rendered the kind of invaluable service that Sir William Gosselin rendered to the British Empire in connection with the utilization of the waters of the Nile, and his work has been even more difficult. * * * He is a public servant of whom it is the bald and literal truth to say that by his service he has made all good American citizens his debtors.

"THEODORE ROOSEVELT."

Here is Mr. Pinchot's letter to Mr. Breck in part:

"Frederick Haynes Newell, who has recently been removed from his position as Director of the United States Reclamation Service, is in my judgment one of the two or three most useful public servants of his generation.

"Mr. Newell not only created the United States Reclamation Service after the passage of the Reclamation bill in 1902, but by years of patient investigation beforehand he laid the foundations of exact knowledge upon which the Reclamation Service was built and aroused the public sentiment which made it possible.

"Mr. Newell has not succeeded in being popular with that portion of the people of the West who want more from the government than they ought to get, and this is to his credit. No efficient guardian of the public welfare can be popular with the grabbers or the crooks.

"Mr. Newell's removal is a blow not only to the efficiency of the Reclamation Service, but to good administration through the government service, and especially to the morale of the government servants themselves. If a man with Newell's record can be treated as Newell has been treated the incentive to unselfish public service cannot but be lessened and weakened, and the whole government machinery must suffer, and in this case has suffered, accordingly.

"In conclusion I repeat that Frederick Haynes Newell is one of the two or three most valuable and most effective public servants of his time, and that his removal from office, however concealed under the name of administrative changes, is inexcusable, and that it constitutes a serious blow not only to the Reclamation Service but to the efficiency and integrity of the government service everywhere.

"GIFFORD PINCHOT."

A UTAH BOY POTATO CHAMPION'S OWN STORY

By HOWARD DALTON

A FIFTEEN-YEAR-OLD member of the Department of Agriculture's and Utah's Agricultural College Potato Club has raised a crop of potatoes valued at \$187.77 on one-half acre. His net profits were \$141.07. This is the best record of all the Utah potato club boys for 1914. The boy's own story of how he made this record, despite the fact that the year was not quite so good for potato production as usual, is worth reading. Here it is:

In the early spring of 1914 I bought my seed potatoes at Burley, Idaho. I purchased the Idaho Rural potatoes. They were not especially selected seed, therefore I was very careful in preparing the seed for planting. I was anxious that every seed piece had one or two perfect eyes on it. I then treated the seed with a formaldehyde solution (one pint to 30 gallons water). This treatment consisted in soaking the seed (before cutting) for two hours in the prescribed solution. The purpose of the treatment was to kill any scab germs appearing on the surface of the potatoes. Other than this there was no treatment given.

From March 20 to March 30 I prepared my land. I covered the ground with barn-yard manure, using 8 tons of wet manure to the half acre. I plowed the land 12 inches deep, using four horses for the work. I immediately followed the plow with a spring-tooth harrow. I harrowed it three different times. I did the plowing in the forenoon and followed with the harrow in the afternoon. I did this to conserve the moisture and mellow the soil. After harrowing, I pulverized the clods by dragging up the soil with a square framed timber.

H ERE is Howard Dalton's itemized cost and profit account on his record-breaking one-half acre of potatoes:	
Value of crop.....	\$187.77
COST—	
Value of manure.....	\$ 2.00
Spreading manure.....	4.00
Spreading manure.....	4.00
Plowing.....	1.00
Harrowing six times.....	1.50
Leveling	1.00
Cost of seed, 450 lbs.....	5.20
Planting seed.....	2.00
Cultivating two times.....	1.00
Irrigating three times.....	1.50
Weeding once.....	1.50
Harvesting	18.00
Rent on land.....	8.00
Total	<hr/> \$ 46.70
Profits	\$141.07

I tried in every way to be particular about every phase of cultivation as I figured that the secret of my success was good cultivation.

Five days later, on April 5, I again went over the land with a spring-tooth harrow. The following week I again went over it with a spiked-tooth harrow, which kept the soil moist and mellow. Just before planting I went over it again with the square timber in order to make it perfectly level.

On April 18 I planted the seed in plowed furrows 4 inches deep and the rows 30 inches apart, the seed

being dropped about 12 inches apart in the rows. The seed was then covered about 4 inches deep with a small hand plow. As soon as the little plants appeared above the ground I began my work on the field. I at once freed the field of weeds by giving it a thorough harrowing with a spiked-tooth harrow. This I did May 5 and repeated the same treatment on May 12. On May 26 I used the hand cultivator drawn by one horse, giving them a thorough cultivation with this implement, after which I cultivated them once with the hand hoe, cleaning out all of the weeds.

During all the time I was working in my potatoes I watched their growth very carefully, as I was warned about the appearance of plant diseases and insect enemies which might appear to injure the plants. Fortunately, as far as I was able to detect, neither plant diseases nor insect enemies appeared, as the growing plants had such a strong, thrifty appearance.

Up to June 15 the plants had grown rapidly and gave a strong, vigorous appearance. Soon after this date they began to blossom and on June 25 I

gave them the first application of irrigation water. I irrigated them on July 5 and again on July 20. The crop was matured with but these three applications of water. After the second irrigation the vines were so large that I could not work in them without destroying them. The operations practically ceased from this time on until the tubers were ripe and ready for digging.

I sent a selected 50 lbs. to the State Fair, which was held at Salt Lake City, October 3-10, for which I received honorable mention by the judges. On October 13, 14 and 15 I harvested the crop and the potatoes were weighed and sold right from the field. I found on careful checking of the weights that my half acre had produced 360 bushels of marketable potatoes, the equivalent of 720 bushels per acre.

WATER USERS' ASSOCIATION vs THE DISTRICT

A COMMITTEE of homesteaders on the Payette-Boise project has completed its investigations of the advantages of the Irrigation District, now urged by certain Reclamation Service officials as a substitute for the Water Users' Association. The committee's report is a most interesting document. It follows, in part:

"According to the laws of Idaho, 'All lands within the boundaries of an Irrigation District, including unimproved lands held for speculative purposes,' may be taxed equally for the construction and maintenance charges.

"Under the present Water Users' Association each acre of land in the project is bound separately to pay the construction and maintenance charges by the owners of said lands subscribing for stock in the corporation.

"At the present time the owners of approximately 60,000 acres of land within the boundaries of the Boise Project have not signed the stock subscription contract and therefore said land is not bound to pay any part of the construction or maintenance charges.

"The owners of approximately 100,000 acres of land within the boundaries of the Boise Project have signed the stock subscription contract. These lands are bound to pay the total cost of construction and operation.

"Therefore under an irrigation district 160,000 acres of land will be taxed for the construction and maintenance charges, instead of 100,000 acres under the present Water Users' Association. This will reduce the cost of construction approximately \$20 per acre, and the cost of maintenance will be reduced in like proportion.

"The existing stock subscription contracts are considered and held to be a first mortgage on the land. Land and investment companies that are required by law to invest their funds in bonds and first mortgages upon farm lands cannot use their funds on such lands.

"Under an irrigation district the cost of construction of the irrigation works is considered the same as a municipal bond and collected the same as state or county taxes. The title of the individual land owner is clear. The construction charge is not considered as a first mortgage, consequently the land companies are not prohibited from making loans upon such lands.

"In the formation of an irrigation district there is also some disadvantage that the land owners do not have to contend with under the present Water Users' Association. The laws of Idaho provide for

only three directors on the board of an irrigation district.

"The opinion of this committee is, that this will place too much authority in the hands of three men and that it is not a sufficient number of directors to give the district the proper representation.

"As an irrigation district is a public corporation, all qualified electors residing within the boundaries of said district can vote at any election, including an election held for the purpose of voting bonds. This permits an elector residing in the district, but not owning land, to have an equal share with the land owners in the management of the district.

IRRIGATE FROM ILLINOIS RIVER

Twenty acres near Marseilles, Ill., will be operated with an irrigation system this coming season by two Mendota men—E. B. Gephard and I. N. Clark. No, La Salle county, Illinois, is not becoming an arid or even semi-arid region, nor is this particular twenty acres of that character, but the men undertaking the project do so realizing the fertilizing properties of the Illinois River, from which they will get the water for irrigation. The twenty acres lies adjoining the river, west of Marseilles and a pumping station will be erected with a ten horsepower pump. About 1,500 feet of 4½ inch iron pipe will be laid to the higher points of the tract and irrigation made therefrom as in dry countries.

The land has been leased by Dwight E. Cooke for five years with an option on another twenty acres. Potatoes, cabbage, and truck gardening will be raised.

TELLS OF NEW JERSEY IRRIGATION

Milo B. Williams, of the Department of Agriculture at Washington, who has been supervising the establishment of irrigation plants in South Jersey, told of "Irrigation Progress in New Jersey" recently.

The overhead plant at Sea Brook Farm, near Bridgeton, has resulted in crops worth \$100,000 yearly, one acre yielding \$1,500, three crops being gathered from it. The plant at the Granville Leeds farm, at Rancocas, and the one at the training school at Vineland are also successful.

The present session of the New Jersey legislature is expected to take up several irrigation bills.

METAL FLUMES MEAN DITCH PERMANENCY

By GEORGE L. HESS

THE use of flumes was not so prevalent in the early community ditches as in the later irrigation systems which arose out of the flat valleys into the rougher country. Many of the bigger ditches have been built alongside rough hills interspread with draws and arroyas. Even in the smaller ditches now side hill construction is prevalent over the greater part of the ditch. Wood was the first material employed for flumes, because it was handy and moreover there was nothing else with which

must be easy to erect and simple in construction so that any farmer or ranchman can install it without previous experience. A thousand or more feet of smaller size metal flume can be put together in one day by two or three men. Metal flumes must be lasting. New and better grades of galvanized iron such as Keystone metal and Tonian metal have been placed on the market which resist rust and corrosion.

When flumes are made of these superior metals, fifty or more years' life has been considered a conservative estimate of their endurance. Unlike wood, metal flumes do not require any attention or expensive repairs. No water is lost. There is no danger of breaks and loss of crops. The sub-structure for a metal flume costs much less than for a wooden one. With the development and sale of such an



A 9-foot flume with a concrete intake, near Laurel, Montana.

to make them. They were used, just as were the hand churning prior to the development of the modern separator and are becoming a thing of the past just as the modern binder has replaced the hand reaper.

True the wooden flumes leaked—sometimes slightly, often like a sieve. Costly breaks in the flume would wreck it, causing heavy expense for rebuilding and the loss of water for the time required in repairing would even cause injury or loss of crops on thousands of acres of land. The first cost may have been cheap, but the heavy yearly repair bill, loss of time in attending to the flume, danger of breaks, loss of water, and necessity of replacing the wooden flume frequently made it the most expensive structure that has ever been used.

The patents issued to P. Maginnis of Kimball, Nebraska, and the subsequent patents issued to the Hess Flume Company of Denver made possible the replacement of wooden flumes with metal. To make an acceptable metal flume the following features are required: It must be absolutely water tight. No rivets, solder or other caulking material should be used. The Hess-Maginnis types fulfill this requirement by having a beaded overlapping joint which is made water-tight by an inner clamping bar pressed against an outer carrier rod. It



Another 9-foot flume with a metal apron intake on the lower Yellowstone federal irrigation project near Forsyth, Mont. Courtesy of Klauber Mfg. Co.

improved device, flumes have come to be used more largely in place of other types of construction. Where seepy side hill ditches were formerly built, watertight sidehill flumes have taken their places. It has been found cheaper and better to flume directly across arroyas and low places, rather than build a long ditch up to the head of the draw or around the low place. Ditch lines have been made straighter and shorter, saving in grade and enabling higher lands at the lower end of the ditch to be watered. Some ditch lines now consist mostly of durable water tight metal flumes.

The nestable clamping flumes are made in all sizes, from eight inches up to twenty feet in diameter. The United States reclamation service in Colorado is now installing a flume almost fifteen feet in diameter. Smaller sizes for farmers' use

(Continued on Page 123.)

CHEAP OIL MAKES DEEP PUMPING PROFITABLE

BY JULIUS BEEMAN

THIS is not intended as a technical treatise upon the oil engine, nor upon irrigation in California, but a plain matter-of-fact citation of present conditions and future prospects for the benefit of anyone contemplating coming to California in the future or already located in the Southwest and not as yet operating a developed property.

Probably no state in the Union has been so favored by Nature in climate and natural resources as California, and at this writing there has been comparatively little development of these resources in proportion to the total, but the immediate future forecasts a great influx from the East as well as from foreign countries.

While it is true that everything favors the settler in this state, it is not a fact that one without funds may make headway much better in California than elsewhere, it being just as essential that enough money be available here to start operations, check up and prepare land and install pumping equipment, as in any other state where government or cheap acreage may be had, there being, however, the advantage of an almost perpetual season, a ready market for all products of the soil, and climatic and soil conditions that are not equalled elsewhere, cheaper fuel and less necessity for expensive buildings, the winter temperature being mild enough to permit of using tents if necessary to house the settler until more comfortable quarters may be provided.

Up to the very recent past there has been land available where the water was close to the surface and plentiful, the first newcomers in any field choosing the location involving the least expendi-

ture. As a consequence it is only within the three or four years last past that there has developed inquiry as to how water could be delivered against a greater head for little enough cost to permit of competing with those more fortunately situated.

At the present time, and in the future, the real success will come to those able to work out their problems upon a strictly business basis. The man able to grasp the situation and work out the economies that may now be utilized through the improved efficiencies of equipment, the use of extremely cheap fuel oil, and the raising of crops that yield immediate return

while a portion of the land is given over to orchards and vineyards requiring a term of years to mature.

Probably the crop that will appeal to the majority will be alfalfa, because this is one California crop that offers not only quick but continuous returns, and the roots of matured alfalfa make about the best fertilizing medium known, and will add

from twenty to forty dollars to the value of every acre of soil, when other crops are planted, basing this estimate upon the prevailing cost of fertilizer. There seems to be quite a general idea that this crop requires so much water that it may only be successfully grown where an abundant supply is close to the surface, and one object of this article is to disprove this idea and show the possibilities under present conditions.

It must be considered, in the first place, that most of the land now under cultivation was chosen on account of the closeness of the water to the surface of the ground, that soil conditions, slope, drainage and other vital factors were not considered of moment when this land was chosen; also



A California Reservoir That Never Gets Empty and the Prosperous Looking Family of Farmers, Who Own the Pumping Plant and Reservoir.



A New Mexico Gusher. The Cuts Used With Mr. Beeman's Article Are From Photographs Made for the Bessemer Gas Engine Co., Grove City, Pa.

that the irrigation equipment that was installed consisted of inefficient pumps and engines using an expensive fuel and, in a large number of instances, the land under cultivation cannot be seriously considered as suitable for any other crop. The land so planted yielded fairly well for a time, as drainage in a new country is materially better than after it is settled up, for the manifest reason that the quantity of surface water increases in the low lands as adjacent acreage is put under cultivation, and the water frequently raises until the crops are drowned out. Alkali works up to the surface, and many irrigators, not being used to the scientific consideration of their problem, used water to excess and actually ruined their land for alfalfa or any other crop.

There is ample evidence of this waste of water in some of our older settled communities. Right adjacent to the city of Fresno may be seen many thousands of acres that at one time were considered as choice as any land in Fresno county and, were it not for the fact that the owners of this land were obsessed with the idea that the more water they used the greater crops they could grow, this land would still be under cultivation and of great value. As it is, it is nothing but an alkali waste.

Higher lands are always better drained; quite often they are more easily checked and levelled and the soil is superior in every way, less liable to frost, and may be planted to deciduous or citrus fruit and become in the course of four or five years immensely valuable. The raising of water upon these higher levels is not a serious matter, and it is well within the truth to state that it is possible now to pump water against a head of 100 feet for less money than the early settler could raise water 25 feet. In California this is well known and the statement is never questioned, but to anyone not conversant with the circumstances it may seem an exaggeration.

Water measurement used to be almost entirely by the miner's inch, but of late years an endeavor has been made to do away with this, owing to the fact that very few of the Western States use the same standard and for that reason the miner's inch will not be used here. The standard of measurement is the acre foot or the second foot, and to explain these two measurements, will say that a second foot of water is a flow equal to one cubic foot per second; that is, about $7\frac{1}{2}$ gallons of water per second or 450 gallons per minute, while the acre foot involves quantity only, being the amount of water necessary to cover one acre of land one foot

deep. This amounts to 43,560 cubic feet of water or 325,851 gallons. It takes a pump of the capacity of one second foot flow twelve hours and six minutes to deliver one acre foot of water, hence if we know the crop, the soil and water conditions it is a matter of very simple calculation to ascertain the size of plant necessary, the flow per minute and all pertinent facts in connection therewith.

With this information before us we will assume a specimen condition. For instance, a prospective irrigator selects 160 acres of land, and proposes to plant one-half to alfalfa during the first year, or figures that by the end of the third year he will have the entire tract in alfalfa, in the meantime setting out other crops that will come later into bearing. While the amount of water necessary to raise alfalfa varies with the soil conditions, it is fair to take $2\frac{1}{2}$ acre feet per season as the amount that will have to be pumped, in view of the fact that there is considerable rainfall throughout the State that may be depended upon to help out the irrigator during a certain season. This will mean

that enough water will have to be pumped during the season, which averages about two hundred days, to cover his 160 acres of land $2\frac{1}{2}$ feet deep, making a total of four hundred acre feet of water. In other words, this means that he will need a pump and enough power to deliver two second feet continuously, or two acre feet per day of twelve hours.

For the sake of making a specific showing we will assume that it is necessary to raise this water 60 feet. Now we will begin to demonstrate how it is possible for this man to make money under these conditions.

In the first place, if first-class equipment is purchased his plant will be 65 per cent efficient. Right here he is cutting down his cost as compared with old-style equipment because very few of the plants put in ten years ago were even 40 per cent efficient. He will need about 25 H. P. to elevate this water, and throughout the major portion of the State of California the oil will not cost over $2\frac{1}{2}$ cents a gallon, and this is probably the most difficult statement for the Easterner to understand, and it is necessary to go into a little bit of detail as to why this is so.

The California oil refineries are different in that they have to refine asphaltum base oil and in refining this oil they make several different products ranging from gasoline down to what is called fuel oil. This latter oil is a product of all refining processes in California and is produced in large

(Continued on Page 122.)



A Young Apple Orchard at Roswell, N. M. Kaffir Corn Has Been Planted Between the Rows.

WAR HALTS \$100,000,000 BOND PLAN, SAYS LANE

SECRETARY Lane will not press, for the present at least, his suggestion to Congress that \$100,000,000 in bonds be issued to raise funds to reclaim arid lands of the West. This vast fund, according to plans outlined previously by the Secretary and for which bills are now before Congress, was to be used to augment the present Reclamation fund, thus permitting completion of projects now under way; to finish projects partially constructed by other interests, and to build new irrigation systems pronounced feasible but for which private capital is not available.

The proposed bond issue was favored throughout the West, not only because it meant development for the arid states, but because of the work it would furnish to vast armies of unemployed. For the latter reason, the plan was also beginning to find substantial favor in the East. Administration demands for economy are believed to have put brakes on the plan, although the Secretary blames the war. He says in his annual report to the President and Congress:

"It had been my hope at this time to lay before you a plan or plans for the greater extension of the work of reclaiming the arid West. Some of these States richest in possibilities, which without doubt will in the future maintain dense population, must await the day of further irrigation. It is a misfortune to them that war has come upon Europe and closed the sources of those streams which reach even into the farthest and most arid parts of America. In conjunction with the governors of the Western States there has been formed an interstate irrigation commission. This body contains men of sagacity and high purpose, who have at heart the developing of a practicable plan of financing other great reclamation projects, to be constructed, perhaps, by the co-operative effort of the States with the Federal Government. Such plans, however, are not for this day."

To the settlers on the Federal projects the most important statement in the Secretary's report is his declaration that he has reduced the ratio of general



A metal-lath cement plastered silo in Southwest Texas.—Courtesy Santa Fe Railway.

expenses of the Reclamation Service from an average of 9 per cent during the preceding three years to less than 6 per cent during the calendar year of 1914. In discussing the Reclamation Service, the Secretary says further:

"In the 12 years which have elapsed since the passage of the act, large projects of water storage, diversion, and development have been

initiated, the principal works constructed, and water brought out to an extent sufficient to supply over 1,300,000 acres of land. The foundations thus laid and the works thus built are planned with a view to expansion to double this area, and it is possible with relatively little additional cost to extend or complete the details of construction until nearly 3,000,000 acres have been supplied with water.

"That a certain degree of success has been attained under the act is indicated by the fact that during 1913 the crop production on the areas already supplied with water exceeded \$15,700,000, and also by the further fact that during the spring of 1914 additional areas of heretofore untilled land were being subdued and brought into productive condition. This return of \$15,700,000 was received from over 16,000 farms from which the crop production was valued at an average of \$24.50 per acre.

"It should be borne in mind, however, that the total crop production of the year 1913 was burdened with charges due the reclamation fund for the fiscal year, amounting to nearly 16 per cent; that is to say, of the \$15,700,000 produced over \$2,500,000 was due to the United States under the terms of the reclamation law. The accrued charges for 1913 include water rentals on land as to which no construction charges had been assessed and also charges against land not under cultivation.

"The better knowledge of the opportunities and limitations of irrigation development, especially as brought out by a thorough study of actual crop production, has led to an appreciation of the fact that the average man on new land and under new conditions cannot develop the land, support his family, and at the same time return the cost of the water in as short a period as that previously estimated.

Effective agitation for extension of time of payment from 10 to 20 years resulted in the passage of the reclamation extension act on August 13, 1914.

"The reclamation act required originally that an irrigation project be built in each of the States named in the law; but in putting this requirement into effect two or more large works have been initiated in some of the States. The general plan pursued has been to lay out each project in a broad, comprehensive manner so as ultimately to utilize the available water and land to its full capabilities.

"But while this policy of carrying on simultaneously the construction of a large number of irrigation works and of inaugurating new ones without awaiting the completion of the old may thus be defended, there comes a point where such policy must of necessity cease. The resources of the reclamation fund are now overburdened and the projects under way cannot be completed within a reasonable length of time unless there shall be large accessions to the fund. The date of completion must be further delayed by the reduction of annual collections of construction charges by reason of the 20-year extension act unless there shall be found some other means for the replenishment of the fund.

"The initiation of new projects can now only be undertaken at the cost of certain delay in the completion of those under way.

"While interest is not chargeable to the users of Government irrigation works, nevertheless account should be taken of the loss of interest on this investment in determining the future construction policy. Every year of delay in completing and opening these works to the use for which they are intended causes a heavy loss, not only of interest on the sum invested but in the annual depreciation of such portions as have been completed or partially completed. The annual maintenance of partially completed works is a heavy charge. A net investment of \$84,000,000 with interest computed at only 2 per cent involves an annual charge of \$1,680,000. The total accruals of construction charges for the fiscal year 1914 amounted to only \$1,340,435.66. The amount collected was only \$251,679.64. Every consideration urges the wisdom of early completion of works now under way and the most speedy possible realization of that moment when all the reclamation land under such works shall be made productive and contributory to the reclamation fund."

COST FAR ABOVE ESTIMATE

The Land Owners' Association of the Lower Yellowstone Federal irrigation project in Montana and North Dakota has taxed its members to pay the expenses of a representative to be sent to Washington. He will be authorized to demand a full explanation from government officials as to why the cost of the irrigation work has, up to the present time, exceeded by nearly \$2,000,000 the original estimates of the government.

The original estimate of the cost of the irrigation project was \$1,800,000. Bids on the work were even lower than that estimate, but at the present time the accounts covering the project show about

\$2,000,000 above the original estimate having been expended, according to the annual statement of the Land Owners' Association.

Another striking feature of the statement is shown in the fact that operating expenses for the past year have been reduced to approximately \$25,000, in addition to an annual overhead expense sustained in connection with the work at Washington of \$12,500.

Only a few years ago the maintenance cost was \$90,000, the reduction having been effected through economic methods suggested by the land owners themselves.

At the present time there is a total of \$400,000 accumulated operating expenses against the project. The question of what to do to retire that charge will be considered by the association during the coming year.

IRRIGATES VERMONT ORCHARD

C. T. Holmes, who owns a noted apple orchard in Charlotte, Vt., has just purchased of Fairbanks, Morse & Co., of New York, a 40-horsepower engine, with duplex pump with pumping capacity of 900 gallons a minute to be used in furnishing water to irrigate his orchard.

The orchard lies on the shore of Lake Champlain, and the water will be pumped from the lake. Mr. Holmes will lay about 4,000 feet of pipe with an eight-inch main and laterals running from six to two and one-half inches. The outfit is to be installed and ready for use June 1, 1915, and will be used to irrigate 90 acres of the orchard next year.

Mr. Holmes was the first orchardist in Vermont to advocate and successfully put into effect the spraying and cultivation of an orchard, and is now the pioneer of New England in installing an irrigation plant on such a large scale.

The enterprise will be watched with a great deal of interest by all the Eastern orchardists.

CANADA MENACES PROJECT

Again international complications threaten the Milk river project in Montana. The question of the division of the waters of St. Mary's and Milk Rivers is now before the International Waterway Commission and new demands are being made by the Canadians. The treaty provided for the division of the waters of the two rivers in certain proportions. It was the understanding of the parties to the treaty on the American side that the division should be made at the boundary line where the two rivers cross. Now the Canadians want the water measured at the mouths of the two rivers and divided according to those measurements. The treaty between the United States and Canada respecting these waters was approved in 1909.

IMPERILS APPROPRIATIONS

Speaker Clark has ruled that the bill carrying appropriations from the reclamation fund aggregating \$13,000,000 should be referred to the committee on appropriations and not to the committee on irrigation. The western congressmen fought to have the irrigation committee consider it, as they believe the appropriations committee less friendly.

URGE STATE TAX FOR OREGON IRRIGATION

THE Oregon Irrigation Congress, which met recently in Portland, Ore., took a number of important steps to further irrigation in that state.

Officers were selected as follows: President, Asa B. Thompson, Echo (re-elected); secretary, Fred N. Wallace, Laidlaw (re-elected); first vice-president, J. W. Brewer, Redmond (re-elected); second vice-president, John Rigby, Vale; third vice-president, A. M. Crawford, Salem.

Following is the substance of the resolutions which were adopted:

Legislation urged to levy one-half mill tax on all property in state for irrigation development.

Constitutional amendment giving state authority to issue bonds for irrigation development is recommended.

Legislature asked to memorialize congress, urging law permitting all natural federal resources within the state to be used for sole purpose of raising funds to co-operate on dollar-for-dollar basis with the state in developing these resources.

Federal government urged to give Oregon its just share of reclamation fund.

Federal government urged to guarantee bonds of accredited irrigation districts.

Policy of national secretary of agriculture enabling counties to collect money from federal government with natural resources as security endorsed.

Federal reclamation service asked to give state free use of its maps, data, water measurements and other statistical information.

Legislature asked to extend payment periods for Tumalo settlers.

Recommendations of Secretary Lane, of the Interior Department, for uniform irrigation laws in various states approved.

Irrigation bonds urged as proper subject of investment for state funds.

Irrigation districts should be given self-government powers similar to those of municipal corporations.

Amendment to state law giving corporations holding title to land within districts right to vote on district affairs.

Repeal of law fixing tax on water power filings urged.

Law recommended giving irrigation districts right to sell surplus water power.

Drainage code asked from legislature.

Federal rural credit banking law recommended with centralized national banks as basis of system.

State and federal government urged to co-operate in investigating following proposed irrigation projects and printing reports on same: Lower desert project, Tygh Valley-Wamic project, peninsula district between Deschutes and Crooked rivers, Harney valley districts of 250,000 acres, Silver Creek project of 50,000 acres, Malheur warm springs reservoir project, Dead Ox Flat district, Ochoco and other districts.

Legislation making possible early completion of North canal unit of central Oregon project urged.

Action upon North and West sides units of Deschutes project invited.

NEBRASKA FARMERS TO IRRIGATE VALLEY

FARMERS in the Lodge Pole valley, Cheyenne county, Nebraska, have organized an irrigation association with the following officers:

A. G. Newmann, Chappell, president.

Chas. High, Potter, first vice-president.

Fred Likmkuhl, Lodge Pole, second vice-president.

H. F. Doran, Sidney, treasurer.

R. A. Blake, Sidney, secretary.

The farmers are determined to raise the value and producing power of their lands by irrigation, and at their first meeting proved a most attentive lot of listeners to the experts who addressed them. W. V. Hoagland, father of much of Nebraska's irrigation legislation and former state senator; H. C. Dieson, a government engineer, and Everett B. Murray, a prominent engineer of Kansas City, Mo., were among the speakers.

The total amount of land contained in the Lodge Pole valley amounts to approximately 100,000 acres. Lodge Pole Creek, which runs down the center of this valley, is a small stream carrying little water, and by throwing dams across it, it is only possible to obtain sufficient water to irrigate comparatively small tracts of land immediately adjacent to the creek. It has, however, been clearly demonstrated as to just what this land will do if

properly irrigated, and the results are not only surprising, but extremely gratifying.

Land which by dry farming methods will raise but one ton of alfalfa to the acre and give but two cuttings a year, will raise three or four tons to the acre and cut from three to four times a year. Land now selling for from \$20 to \$30 an acre could be increased in value, by the expenditure of from \$15 to \$20 an acre for irrigation, to from \$80 to \$100 an acre as a reasonable selling price.

The proposition of irrigating this valley is a thoroughly practical and an economical one. There is an inexhaustible supply of sub-surface water which ranges from 25 to 40 feet below the surface of the ground in the valley.

GOULDS MAKE NEW PUMP

The Goulds Manufacturing Company of Seneca Falls, N. Y., has just completed a pamphlet describing their new Multi-stage Centrifugal Pumps. These pumps are designed for installation where the head is greater than can be dealt with efficiently by a single stage pump. Bulletin No. 119, another Gould booklet, just off the press, is a decidedly valuable document for those interested in centrifugal pumps.

CHEAP OIL HELPS PUMPING

(Continued from Page 118.)

quantities. The asphaltum has been extracted to a great degree and there is only left from 12 to 15 per cent in the oil and this is readily consumed as a fuel. A 25 H. P. engine designed to use this by-product will use less than three gallons of this cheap oil an hour, and as it takes about six hours to pump one acre foot of water the fuel cost per acre foot will be about 45 cents. We figured that he would use $2\frac{1}{2}$ acre feet per year per acre so the fuel costs for irrigating one acre of land will only be about \$1.10 or \$1.15 a year. Anyone that knows anything about costs of irrigation knows that any crop can be grown profitably if water costs twice as much as this, and if one will only investigate the situation prevailing amongst those occupying lands where the water is near the surface, it will be found that the poor equipment that was put in some years ago will operate only upon fuel costing several times as much as the fuel oil that certain engines now use.

It may appear strange, but it is none the less true, that Eastern manufacturers realized the necessity of building engine equipment that would use this low grade fuel before builders in California awoke to this necessity, and at this time the only engines available in the West that will use the heavier grades of asphaltum base oil are Eastern built.

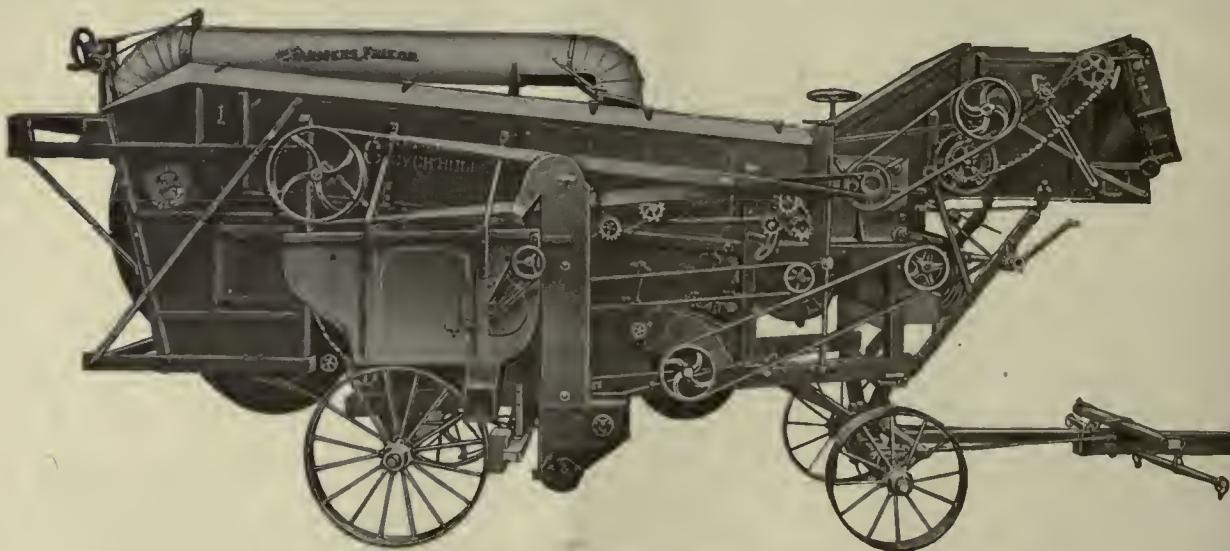
To summarize the situation in a few words, California has limitless thousands of acres of the choicest land awaiting development under ideal climatic conditions, ample water supply, the cheap-

est known fuel, and the markets are clamoring for what California alone can supply. The best and wealthiest cities in the irrigable valleys were struggling rows of buildings along the line of the railroad with nothing but desert stretches north, south, east and west, not so many years ago, and it is to be borne in mind that new towns are started and grow to healthy, well built, well governed cities with excellent schools and all that goes to make any city worth while, in the space of a few years, and land values in and around these oases increase rapidly, but consistently, and seldom decrease.

Small tracts are appealing strongly to many of the more recent investors and the old idea that the income from a farm or ranch was in proportion to the acreage is gradually giving way to the newer theory that a smaller tract handled properly, planted to any of the scores of money-making products of the soil, involves less initial cost, less labor and better returns. Ten acres of the right crop in the right section is all anyone really needs, although a majority prefer as much land as their pocketbook will permit of their buying.

To be truly independent, regardless of the acreage involved, the water supply should be secured from under the land itself. Small pumping plants are just as practical, and in proportion to their size, are just as economical as larger installations. Cheap fuel oil is now available in practically any section of the State.

To aid prospective settlers in the cheap-oil pumping sections of California, the Bessemer Gas Engine Company recently has opened a Bureau of Information at 908 South Olive street, Los Angeles.



HULL YOUR SEED QUICKLY, PERFECTLY and ECONOMICALLY With a
"MATCHLESS" CLOVER and ALFALFA HULLER

That's just what you will do if you use a "Matchless" Huller on the job. It's the one huller that will hull all the Clover or Alfalfa you can get to it without sacrificing the quality of the work. Here's the reason! We use square steel brads in our hulling cylinder. This construction has every advantage over rasps of spikes, because no set of spikes will knock the seed out of the damp pods. Rasps gum up and are easily destroyed. Our system of separation is unique and effective. This consists of a series of rotating troughs with perforation in the bottom, with provision for adjustment to meet the various conditions of clover. The Patented Steel Scrapers attached to the bottom of these troughs thoroughly scrape the separator bottom and insure a steady and positive delivery of the pods to the hulling cylinder, regardless of the condition of the clover. This construction enables you to hull seed under conditions in which no other huller can operate; enables you to hull earlier in the morning and later in the evening than with any other—this insures a longer day, thus increasing your earning power. Give us an opportunity to prove to you right on your own farm that the "Matchless" is the speediest and cleanest huller on the market. WRITE FOR CATALOG TODAY, or call at our nearest Branch House.

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BRANCHES: Minneapolis, Minn.; Portland, Ore.; Lincoln, Nebr.; Kansas City, Mo.; Wichita, Kan.; Decatur, Ill.; Indianapolis, Ind.

METAL FLUMES MEAN PERMANENCY

(Continued from Page 116.)

are made with joints ten feet apart, larger sizes with joints approximately three feet apart. The superiority of metal flume used as canal lining is demonstrated by the following established facts: Miles of metal flume have been used to replace concrete lining, showing its superior durability. It is cheaper than concrete. It may be run directly from the earth section to trestling, across canyons, arroyas, or streams, greatly reducing the length and saving in grade. Rock cuts may be avoided by detouring on a low substructure instead of benching or cutting through where rock is encountered. It is easily adapted to any and all conditions where open channel construction may be used. It is not affected by alkali, freezing, settling, expansion or contraction. It is easily and cheaply installed with unskilled labor.

It conserves the water, insures uninterrupted service and reduces maintenance cost to the minimum. It is semicircular in form and has greater carrying capacity for the same cross section than any other type of canal lining; this capacity does not decrease, due to formation of vegetable growths, as in the case of concrete. The cost is less because of its smooth interior. A much smaller cross-section is required as compared with the earth section, reducing excavation by at least one-half, which in some cases equals the cost of the lining. Under conditions where it is necessary to run on a low grade, the same size section will give a much larger capacity than the corresponding earth section. We have come now to the point in our irrigation progress when more permanent structures are a necessity and from this time on they will be adopted instead of depending upon the slipshod contraptions of the pioneer days. Science has done a great deal in developing more substantial materials for construction.

RAILROAD GIVES SETTLERS \$25,000

What amounts to a gift of \$25,000 was received by about 40 settlers on the Umatilla Federal project in Oregon from the Northern Pacific Railroad Company recently.

In other words, all contract holders with the railroad in good standing will be relieved of further payments, provided they have paid certain amounts

recommended by the project engineer and that they will comply with the requirements of the Department of the Interior as to cultivation and reclamation. The amounts unpaid vary from \$500 to \$1,000 on each contract.

The result will be the development of several hundred acres of new land during the coming spring. Half of every tract must be improved in some permanent crop by October 31, 1915, when, on satisfactory proof, deeds will be issued.

STUDIES BOUNDARY PROJECT

Henry P. Corbin, of El Paso, consulting engineer for the United States boundary commission, and a corps of engineers has begun making observations on the Lower Rio Grande to devise if possible a method of perpetuating the immovable boundary line by storing flood waters with a view to constructing an immense gravity irrigation project that, it is estimated, may cost \$15,000,000 to \$20,000,000. An organized effort is being made along the lower Rio Grande section to have the government undertake the project. New treaties with Mexico will be necessary. The observations now under way will be made from the gulf to Devils River.

Mr. J. W.
Lough, Scott,
Kan., writes:

"My 60 H.P.
Charter Type
"R" Oil Eng-
ine burns
about 100
gallons of oil
every 15 hrs.,
costing 2½c
per gallon
laid down in



This flow of water is pumped by Mr. Lough's
60 H. P. Charter Oil Engine

Submit your irrigation problem and we will help figure it out for you.

Operates on Distillate, Kerosene and Gasoline, fuels that are obtainable at all times.

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THE TENT-COT
OPEN AND FOLDED

above the ground under a storm-proof covering that enables you to use the Tent-Cot every night in the year, and all the doors and windows are fitted with both storm and mosquito curtains that can be raised and lowered at will of the occupant. For anyone afflicted with lung trouble there is nothing equals the Tent-Cot. It also has a splendid appearance and can be set up on your porch, lawn or roof and taken down when not in use. Can be set up in a space 30x78 inches and only requires about 30 seconds to operate. It is ideal for hunters, fishers and campers as it eliminates all the annoyance of "making camp." With a Tent-Cot you carry your camp with you under your arm and sleep safe and sound any place.

SPECIFICATIONS—Length of cot open, 6 ft. 6 in.; width of cot, one person, 28 in.; width of cot, two persons, 44 in.; height of bed from ground, 17 in.; height of tent over cot, 32 in.; size of cot folded, for 1 person, 28x36; size of cot folded, for 2 persons, 44x56; weight, 1 person, 29 lbs.; weight, 2 persons, 44 lbs.; frame is of hard maple, painted green; covering is of heavy waterproof canvas in colors, tan or olive green.

PRICE—Tent-Cot 28 in. wide, open 1 side, \$9.00; Tent-Cot 28 in. wide, open 2 sides, \$9.50; Tent-Cot 44 in. wide, open 2 sides, \$11.50.

Manufactured Exclusively by **ENTERPRISE BED COMPANY, HAMMOND, INDIANA**

YOU SHOULD USE The Enterprise Tent-Cot

"The Perfect Outdoor Bed"
For Porch, Lawn or Camp

The Enterprise Tent-Cot will protect you from all the discomforts and dangers of sleeping out. You sleep 17 inches off the ground, 17 in.; height of tent over cot, 32 in.; size of cot folded, for 1 person, 28x36; size of cot folded, for 2 persons, 44x56; weight, 1 person, 29 lbs.; weight, 2 persons, 44 lbs.; frame is of hard maple, painted green; covering is of heavy waterproof canvas in colors, tan or olive green.

BRIEF NOTES FROM IRRIGATION PROJECTS

Idaho

The annual election of officers of the Twin Falls Canal Co. at Twin Falls, Idaho, on Jan. 12, resulted in a change of control of the board of directors, which will leave the position of manager open to candidates of experience and ability. The system comprises about 200,000 acres.

A meeting was held recently at Homedale, Idaho, for the purpose of organizing an irrigation district. The proposed district will get its water from Succor Creek and will cover all or nearly all the land which is exempted from the present Gem District. There will be about 10,000 acres served by this district.

Arizona

John Schock, Wichita, Kan., is at the head of a syndicate that has just been formed with a capital of \$750,000 to bore wells upon a tract of 25,000 acres of land near Chandler, Ariz. Pumps will be installed upon each well and the water used for irrigation. The other members of the syndicate are Eugene Kelly, Los Angeles, Cal.; J. R. Rittenhouse and Eugene Detweiler, Phoenix, Ariz.; O. S. Stapley and Paul B. Beville, Mesa, Ariz., and W. H. Renck, Higley, Ariz.

California

The pumping plant installed by J. H. Ramm on his place on the west slope of Smith mountain near Dinuba, Cal., is the first of its type to be installed in the valley. A 12-inch well has been bored to a depth of 180 feet, at the foot of the hill, and a triplex pump installed in the pit, the walls of which have been concreted. A tractor, which can be used for cultivation, as well as to furnish power for the pump, will be a feature new to irrigation plants. The tractor will furnish power enough to pump approximately 1,000 gallons per minute to the highest point on the place, which is 160 feet above the water level. The use of the tractor in cultivating the land will reduce the cost very materially, requiring only one man to plow and care for the entire farm.

The Commonwealth Club of San Francisco has promised to consider what it can do to promote the sale of irrigation bonds in order to give work for the unemployed in the Oakdale and South San Joaquin irrigation districts of California, where bonds are being offered for sale, with few takers because of the stringency in the money market. If the \$400,000 bond issue recently authorized by the voters can be placed at an early date, the system will be extended to lands now without water.

The Platt Investment Company of Pasadena, Cal., has contracted to install a 300-foot centrifugal multi-stage pump on their land near Rialto. The water conditions in this district are said to be exceptionally fine and an excellent supply of water should be

produced. The Layne & Bowler Corporation of Los Angeles are installing the pump.

Plans are under way for the development of the Carizzo valley of California, consisting of more than 20,000 acres of exceptional fertility, lying on the western edge of the desert, on or near the line of the San Diego & Arizona Railway between the Imperial valley and San Diego. The fine soil of this district has for a long time tempted settlers and many attempts have been made to secure water for it. An association is being formed for the purpose, to be known as the "San Filipe River & Carizzo Creek Development Association." It is composed of actual land filers in the valley. Attempts will be made by the association to store the waters of the two streams mentioned and use it for irrigation. These streams, during certain parts of the year, are full of

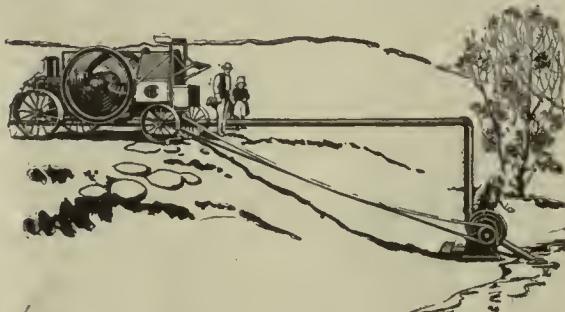
water and there rests no doubt that a reservoir can be built to hold it.

In conformity to the views of the California Railroad Commission as expressed in a letter to Jesse W. Lilenthal no money of the United Railroads, according to a statement made by Lilenthal, will be invested in any scheme to rehabilitate the Solano Irrigated Farms. That his plan for the reorganization of the land project will be carried out by private enterprise in which the stockholders of the United Railroads Investment Company of New Jersey, the United Railroads Holding Company, will take a prominent part, was also indicated by Lilenthal.

Oregon

Approximately \$250,000 will be expended by the Western Land & Irrigation Company in the construction of a reservoir and irrigation ditches in Umatilla county, near Echo,

International Harvester Engines for Irrigating



WHEN you put in an irrigating plant of your own, the most important thing to get is an engine that will run your plant at any time you want water. Make the safest selection and buy an I H C oil and gas engine—Mogul or Titan.

An I H C outfit delivers the most power on the smallest fuel consumption. It uses the fuel that is cheapest or most convenient for you to buy. In case of accident you can get repairs in a few hours.

The same engine may be used for running a saw, cream separator, feed grinder, hay press, or any other machine to which power may be applied.

I H C engines are made in sizes from 1 to 50-horse power and in styles suitable for every form of irrigating outfit or for general farm work.

The I H C local dealer near you should be able to show you I H C engines. If he cannot, write us, and we will tell you who handles them.

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U.S.A.



Ore. Surveys for the reservoir in Alkali Canyon have just been completed. The canyon is about a mile from Echo.

The Oregon State Engineer has been asked to withdraw Badger, Three Mile and Gate creeks, in the Wamic-Tygh Valley district, for the purpose of an investigation as to the cost and advisability of the construction of a system of reservoirs, which is proposed so that more water may be secured for irrigation and domestic purposes.

Texas

The suit of the Grandfalls Irrigation Company vs. The Imperial Irrigation Company came up for trial recently at Barstow, Texas. About \$25,000,000 worth of property is involved and the result will be most important to the future development of the Pecos river country.

The Markham Irrigation Company is making some extensive improvements by extending its canal some distance into the Ward Cattle Company's property south of the LeTulle & Collins farm near El Maton, Texas. The Ward Cattle Company has about 7,500 acres of very choice land and is putting in about 2,500 acres in rice this year.

The Texas state board of water engineers has issued permit to the Toyah Valley Irrigation Company to divert and impound 41,400 acre feet of the flood waters of Toyah and Sandia creeks and their tributaries to irrigate 13,800 acres of land in Reeves County. This is a \$250,000 enterprise, with Sol Mayer of St. Louis as president and Richard P. Head of Balmorhea, Texas, as secretary. A. M. Anderson was given permit to divert 4,000 acre feet of water from Blue Creek to irrigate 2,000 acres in Matagorda County.

Montana

Settlers on the project of the Tongue River Canal and Irrigating Ditch Company of Montana, have made a lease providing for the use of the water from the ditch during the 1915 season. It provides for the use of the water on the basis of a rental

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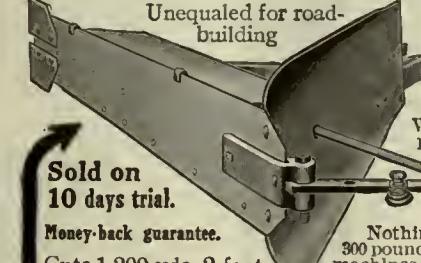
your land properly. It is used and endorsed by farmers from coast to coast, because it is the most

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at 6 per cent on the water right of \$20 per acre and the maintenance of the ditch during the season. If the land owners decide that they wish to purchase the ditch, an understanding is had with W. B. Jordan, the owner, that the lease may be abrogated. The price of the project has been fixed at \$195,000.

The report of the Montana state



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10 days trial.

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Cuts 1,200 yds. 2-foot
ditch in one day with
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engineer, as secretary of the Carey act land board, shows that since the establishment of the board there have been sold to settlers on the Billings project 10,113 acres, on the Big Timber project 4,894 acres, and on the Valier project 32,760 acres.

Two new projects have been approved by the board since the report of two years ago. The Flatwillow project of 7,768.80 acres, in Fergus

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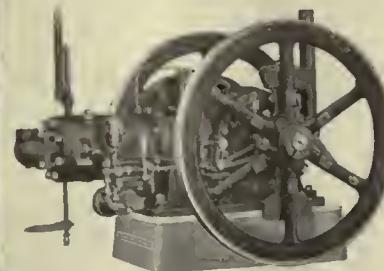
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county, and the Little Missouri project of 20,607.98 acres, in the southeastern part of Fallon county. The Ruby project in Southern Montana and the Musselshell project, along the river of that name, have been canceled. A temporary segregation has been made, embodying part of old Red Rock and the Ruby projects, to determine the feasibility of the scheme.

"There seems to be a tendency by the public at large," says the report, "from some unfavorable conditions that have arisen in the past, to doubt the water supply of all Carey projects. Montana has, however, been taking every precaution to guard against such a condition arising in this state. The companies have been notified that before their work or water supply will be accepted they must be prepared to have the hydrographers of the state engineer's office report upon their capacities, from actual current meter measurements taken on the system in actual service."

Utah

The suit to determine the water rights on Logan river in Utah, which has been in sight for some years past, has been filed. The title of the suit is: The Thatcher Milling and Elevator Company, The Hyde Park Irrigation Company, Logan North Field Irrigation Company, Logan Northwest Irrigation Company, Benson Irrigation Company, Logan Island Irrigation Company, Providence and Logan Irrigation Company, Providence Pioneer Irrigation Company, Logan Hollow Canal Company, Seventh Ward Irrigation Company, Anderson and Sons Company, Central Milling Company, Logan Stone & Monument Company, William Affleck and H. Sumner Hatch vs. The Logan & Northern and The Logan, Hyde Park and Smithfield Canal companies.

Wyoming

C. E. Howell, member of the Wyoming state board of water control and local manager of the Eden Valley Irrigation Company, states that the first unit of the big irrigation project, including a dam to divert the waters of the Big Sandy river to a reservoir that has been constructed, has been completed. The building of main canals and laterals sufficient to irrigate 21,000 acres of land is also finished. It is proposed to begin at once a campaign to induce settlers to locate on the tract and with the settlement of the 21,000 now under irrigation other units of the plant will be built until the 90,000 acres under the project are made susceptible of irrigation.

An old proposition which, if carried out, will mean much to Sheridan, Wyo., and the entire Sheridan county, is being revived; men of means are becoming interested; and there is every possibility that the project may be carried out. The proposition is that of converting Lake DeSmet, in Johnson county, into an immense storage reservoir, the water impounded there to be used in irrigating a vast tract on Clear creek, other lands on Piney creek, and reclaiming a big area on Dutch creek and Prairie Dog, in Sheri-

dan county. Edward Gillette, who has had charge of the project for a great many years, states that he has lately received word that a number of Denver capitalists, some of whom are already interested in Sheridan county property, are looking into the proposition and that they sent a representative to Chicago to interview others who are interested.

Sidney E. Bartlett, manager of the Fremont Lake Irrigation Company, announces the completion of the canal

which will irrigate 10,000 acres around Pinedale, Wyo.

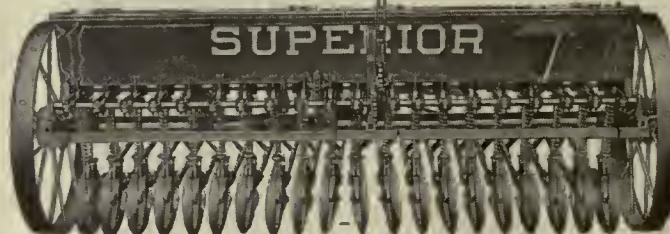
After years of delay, caused by the failure of the Wyoming Central Irrigation Company, work on the reclamation of rich ceded Indian lands in the vicinity of Riverton, Wyo., has been resumed. The Riverton Ditch Company, of which J. A. Delfelder, mayor of Riverton, is president, has undertaken construction of an extension of the Indian department's Edmo

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St. Claire ditch which will reclaim 15,000 acres. One hundred teams now are at work on the new project. It is anticipated that water will be on a portion of the land in time for cultivation next spring.

Kansas

Farmers of Morton county, Kan., have asked the United States Government to erect a demonstration plant along the Cimarron river to prove the economy of irrigation with tiling. The federal government has a reservoir site in Oklahoma and that state is attempting to appropriate sites along the river and threatens the exhaustion of the water before it reaches the Kansas line, so that if the benefits of sub-irrigation are to be secured for Kansas, federal protection of Kansas rights is necessary. The Cimarron has an abundance, and, as the floods of a year and two years ago showed, an excess of water at times for irrigation of large areas of land.

To make the land of the Arkansas River valley around Arkansas City, Kans., as valuable as that of the irrigated lands of California, Colorado or the Rio Grande valley is the purpose of a number of citizens. By March 1 about 500 acres of valley land will be under irrigation ditches supplied with water by modern pumping plants from the river bed gravel flow along the banks of the Arkansas river.

In Arkansas City there is now being installed a complete Skinner system of overhead or sprinkling irrigation by the Henneberry Company

covering two acres of rich valley land and this tract will be under the management of G. E. Martin, a practical truck gardener and scientific farmer. This plant will operate a series of hot houses in connection with the sprinkler system and will demonstrate the fact that from \$2,000 to \$3,000 per acre can be made annually on a small truck farm by intensive cultivation.

The Arkansas City Commercial Club is giving these matters much attention, believing that in no other manner can so much substantial good be accomplished for a community and this organization confidently expects to see valley farms susceptible of irrigation advance rapidly in price and the agricultural output of such farms increased several hundred per cent.

Washington

Work on the White Stone irrigation project in Washington will be vigorously pushed forward as soon as weather will permit in the spring. A contract for 1,000,000 feet of flume timber has been let. This will be used in building the flume from Toats Coulee creek to the land that is to be watered under the project. This project includes a large area of fine bench land in the White Stone lake district of moderate elevation and when completed promises to be one of the richest and most attractive irrigated districts in Okanogan country.

The purchase of the controlling in-

terest in the Loon Lake irrigation company by O. L. Olson, secretary of the Arcadia Orchards company, it is believed, means absorption of the holdings of the former company by the latter and the end of litigation pending between the companies. Both have extensive irrigated orchard lands in the vicinity of Deer and Loon lakes in Stevens and Spokane counties, of Washington, and both secure water from Deer lake. A suit is pending in superior court in which the Loon Lake Irrigation Company seeks to quiet title to water rights on Deer lake. The Loon lake company alleges that a contract entered into by it and the Arcadia company has been violated by the latter, and it seeks to have the water rights restored to it. E. H. Becker, president of the Loon lake company, and Evan Morgan, vice-president, have sold their stock, and H. R. Mann secretary-treasurer, is the only officer remaining.

Foreign

The Argentine government has approved the plans and estimates for irrigation works in Huillapina and Capayan in the Province of Catamarca. Approximately 500,000 acres will be included in the project.

Five acres of tea will be planted this fall at Bentz, near Oroville, Cal., by Tyson Lockerman. A portion of the plants will be set out on non-irrigated land to determine whether the tea can be grown without irrigation.

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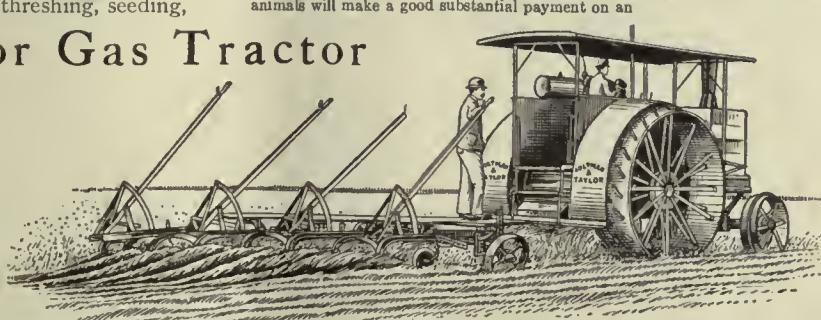
hauling, etc. In fact, it will save you money at every power job, large or small, on the farm, and the beauty of it all that it is, costs you nothing when not working.

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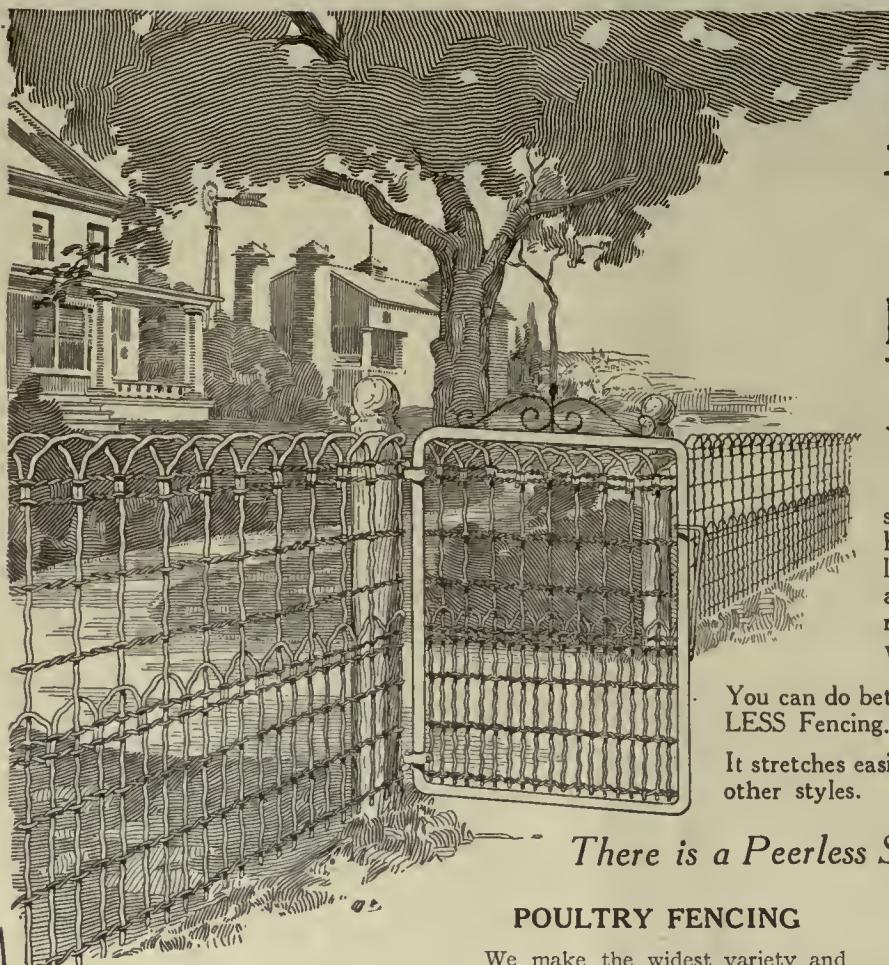
and then you can farm better, cheaper, and with more satisfaction. You can get your seed bed ready when the ground is in prime condition. You can sow when conditions are just right, and you can gather your crops when they should be gathered. All this, and lots more can be done quicker, cheaper and better than you can do it with horses. You'll be astonished at what can be accomplished with this great tractor. No other tractor can give you such wonderful results—such entire satisfaction, for the simple reason that the Aultman-Taylor Gas Tractor is particularly adapted to the power needs of the farm—built for this particular work at no spared pains or expense. It's the tractor that makes good everywhere at all kinds of work. The Aultman-Taylor burns either gasoline or kerosene under all loads. Go see this great tractor work. There's



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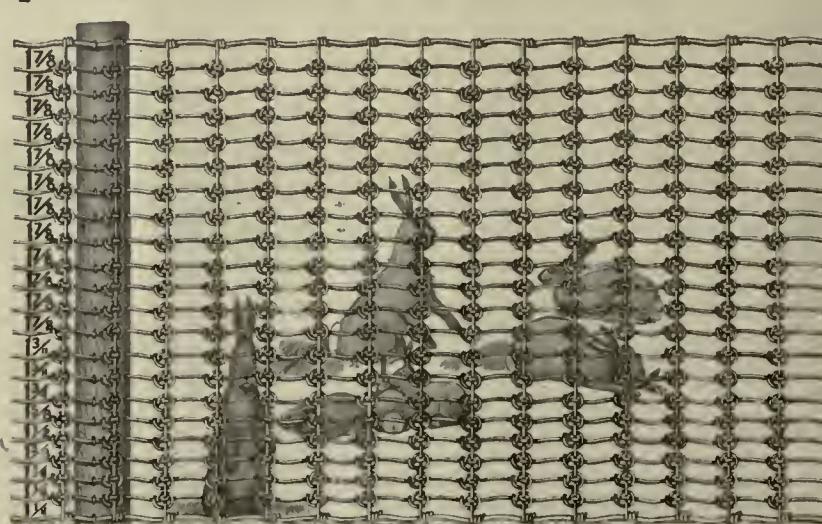
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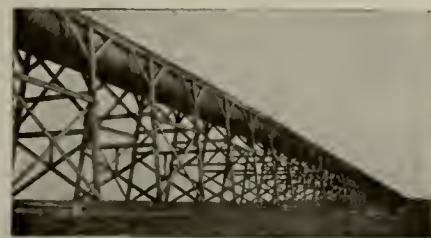
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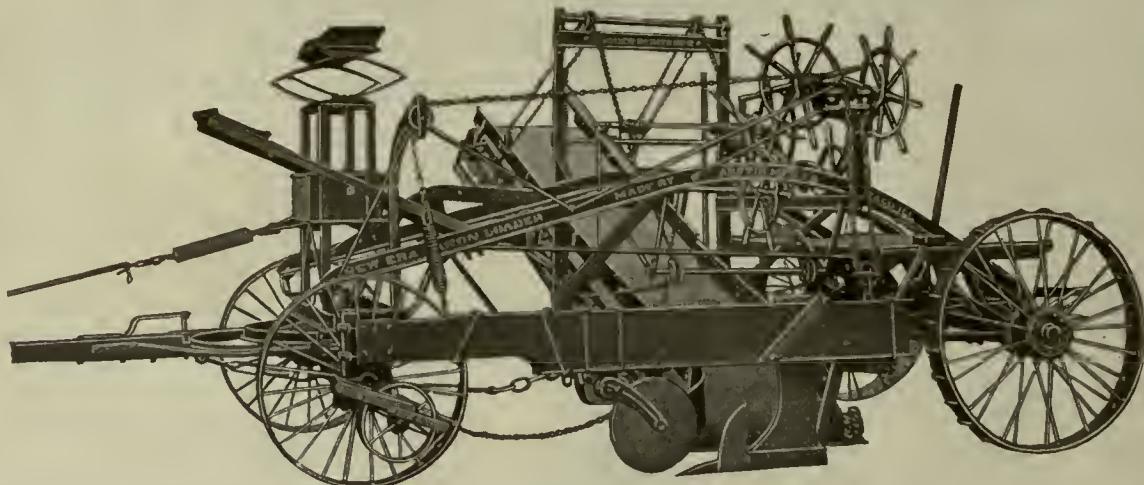
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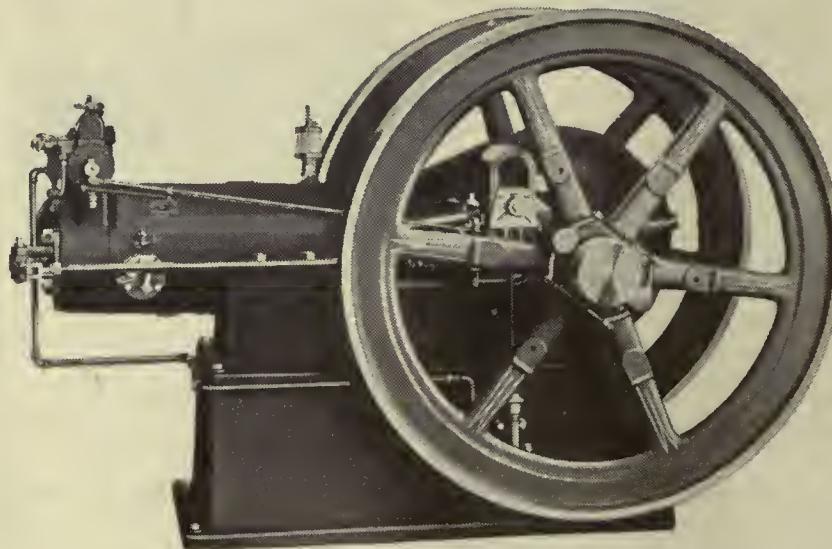
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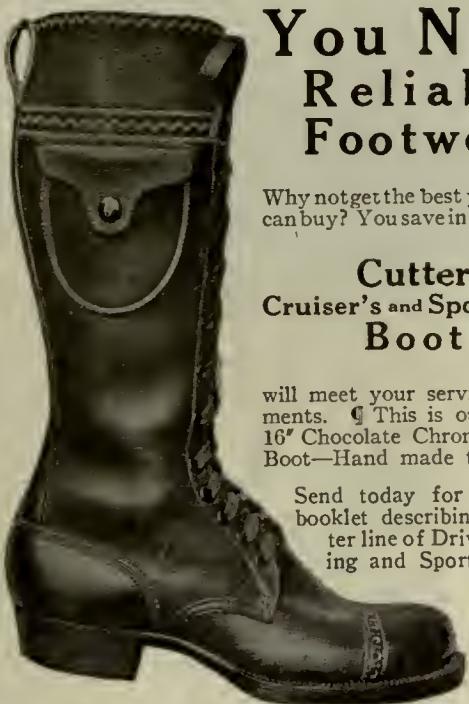
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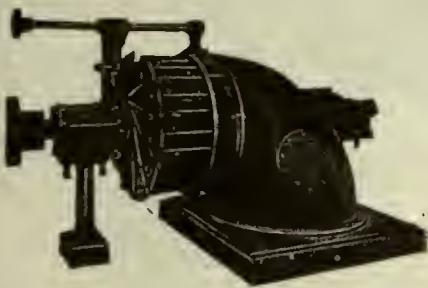
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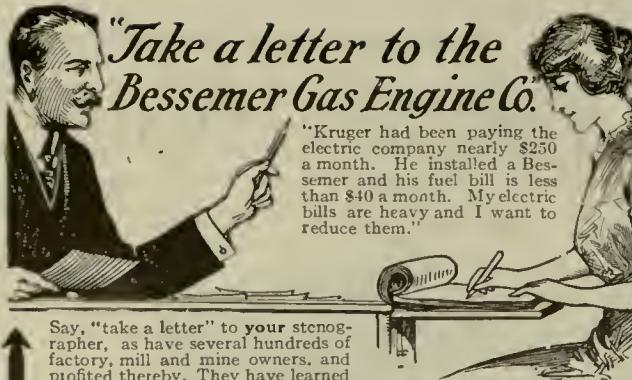
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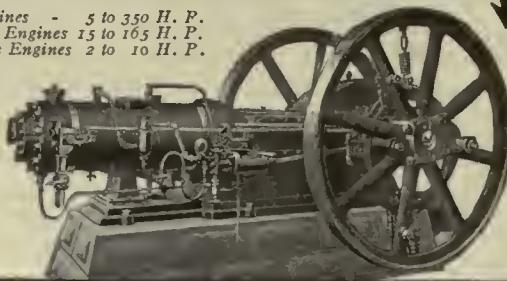
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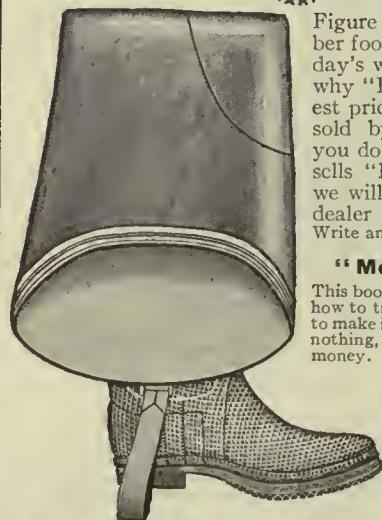


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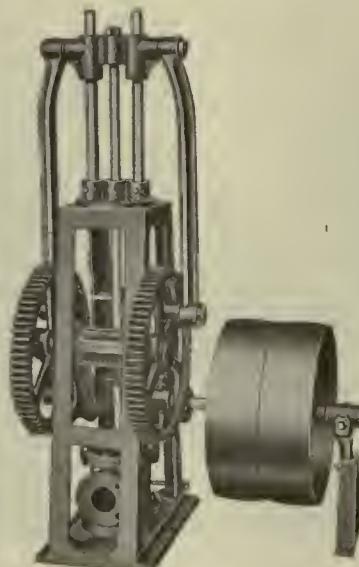
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THE IRRIGATION AGE

VOL. XXX

CHICAGO, MARCH, 1915.

No. 5

THE IRRIGATION AGE

With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARIO AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MIO-WEST

THE FARM HERALD

THE IRRIGATOR

D. H. ANDERSON

PUBLISHER,

Published Monthly at 30 No. Dearborn Street,
CHICAGO

Entered as second-class matter October 3, 1897, at the Postoffice
at Chicago, Ill., under Act of March 3, 1879.

D. H. ANDERSON, Editor

ANNOUNCEMENT.

The "Primer of Hydraulics" is now ready; Price \$2.00.
If ordered in connection with subscription \$2.00.

America!

May she always be right;

But America, right or wrong!

Decatur's famous toast is one which every citizen of the United States should keep in mind day in and day out. This is no time for hyphenated Americanism. The nation is facing a grave crisis. We do not doubt that the United States will go through this crisis safely, but every bit of true Americanism is needed to safely guide the ship of state through the sea of mines which the British and German policies on the ocean have created.

Make Your
Contract Part
of Revaluation
Board's Record

"To ascertain the proper construction cost to be collected under the terms of the Reclamation Act and amendments thereto from the settlers upon, or owners of land, on each project of the

Reclamation Service, or units of projects, as to which the construction charges have been heretofore announced by public notice."

These are Secretary Lane's words. They state the first object of the revaluation of the Federal irrigation projects, which will begin early in April.

This paragraph will bear most careful analysis by every settler or land owner whom it affects.

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To United States Subscribers, Postage Paid,	\$1.00
To Canada and Mexico.	1.50
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In forwarding remittances please do not send checks on local banks. Send either postoffice or express money order or Chicago or New York draft.	

Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Associations has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Interesting to Advertisers

It may interest advertisers to know that The Irrigation Age is the only publication in the world having an actual paid in advance circulation among individual irrigators and large irrigation corporations. It is read regularly by all interested in this subject and has readers in all parts of the world. The Irrigation Age is 30 years old and is the pioneer publication of its class in the world.

"The proper construction cost." What should it be? Mr. Lane evidently hopes through his revaluation boards to fix figures under which the settlers will accept new contracts by which they will assume practically the entire present cost of the projects. Is this fair?

While THE IRRIGATION AGE believes every settler should pay the government for every dollar's worth of value in the project which he receives, we do not believe that Mr. Wilson's administration, nor anyone else who, for the time being, represents the United States government, should ask the settler to pay one penny of unjust or unfair charges.

Furthermore, we believe a contract which the United States government makes with one of its citizens should be inviolable—at least on the government's part.

Settlers on most of the projects hold agreements with the government which, according to Judge Sanborn's opinion in the Belle Fourche case, constitutes good and valid contracts, stating that they shall receive their water rights at a certain figure—based upon the estimated cost of the project. Many of the settlers have made several payments under these contracts. Some have even paid in full for their water rights. The contracts were made in accordance with the Reclamation Act.

What then should be "the proper construction cost to be collected from the settlers?" The price per acre fixed in the government's contract with the settlers.

Therefore it behooves the settlers on each project to see to it that the contracts between their Water Users' Association and the government, and the contracts between the individual settlers and the government are made a part of the records of the boards of revaluation. The settlers should do this in order to protect themselves.

It is true, despite Secretary Lane's words to the contrary, that every settler is, in a way, jeopardizing his contract for water by participating in the revaluation plan. Unless the contracts are well and carefully set out in the record of the boards, the settlers will not be in very good position to fight in the courts, if attempt is made to assess exorbitant charges in order to pay the bills of the Reclamation Service.

There may develop cases on every project where the government is entitled justly to more money per acre than the price fixed in the Water Users' contracts. In such cases we do not believe one settler will object to paying such charges—and none should.

An attitude of fairness on the part of the settler should not, however, make him the "goat" for the Reclamation Service mistakes, inefficiency or foolishness.

The "proper construction cost" has been fixed in a solemn contract. Such a contract should be respected and observed.

Make the farm a desirable place for the boy.

Do not let an inch of your ground lie idle this year.

The United States is expected to feed the world this year. Every farmer should do his full duty.

We have peace and we intend to remain at peace with all the world, but it is well to be prepared.

There will be many more irrigation plants installed in the humid regions this year. Irrigation is the best insurance against crop failure.

Irrigation farmers should prove to the world this year that the irrigated lands are not only the life insurance policy of the United States, but also of all humanity.

It Is Time to Let Business Alone

Business must be let alone and permitted to recover. The national and state law makers already have harassed business too long. The nation is on the eve of a period of great prosperity, if business men can have a fair opportunity to conduct their affairs in workman-like manner.

The business situation in the United States today, as affected by laws and law makers, was analyzed recently in a message which James J. Hill of the Great Northern railway sent to the Chicago Traffic Club.

He said: "Business needs a rest—a clear field, no favors, and a full restoration of confidence. Division, hostility, and working at cross purposes have gone far enough."

His message continued, in part:

"The main conditions favorable to a happy change exist. It calls only for understanding, cooperation, and harmony between all those elements that unite to make us both economically and politically one. To urge this hearty and lasting cooperation, in good faith and good feeling, is now the first interest of all our people.

"Thus, and not otherwise, the next generation may be able to look back over the period following the greatest war that the world has ever seen as one of the greatest prosperity that the United States has ever known.

"The tariff changes are the smallest trouble the business man has to conform himself to. The federal banking system will have a profound effect. Only experience can bring it out. Some uncertainty remains, and uncertainty, almost as much as actual disaster, slows down business operation everywhere.

"In addition, a commission of five members has been named to supervise all business corporations. No session of congress will pass without actual or attempted legislation to extend its powers and make its control more absolute and more arbitrary.

"In the Clayton bill some of the provisions are crude. The limitation on interlocking directorates can produce nothing but a crop of dummy directors."

Francis G. Tracy, who has talked with Secretary Lane, says the revaluations of the Federal projects will result in benefits to the settlers only if they are able to present their case in a business-like manner. It is up to the Water Users.

Keep Robins and Bluebirds Supplied With Food The economic importance of keeping our robins and bluebirds supplied with food is emphasized in a new bulletin (No. 171) of the United States Department of Agriculture, entitled "Food of the Robins and Bluebirds of the United States." These two members of the thrush family are most attractive and desirable assistants to the farmer, reducing the insects that prey on his crops besides eating a number of undesirable weed seeds. However, as they are very generally distributed throughout the United States, and are usually abundant wherever found, it sometimes becomes a problem to provide for them when the supply of insects and wild berries is insufficient and the birds have to resort to cultivated crops to sustain life. In order to keep the birds from destroying valuable crops the Department's biologist advises that they be provided with adequate supplies of wild fruits and berries by their human friends. Ornamental trees and shrubs which furnish these may be planted in the vicinity of cultivated crops for this purpose.

The complainants against the robin generally dwell on his fondness for cherries, strawberries, blackberries, raspberries, pears, peaches, prunes, grapes, and even olives in California. The bluebird's consumption of cultivated fruits seems more limited, being practically confined to cherries, raspberries and blackberries, and its fruit-eating period is very short, being only from late fall to early spring, when the insects which it prefers are scarce.

The bulletin contains a list of ornamental plants which, it is suggested, might be planted in regions where the robin and bluebird are occasionally compelled to feed on cultivated varieties of fruit and berries. In olive regions, for instance, if a robin can find such berries as Madrona, Heteromeles, and Cascara, he will prefer them to the cultivated fruit valued by man. Mistletoe and elderberries are among the varieties recommended for the bluebird in particular. Dogwood, pepper berries, china berries, and hackberries are popular with the robin and, in the North, cedar, smilax, and holly give them both food and shelter.

It will prove a good investment for any farmer to encourage the robin and the bluebird, considering that they will more than compensate for occasional degradations by the assistance rendered in killing undesirable insects and that they can be pretty effectually kept from eating valuable fruits if they are provided with a supply of wild ones for winter diet when insect food is scarce.

Financing Good Roads; What It Means Is your county planning to build some roads? If so, it should be your business as a citizen and property owner to know whether this is going to be a good business proposition and conducted in a business-like manner.

While there is probably no better investment for a farming community than good roads, this sort of enterprise has its pitfalls. Guard against them if possible.

It is frequently easy for a county to issue bonds and borrow money for improving the local highways. The raising of the money to retire those bonds at maturity is often not so simple. Many counties, in borrowing money for bonds, figure that the amount of money raised represents the total cost of the road, forgetting that the road must be maintained and repaired if, at the end of the term of the bonds, the county is to have anything to show for its investment.

The question of financing country road building is discussed fully in Department of Agriculture Bulletin No. 136, entitled "Highway Bonds," which is written by the Office of Public Roads in collaboration with James W. Glover, Professor of Mathematics and Insurance, University of Michigan. In this bulletin the authors discuss fully the various methods of financing road building and retiring debts for road construction, and also deal frankly with the actual total cost of a road during the life of the bonds. On the total cost of a road the authors cite the following two examples as affording at least a basis for estimating the total minimum cost of a mile of road built with 20-year bonds:

Bituminous-macadam:	
Cost of construction (\$10,500) under 5 per cent serial bond with interest for 20 years	\$16,012.50
Cost of annual repair and maintenance (\$600) for 20 years.....	12,000.00
	<hr/>
Total cost for 20 years.....	\$28,012.50

Brick:	
Cost of construction (\$18,500) under 5 per cent serial bond with interest for 20 years	\$26,426.73
Cost of annual repair and maintenance (\$300) for 20 years	6,000.00
	<hr/>
Total cost for 20 years.....	\$32,426.73

The authors point out that the actual cost of building and maintaining a specific highway can be determined only after the character and volume of traffic and actual wear and tear have been studied for a series of years.

THE ECONOMIC USE OF IRRIGATION WATER

By FRITZ KNORR

Of the United States Experiment Farm at Scotts Bluff, Neb.

THE economic use of irrigation water is a problem that should be given more consideration in the future than it has received in the past. It seems that an engineer's problem is far from solved when the irrigation system is completed; and the organization that finances the proposition does not meet with the real grief until the entire system has been in operation for several years. The cause of much trouble is the call for more water on one side, and the constant cautioning for a more economic use on the other side, and sometimes the positive refusal to supply more water.

Each side is right when their reason and cause is studied by itself, but let us make it a common cause, a community problem, and the proposition has a different aspect. The farmer's side is: We must have more water to grow larger crops; a large head of water in order to be able to cover a larger area in less time; a constant run instead of an intermittent supply, that we may irrigate at any or all times. The water holding organization says: Use less water and your crops will be just as large; a constant run and a large head means waste and that will ultimately lead to either seepage or alkali.

The water user, on the other hand, feels that the water furnisher wishes to protect his interest in order to supply a larger territory with water, which belief is often justified to a certain extent. On the other hand, all land holders should be considered; those on the low lands that are affected by injudicious practices above should receive consideration.

All seepage cannot be prevented; the contour of the land, soil formation, and even some of the soils are conducive to seepage, but vast areas have been made worthless by negligent methods. Many farmers have been accused of shiftless methods in irrigation. It is true that many are shiftless and careless in the application of water, but we believe a far larger portion are not aware of the conditions that they are bringing about by the methods they employ, and it is also due to their lack of knowledge of soil conditions and plant requirements, and when once their attention has been called to this they will realize the necessity as well as the ad-

vantage of a decreased use of water.

This year, more than ever, have we realized our shortcomings, or lack of knowledge, if you will, in the time and method of the application of irrigation water. It would be folly for anyone to lay down a rule stating that irrigations should be so far apart and the water should be allowed to run a certain time in order to get the best possible results with irrigation. These factors depend entirely upon the slope of the land, nature or texture of the top and subsoil and, last, upon the nature of the crop.

It is not necessarily true, as many believe, that the greatest economy of water is in the use of a large head forced over the greatest possible area that this water will carry. On the Scottsbluff (Neb.)

Substation this year it was found that one and one-half second feet of water turned out and allowed to run over an area having ten inches fall to one hundred feet, covered the soil at a depth of three to four inches near the turnout. This was allowed to run thirty-five minutes. At another point in the same field a similar head was run one hour; near the tail end



Farmers inspecting an irrigation well at Littlefield, Texas. Courtesy of The Earth.

of the hour run the water moved across the surface very slowly for thirty-five minutes. In comparing the amount of saturation of the thirty-five minutes' run, that where the water ran fast and stood on the surface, the soil was wetted down only to the sixth foot, whereas at the other point, where the water moved slow, the saturation was down to seven feet. To be more accurate, water running fast, the first six feet of soil contained an average of 13.8 per cent of moisture; running slow, the first six feet held an average of 20.7 per cent of moisture.

In another field water was run across a good slope, having covered over one hundred and eighty feet in about one and one-half hours' run; at the turnout the soil contained an average of 15.1 per cent moisture in six feet, one hundred and eighty feet from the turnout, the six feet of soil contained 12.1 per cent of moisture.

Tests made of our soil, a sandy loam, having an average weight of eighty-five pounds to the cubic foot, the following data was secured:

6.1% of moisture is equal to 1 inch of rainfall.

12.2% of moisture is equal to 2 inches of rainfall.

18.3% of moisture is equal to 3 inches of rainfall.

The percentages were secured on oven-dried soil samples. The absolute air-dry soil does not fall below 3 per cent moisture.

With a moderate head of water and a good distance between laterals it is not necessary to allow the water to run a great length of time in order to get a good wetting near the tail end of the run.

The best saturation was obtained where the least amount of water would cover the soil and spread well between the laterals, and the least benefit was derived where a large head was used that flowed very rapidly. Following up some of these observations upon other fields, we have come across a number of instances where better beets were grown in fields near the lower end of the rows; potatoes have yielded better; in one case corn was decidedly better at the end of the runs. Upon inquiry and investigation it was found that on the long runs it was necessary to turn large heads into each row; as the

water diminished near the end, the saturation into the soil was greater and better results were secured.

Rowed crops should be planted in such a manner that the water will not wash in the rows and that it will almost exhaust itself in about a 250 to 300-foot run. To run water down a rowed crop so as to cause undue washing is a loss of good soil and a waste of irrigation water. It is impossible to secure good irrigation where water flows too fast.

The depth of saturation must also be considered. With the exception of perhaps alfalfa we are safe in saying that the average of our crops do not feed deeper than five feet; this being true, why should irrigation water be wasted in trying to secure saturation to a greater depth? Besides the waste resulting through seepage, run off waste should be guarded against. On a large portion of farms, time dams could be used to a great advantage for night irrigation. It is true that one cannot expect perfect irrigation under all conditions with such devices, but with a little time and trouble the uncovered place may be gone over the following day.

A night set will accomplish its work within a few hours; all water running after that time is waste.



A second cutting of Sudan grass, raised in 1914 by E. J. Abell, of Amarillo, Texas, who is holding the grass. The second crop was ready to cut thirty-five days after the first crop was harvested. Courtesy of The South West Trail.

No.	Acres Irrig.	Water Used.	Tons Beets.	Tons Hay.	Bu. Potatoes.	Bu. Corn.	Pasture Acre.	Value of Crop.
1	77	2.06	380	120	750	..	12	\$2,595
2	70	3.25	..	175	..	..	2	700
*3	70	4.1	40	195	..	35	..	1,023

*A very sandy farm, whereas 1 and 2 are good soil. No. 3 is land that many would pass by as farming land as compared with No. 2, but by using a little more water it produced good crops.

No.	Acres Irrigated.	Water Used.	Tons Sugar Hay.	Bu. Beets.	Bu. Corn.	Bu. Oats.	Value of Crops.
4	80	2.2	140	..	..	..	\$ 560
5	80	1.7	105	60	800	1,300	1,976

No. 4 and No. 5 with 80 acres each, on which water was actually applied, offers another striking example where a larger amount of water did not add to the farm income.

Another case of what may be almost criminal abuse of water is a property holder renting adjoining land; crop and water applied follow:

Total acres.....	Rented.	Owned.
Irrigated acres.....	74	57
Water used—	38	55
Alfalfa—	5.1	2.6
Acres	38	30
Tons	40	60
Oats—		
Acres		5
Total bushels.....	..	80
Wheat—		
Acres		2
Total bushels.....	..	10
Potatoes—		
Acres		6
Bushels .....	..	600

*On the home place there was not the waste of water there was on the rented farm and the crops were considerably better.

Another saving of water is accomplished by enriching the soil. As the soil fertility is increased, so is the water requirement for the plant decreased up to a certain percentage.

Last and above all, cooperation is required between irrigators. Neighbors must respect each other's rights. Irrigators on the higher ground can, in many instances, do much towards partially relieving some of the seeped land below. As has been observed, it is even possible for an irrigator to protect his own land to a large degree.

The men in charge of the various government experimental farms have been giving much attention in recent years to the seepage problem as well as to the actual values of water.

In going over a large number of records of crop yields as collected by the Reclamation Service on the North Platte Project, it is found that the men using the largest amount of water do not always grow the largest crop, soil condition taken into consideration. To give a concrete example, two men under very similar conditions, Nos. 1 and 2 (note the crops grown and the yields obtained):

Such use of water as in the above stated case should be condemned by all good farmers. Besides doing much toward increasing seepage areas, methods of this nature detract from the value of all surrounding land.

In tabulating many of the records, some very interesting facts are brought out.

FIRST. Success at farming under irrigation is not dependent upon the amount of water received, but upon farm management.

SECOND. That where there is a diversification of crops, less water was used.

THIRD. The total income of the farm was greater wherever diversified crops were grown and even a semblance of a rotation followed.

The continual and insistent asking and urging by ditch organizations of the irrigators to use less water is usually looked upon and mistaken as a selfish motive, but if all irrigators would make an individual study of the waste land caused by poor, haphazard and careless methods of irrigation, and then observe the methods employed by the more successful farmers, who are quite numerous, then there would be developed a more economic use of irrigation water.

\$25 A YEAR TO INSURE A BERRY CROP

MICHIGAN growers continue to find irrigation a valuable asset. H. F. Klein, of Detroit, writes the following concerning an irrigation experiment on the F. A. Stuart farm, near Marshall, Mich.:

"The irrigation was carried on on a berry patch of five acres, located three miles from Marshall. There were two varieties of blackberries, half being of early and half of late type. The soil was a light gravelly to sandy loam towards the west, changing gradually to loam at last, all of it capable of producing vigorous plants under proper conditions. The land was fairly level, a small ridge running to level ground. The north and south slope was regular and gentle.

"The well was driven at about the center of the patch and connected up with pump and engine into a compact water supply unit. The water had to be lifted fifteen feet.

"Irrigation was given during July and August whenever the soil became very dry. As a rule, it was used every three days during the ripening period, the pickers alternating with the irrigation. After the last irrigation the patch was thoroughly cultivated to break up the cakes which formed in several places where clay was present.

"As you know, we had an extremely dry season until the middle of August, with few drenching rains occurring in the months of June and July. As the early varieties ripened up into good sized and good quality berries, it was not necessary to irrigate them more than once, but the late varieties suffered from the continued drought and were ripening very slowly and irregularly. Although the water was gotten onto the ground rather late, the actual results were conclusive proof of the value of irrigation in this case particularly.

"It could be seen to a bush just where the water was supplied—in the irrigated area every bush was vigorous, the new shoots were growing strongly and the berries were large and tasty, while the unwatered area of four rows in width showed plainly the lack of moisture, the berries being small, hard and bitter.

"The irrigation was not expected to make a marvelous increase in yield, but it was expected to increase the size of the berries and their appearance, and since these results were obtained, the outlay

was justified. The market demanded high quality fruit, and all sold under the firm's trademark was able to meet the demand.

"The first cost and the running expenses of this simple system are surprisingly low. The pumping outfit cost \$150, the well cost \$15, installation of outfit cost \$10, and pipe and hose brought the total for the five-acre plant up to \$190. In figuring the yearly cost, depreciation is charged at 12 per cent, interest at six per cent, fuel at \$3.00 and labor at \$10, which makes the cost of irrigation for one season about \$50.

"The increase in yield, as determined by using the four check rows which were not irrigated, was twenty crates, valued at \$35. Ten dollars was subtracted from this to cover cost of handling and marketing the increase in yield.

"It cost then twenty-five dollars to insure the crop against failure due to lack of rain, to secure a good growth of new shoots, and to increase the size and improve the appearance of the berries sold under the grower's trade mark.

"In summing up the results of this experiment in irrigation, three things stand out clearly:

"1. Irrigation is most important as a means of crop insurance.

"2. While increase in yield should pay the season's bills, the profit comes from the increase in quality and indicated by large size and good appearance.

"3. Simplicity of the outfit must be carefully considered in order to cut down the overhead expenses."

A CHAMPION IRRIGATOR

In Harrison County, Missouri, is an octogenarian who challenges Luther Burbank to duplicate the marvels of his little area of two irrigated acres. Ike Neff, he is called by his neighbors, and he offers as samples of his agricultural skill the following: One seedling strawberry plant that produced 2,391 plants in one year, from which he gathered 100 gallons of fruit; one Concord grape vine that bore 500 pounds of grapes in one year; another vine, thirty years old, that bore 532 pounds of grapes; a hill of watermelons that produced 800 pounds; a tomato plant that produced 100 pounds, and a sweet potato plant that produced 185 pounds

The Federal Water Users



A Department Devoted to the Interests of the Farmers on the Government Irrigation Projects

EDITED BY GEORGE J. SCHARSCHUG

ELWOOD MEAD ON PROJECT REVIEW BOARD

ELWOOD MEAD, prominent American authority on irrigation, and the brains of reclamation of the arid lands of Australasia, has been selected as the third member of the general board of review on revaluation of the Federal irrigation projects. Mr. Mead will serve with Gen. William L. Marshall, consulting engineer to the Secretary of the Interior, and I. D. O'Donnell, Supervisor of Irrigation.

This board will be the supreme court on the revaluations and will review all findings of the local boards. Although Secretary Lane saw fit not to name a water user on this final board, he must be credited with picking out one of the most eminent of irrigation men as the third member, in his selection of Mr. Mead. As an employee of the United States government, Mr. Mead won a high place among students of irrigation affairs. He was called to Australia to tackle a problem in many respects far more difficult than that of American reclamation, and made a tremendous success of it, introducing many advanced ideas in the settlement of irrigated public lands. He also has served on the faculty of the University of California.

While Mr. Mead will not look upon project costs from the settlers' standpoint, the water users may feel certain that he will show fairness in considering the problems placed before him.

After many delays, Secretary Lane is endeavoring to rush through the revaluations. He asked all projects to name their members of the project revaluation boards by March 1. On several projects the settlers did not see fit to comply with this request, fearing participation in the revaluation proceedings would jeopardize their contracts with the government. Under these contracts, the price of their water right, based upon the estimated cost, is fixed at a much lower figure than is expected to result from the revaluations.

Secretary Lane has stated in writing that the

revaluations will not affect in any manner the contracts between the government and the settlers, but if it is not to alter the costs of water to the settlers, why should there be a revaluation? ask the water users.

The cost of the revaluation will be charged to the operation and maintenance of the projects. The settlers' member of each board and the member named by the settlers' representatives of a division, and the government's representative as the third person on the board, are to receive \$10 per day and expenses. It is not expected that the government's representative will receive any compensation other than his salary from the Reclamation Service, but probably will be entitled to certain expenses. There will also be stenographers, and perhaps special engineers and accountants, who must be paid. The selection of the third member on each local board presents one of the most



This is how one man has made a real business out of his poultry farm. The auto truck means daily deliveries in town and satisfied, well-paying customers. Courtesy of the International Harvester Co.

difficult tasks which the settlers' representatives will face. This man is to serve on all the boards within a division of the Reclamation Service and, according to Secretary Lane's instructions, "shall not be a water user on any project or directly or indirectly interested in the project, and shall not be a person who is now or has, at any time, been in the employ of the Reclamation Service." To find men with ample knowledge of Reclamation affairs, irrigation, economics, and just plain hardheaded business to serve on these boards is going to be a difficult problem if the Secretary's requirements are to be fulfilled.

The Secretary declares the following are the objects of the investigation of project costs:

"FIRST, to ascertain the proper construction cost to be collected under the terms of the Reclamation Act and amendments thereto from the settlers upon, or owners of the lands on each project of the Reclamation Service, or units of projects, as

to which the construction charges have been heretofore announced by public notice.

"SECOND, to fix the proper charges on projects where construction charges have not been announced where such projects have reached such stage of completion as to make it practicable and desirable to do so.

"In order to properly fix the amounts to be collected, it is necessary to determine whether any expenditures, direct or indirect, have been, or are being, charged to the projects that under ordinary conditions of carrying out similar works should not be so charged and were not necessary for the laying out, designing and construction of the completed project, and, on the other hand, whether any such expenditures have been omitted as, for example, by treating them as a general expense to be apportioned to all projects, when the whole, or a part thereof, should have been a direct charge to a particular project."

As the brainiest men on practically every project where the water users have contracts insist that there can be but one "proper construction cost to be collected" from the settlers and land owners—that cost being the one fixed in their contracts in accordance with the Reclamation Act—it behoves the settlers or their Water Users' Associations on every project to insist on making their water right contracts a part of the records of the revaluation boards.

Under Secretary Lane's instructions, the local boards must be organized and begin work by April 1, and make their reports by July 1. Instructions have been issued to each project manager to prepare statements of costs of the projects, as shown on the Reclamation Service books. The boards are to have access to the records of the project manager, supervising engineer, the Washington office and any other offices of the Service. The board may also question any Reclamation Service official about costs or project work.

Recommendations concerning readjustment of charges must be made by the whole board or a majority of it.

Concerning reports on costs, Secretary Lane says:

"It is to be kept in mind by the local boards that all the expenditures of the Reclamation Service have been made under direction of the Secretary of the Interior, on works and projects approved by him, and that such expenditures have been examined and approved by the Treasury Department, leaving for determination the question, if presented, as to how much of the expenditures approved by the Treasury Department are legitimate charges against the water users.

"The distribution of these expenditures to the project and units thereof and under the various



Here is a picture of the first Maginnis galvanized metal flume ever installed. It was put in in 1901 and is in perfect condition today. This flume is now being manufactured by the Hess Flume Company of Denver. This company is now replacing the metal flumes on the Cascade Irrigation District at Ellensburg, Wash., and three miles of flume for the Union Gap Irrigation District at North Yakima, Wash. The old flumes in each case were wooden.

on that ground, should be ascertained by the local board and reported with its recommendations."

PRAISES POLICY OF THE AGE

Editor of THE IRRIGATION AGE: As a water user on the Belle Fourche project, I wish to add my amen to the way your paper is taking up the Newell controversy. There is not an actual farmer on any of the Government projects but what should give you all the encouragement possible in pushing the good cause along.

I beg to remain a subscriber to your paper and a booster for the good work you are doing for the irrigation farmer.

Yours truly,
CHARLES MIX.

Vale, Butte Co., S. D.

SERVICE SHAKE-UP STILL ON

H. N. Savage, who was supervising engineer of the Northern division, retired March 1. A Washington dispatch says:

"The change is not regarded as a reflection on Mr. Savage and his work, but is merely a shift of the organization of the work to another line of procedure whereby much more of the detail of the work will be handled directly in the Washington headquarters. It will transfer more of the direct supervision to the project engineers.

"It is said that Mr. Savage will still have much occasion to be in touch with the Reclamation Service, as his broad information as to the organization and specific needs of the various projects will be practically indispensable to the Service, and that the government may have the benefit of this, he will occupy the position of a consulting engineer in the Service, and will have his headquarters at Billings, Mont.

"The Great Falls, Mont., headquarters' force will be cut down very materially and will continue in its reduced form under the direction of Charles P. Williams, with R. M. Briner as office engineer, and George L. Blakeslee in charge of clerical work."

Go over all garden and field equipment and see that everything is ready to use.

headings of the accounts; the pro-rating of general expenses, such as, for example, general surveys, examinations by special boards, overhead charges, etc.; the question of whether an expenditure shall be charged to construction or maintenance account, etc., are all proper questions for examination and report by local boards.

"All charges against a project that may be considered improperly laid or debited, or that are inequitable or questionable be ascertained by the local

WHAT THE SETTLERS OWE TO SECRETARY LANE

By FRANCIS G. TRACY, of Carlsbad, N. M.,

One of the Leading Water Users on the Carlsbad Federal Irrigation Project.

A RECENT trip to Washington, where the writer met for the first time all the members of Secretary Lane's Irrigation Commission and discussed Reclamation problems with them, with members of Congress and others led through certain reminiscences to some fairly definite conclusions.

A few years ago in summing up before the Public Lands Convention in Denver a statement of conditions then obtaining in the government reclamation work the following statements were made:

"The Reclamation Service suffers from one very vital defect in its own organization. Administration and construction have never been separated. There is no attempt at business management, separate and distinct from construction and engineering. * * * *

"Just stop and think about this awhile and see if you can figure out what we have to deal with, and I think you will agree with me it is a juggernaut slowly and remorselessly trampling out the assets of the settler, and not the messenger of peace and plenty which we sought to send out into the desert. * * * *

"What is the remedy?

"First clean house thoroughly; and any woman will tell you that to do this right you must begin at the top.

"Then reorganize upon a business basis, and take administration away from the engineers.

"Create an administrative board to relieve the Secretary of all details. Have it consist wholly of practical western men, partly engineers, partly business men; and have its headquarters in the West and its membership large enough to enable them to keep headquarters always open, and yet keep in close touch with conditions in the field. Let it handle all business matters, remove and appoint all engineers, hear and pass upon all grievances, subject, of course, to appeal to the Secretary, but not asking his original sanction.

"Extend the time of payment of building charges to twenty years, and where undue cost has been incurred for avoidable reason, wipe it out.

"Include every improvement of a permanent character in building charges, and delay fixing these charges, as has been so wisely done in the Salt River Valley, as long as there is reasonable doubt that construction is not over. Keep maintenance as low as possible; for it, not construction, must always be a variable and uncertain quantity."

Secretary Lane has, for the first time, "organ-



Francis G. Tracy

ized" the Reclamation Service. He has now given us a business management. At the same time he has very materially assisted us to obtain in the Reclamation Extension Act, not only 20 years *more* in which to meet our payments, but from three to five years of such easy initial payments as to assure us ample time to arrive at a just determination of our actual legal and equitable obligations to the United States; or failing a mutually satisfactory determination of our debt, ample opportunity for appeal to Congress for relief; before any burdensome collections can be made.

During this same period both the government and the settlers will have ample opportunity to discover if the remaining payments are likely to be met without undue hardship.

Meanwhile, in giving to the representatives of the settlers and his own appointees an equal voice in the choice of the third member of his boards of project appraisers, with the proviso that he must be neither a water user nor Reclamation employee, the Secretary has given further evidence of the undoubted fairness of his intentions and the breadth of his vision.

What the completion of the appraisal boards and the appointment of the third member of the board of review, the new organization will be complete.

It remains now to get to work and try it out. Secretary Lane has done his part. He has furnished a business organization. He has given the settlers, as he promised, "opportunity to make good."

It is now up to us to present our own case as strongly as we can.

Every dollar of needless expenditure that can be definitely shown should unquestionably be deducted from our indebtedness.

Can we show a business organization equal to the one the Secretary has prepared to meet us?

Our difficulty is going to be how to make definite proof without books of our own of what we may feel perfectly convinced are useless or extravagant expenditures.

There will be disappointment at many failures of proof. Secretary Lane cannot sanction reductions of any charges without absolute proof of illegality or injustice.

Whatever may be the final outcome let us not fail to credit Mr. Lane with giving us:

The first opportunity for a full hearing by the Interior Department and before Congress.

The first opportunity to permit proofs of needless or wasteful expenditure by the Reclamation Service.

The first opportunity to make good in our homes through the Reclamation Extension Act.

The first evidence of sympathy and understanding for our problem from the head of the Department of the Interior.

The first example of courageous independent judgment and non-partisan administrative ability we have had from the head of the Interior Department since the organization of the Reclamation Service.

The first evidence of a power higher than the Service itself.

He has also instilled in the Service in marked degree a wholly new cooperative spirit and a great measure of his own geniality and directness of methods.

Surely, with this record in mind we may approach the very difficult and intricate problem of our just debt to the United States with the feeling that the solution sought is an honest one, and that no unfair advantage will be taken of our disability to make complete and conclusive showings; but every opportunity will be furnished us to demonstrate the actual facts.

The game will be played fairly by the Honorable Franklin K. Lane. It is not his fault if we cannot win.

He cannot undo the past. But he has materially assisted to lighten its burdens in the future, the just as well as the unjust, by helping us to distribute the payments over twenty years, in installments of the principal equivalent to only half the usual annual interest charge on all loans in the districts where most projects are situated.

In spite of war clouds and greatly disturbed markets, the year 1915 opens with great promise to Reclamation settlers.

A definite determination of our indebtedness to the United States is at last in sight. This problem once out of the way, the foundation for further financial progress will be finally laid and the basis for true cooperation between the Reclamation Service and settlers will at last be established.

Any change in the administration of the Interior Department in the near future would be a serious blow to real Reclamation progress and true conservation of resources, and a calamity to the entire West. These problems are too big to be subordinated to any personal interests.

600 NEW SILOS FOR SIX COLORADO COUNTIES

FARMERS in the Colorado counties of the Arkansas valley are expected to build at least 600 silos during the year 1915.

Here is the silo building record for these counties for 1914:

Pueblo county, 28; Otero county, 30; Prowers county, 42; Crowley county, 18; Kiowa county, 20; Bent county, 17.

Previous to this year there were very few silos in the Arkansas valley. Here and there an enterprising dairyman had thrown up one of the big tubes or had dug a pit silo. Such men were looked upon as daring adventurers or gamblers by their more cautious neighbors.

The silo pioneers succeeded; they had feed for their dairy cattle and other livestock throughout the winter, and their farms showed real profits per acre at the end of the year. Still there was skepticism concerning the siloing of irrigated crops.

Late in 1913 this skepticism began to die out and when the spring of 1914 had arrived the silo "epidemic" had set in throughout the valley. Profits of silo-using farmers and the work of the educational forces in behalf of the "feed ice boxes" had dealt blows that told.

The silo companies operating in the Arkansas valley have already placed a large number of orders and report a most promising lot of prospects still to be "closed." It is on data gathered from these men that the estimate of 100 silos for each of the six Colorado counties in 1915 is made.

The silage put up this year in the Arkansas valley counties of Colorado is valued at more than \$500,000. It is estimated that it will be sold at the

rate of \$10 a ton in the form of fattened livestock or better milk-producing cows.

Auto engines proved valuable assistants to many of the farmers, who utilized them to run their silo cutters.

By running the crops through a cutting box one increases the quantity that can be stored in the silo. The silage being packed better keeps better and with a greatly diminished percentage of waste, all of which more than offsets any difference in cost per ton. When the crop is put in uncut a horse fork is generally used for elevating to the top of the silo, when it is either dropped into the center of the silo or onto a platform, where a man forks it into the silo by hand. A better job may be done under the latter plan.

The equipment for cutting the crop into the silo consists of a power, either electric, gasoline or steam, a cutting box, and elevator, either endless chain or blower. The equipments are put out of a capacity sufficient to meet the requirements. A surplus of power and capacity is much more desirable than not enough. Wherever the cost of such an equipment makes its use impractical or prohibitive, it will become necessary for the farmers of a community to band together for its purchase and use.

The cost of getting the crops from the field to the silo depends greatly upon conditions. Here is where the farmer can display his executive ability and management. There need be no great haste or excitement about filling the silo. It does not need to be filled in a day or two. The cutting box should be adjusted so as to cut the crop of corn in one-half inch lengths and all other crops in one inch lengths.

JONES BILL WILL GIVE IDAHO BIG BOOST

THE irrigation district bill, which Senator Wesley L. Jones of Washington has introduced in Congress, is creating a great deal of favorable comment throughout the West.

In replying to a letter from Mr. L. W. Rice of Seattle, Wash., former Governor Haines of Idaho says of the Jones Bill and irrigation matters in Idaho:

The state of Idaho has 2,500,000 acres of land reclaimed by irrigation, and with Senator Jones' bill in operation we could build irrigation works for the reclamation of 2,500,000 acres more. No new irrigation works are being built in the state of Idaho at the present time for the reason that there is no market for irrigation securities and the principal reason that there is no market for irrigation securities is because of a lack of faith in the financial success of irrigation projects.

About ten years ago a great many irrigation enterprises were undertaken in the West without due investigation and consideration, with the result that a number of them were financial failures. Heavy bond issues were placed against these enterprises and these bonds were purchased all over the United States and many of them were sold in foreign countries. The losses that followed have caused the purchasing public to become very skeptical in reference to the financial end of irrigation enterprises.

This might all be cured by the Jones bill. If these bonds were made to run for a long period and the interest on them was guaranteed by the United States government, they would be almost as attractive as government bonds and would sell at a very low rate of interest, possibly four per cent. With a market for such securities we could readily finance 2,500,000 acres in Idaho. We have the land and the water. This would afford homes for many thousands of worthy and industrious citizens of the United States and add to the general greatness of the country.

Not only would the Jones bill enable us to reclaim this vast area, but it would enable us to reclaim it at a practically one-half cost that we have paid for reclamation in the past.

As before stated, there is no present market



An apple orchard in the Belle Fourche Valley (S. D.) irrigation project, built by the government. Courtesy of the Chicago & Northwestern Railway.

for irrigation securities, but when there was such a market irrigation bonds sold at from 60c to 80c on the dollar, with a liberal supply of the capital stock of the company thrown in for good measure.

For example, if it was desired to raise \$1,000,000 to build a given project, it would be necessary to issue securities against it amounting to \$1,660,000. These would then be discounted at 60 per cent to raise the required \$1,000,000. Not only were the bonds sold at a ruinous discount, but the interest rate was higher and on the basis of the discount it was an enormous burden for the constructing company to carry. Considering the interest and discount charges, I think I am entirely safe in saying that a project could be built for one-half the sum that it would cost under the system that we were pursuing, because interest on government guaranteed bonds at 4 per cent would sell at par.

The government of the United States could very properly and safely guarantee the interest on these bonds in view of the fact that before such guarantee was given the feasibility of the project was to be investigated and approved by the United States Reclamation Service. The United States Reclamation Service has established a splendid organization of competent and experienced men and there should be no element of doubt in reference to an irrigation enterprise approved by the Reclamation Service. The feasibility of a project may safely be determined with our present knowledge of irrigation. The water supply of all important streams in the arid country has been determined and the area of irrigable land has always been known. The principal element of doubt about the

matter is the cost of construction and with the experience of the past ten years the cost may be quite accurately estimated, so that after the Reclamation Service has passed upon the feasibility of the project and approved it, there would be little risk upon the part of the government in guaranteeing the interest on the bonds.

You have asked me for statistics as to irrigation in Idaho and I herewith submit the following figures as to the number of acres reclaimed under our different methods of reclamation:

	Acres
Carey Act Lands	750,000
U. S. Reclamation	300,000
Irrigation Districts	250,000
Co-operative Enterprises	450,000
Private Enterprises	50,000
U. S. Indian Service	3,500
Total Acreage reclaimed.....	2,553,500

The census reports of 1910 give the number of miles of main canal in Idaho as 7,762 miles and the number of miles of laterals as 5,097, or a total of 12,859. Since the census report was taken there has been much activity in irrigation in Idaho and it is safe to say that the total mileage of irrigation canals in Idaho would reach the enormous figure of 15,000 miles.

The area of land yet to be irrigated in Idaho and for which there is a water supply is equivalent to the area already reclaimed. The swampy or overflow land in Idaho is not very extensive, but we have very fertile valleys quite extensive, in area that need reclamation by drainage. These valleys are the Kootenai, Pend d'Oreille, St. Maries, St. Joe,

Bear River, and Portneuff, and while I have no statistics at hand in reference to the area, I should judge it was in the neighborhood of 250,000 acres.

The financial affairs of our various projects are in excellent condition with the exception of some of our Carey Act projects and some of our District projects. All others are absolutely in the clear financially. Our Carey Act projects could be turned into district projects, as is contemplated by the Jones bill, and any of them that are in financial distress could take advantage of the Jones bill upon the approval of their feasibility by the Reclamation Service.

The Jones bill is of special import to the state of Idaho at this time. About a year ago our state was compelled to take over the King Hill Irrigation project in order to save the settlers from ruin. The Carey Act company became absolutely bankrupt and their bondholders refused to come to the rescue. It was up to the state to take over the project and maintain it or the settlers would be ruined. The state bought in the project at court sale for a merely nominal sum, wiping out the more than \$1,000,000 indebtedness that stood against the property. It will cost \$500,000 to complete the works and make them permanent, and there is a liberal equity in the property and the government would be entirely justified under the Jones bill in guaranteeing the interest.

Idaho is a young state with many burdens to carry and therefore cannot afford to maintain and complete irrigation projects. With the Jones bill in operation this burden could be taken off our hands, and the projects completed, and the settlers made prosperous, and the wealth and population of the state made materially greater.

MAKE A YEARLY INVENTORY ON YOUR FARM

BY C. M. BENNETT

THE young farmer who is endeavoring to build up a more efficient and profitable business seldom retains much cash. When money is received he buys a new implement, another animal, improves a building, or makes payments on bills for things bought on credit.

During the course of the year he may receive and pay out large sums of money, leaving almost no cash at the end of the year. The annual returns may seem to have been only a fair living for himself and family, whereas the farm business may have turned a good profit, which was invested from month to month. Hence it is important for the farmer's guidance and encouragement that he make an annual inventory of his farm investments.

This inventory should be a detailed list, with values, of everything used in the farm business, including land, buildings, livestock, machinery and tools, produce for feed or sale, supplies, bills receivable, and cash; also a list of all accounts and bills owing. The difference between the total assets and debts shows the net farm worth.

A study of two successive inventories of a farm in New York State illustrates how one young

farmer on 100 acres prospered regardless of the fact that he had almost no cash at the end of the year. The total assets at the beginning of the year amounted to \$13,090, and to \$13,400 at the end of the same year, an increase of \$310. The increased investment in livestock, machinery and tools, and more produce held for sale amounted to \$1,073, but this was partially offset by the cash decrease of \$763. The farm indebtedness was also reduced by \$253, thus making a total increase in net worth to the farm business of \$563.

The inventory values covered all the depreciations and increases in values, so that this \$563 was net increase in the value of the farm investment. It means that this sum was saved from the year's business after all farm expenses had been paid, including interest on borrowed money and all living expenses. The amount of cash at the end of the year, \$133, proved to be no indication of the success of the year's business.

Test all seeds on hand. Flannel and blotting paper are good materials to use.

TYPES OF SMALL DAMS AND WHAT THEY COST

By EVERETT B. MURRAY

Assoc. M. Am. Soc. C. E.; M. Am. Soc. T. M., of Kansas City, Mo.

THE first and simplest type of dam is what is known as the earth dam. This is generally used where the soil is composed of a good grade of clay that will insure a satisfactory bond at the base of the dam with the natural ground and also insure a satisfactory core wall, which is one of the most important factors in this type of structure.

Under ordinary conditions this dam is more satisfactory where the length of it is restricted and it will not be subject to sudden extreme rises in the stream in which it is impounded. The crown width of the dam should not be less than 6 feet, and where it is to be used as a roadway it should be at least 12 feet. The side slope on the water side should be at least $2\frac{1}{2}$ to 1 foot, while the opposite slope may be made 2 to 1. Under no conditions should the crown of dam be less than $2\frac{1}{2}$ feet above what is known as extreme high-water, and it is always safer to make this distance more if possible.

The materials used in the construction of a dirt or earth dam should be carefully considered, only good clean earth, either of clay or sandy loam, should be used. Any earth which has large numbers of stones or gravel or vegetable material, subject to decay, should be rejected. It might be well to mention here that in locating a dam one of the most essential features is to select the site where there is a good solid earth foundation, and that the axis of the embankment or dam should be placed at right angles to the general direction of the flow of the water which is to be impounded. The base of the dam should be carefully gone over and all rock, saturated earth, loose stone and decayed vegetable matter should be grubbed out. The dam site should be well broken up by plowing longitudinal furrows in order to insure a good bond with the natural surface of the ground. After this has been done the core wall should be dug.

This core wall consists of a trench at least 3 feet wide and as deep as may be considered necessary to intercept any seepage that is likely to occur at the base of the dam. As a general thing this is hard to determine unless the local conditions can be observed. This wall should in no case be less than 5 feet. After this excavation has been made, located between the inner slope of the dam and the center line and nearer to the center line, it should be filled with good clay carefully puddled in order to make it impervious to what seepage occurs.

The construction of the dam proper should be in even horizontal layers, not more than 1 foot in thickness, and should extend out to the slope stakes to start with, and, as the embankment is brought



Irrigated sweet potatoes raised by J. E. Lucas of Oklahoma City, Okla. Courtesy of the Rock Island Railway.

up, gradually narrowed so as to conform to the prescribed slopes. It is a generally conceded fact that team work makes the best embankment, inasmuch as it packs these layers hard as they increase in height.

If for any reason after the dam is one-half completed in height the work is abandoned for a time and then resumed, care should be taken to scar, either by means of furrows or other means the top surface be

fore resuming the work. If this is not done there is likely to be a joint where there will be no bond between the new and the old work. An extra precaution which is highly advisable is that where the material is loose and dry it should be thoroughly wet and rolled between the succeeding layers.

It is well to take into consideration some preventative for the crawfish nuisance. This is frequently handled very satisfactorily by placing just below the surface of the ground in the slope of the dam on the upstream side a fine wire mesh which prevents the animal from penetrating and causing failure by reason of the water's percolating in after it.

This type of dam will vary in cost with the locality, the size, difficulties of getting labor and maintaining a camp. However, the cost should vary from 15 to 25 cents a yard.

The second class of structures to be considered is what is known as timber or crib dams. These are usually built where the base of the dam rests on a solid rock foundation or in large coarse gravel. One of the most common types is to frame the dam with a very flat slope extending upstream and with a vertical face downstream or a much steeper slope than the upstream side. Heavy timber on the upstream side should be held in place by correspondingly heavy structures, the size of all the members depending entirely on the height of the dam and other general conditions governing the work. These structures or supports should be carried down to a sill which is placed on the rock bed, this sill in turn resting on cross pieces of heavy timber which should be imbedded in to the rock or grave. This is to prevent slipping.

Between the supports, which act in a way similar to buttresses on a retaining wall, there should be placed quantities of heavy stone and clay, this to rest on the sill before mentioned and is for the purpose of giving the dam extra weight. On top of the up and downstream slopes there should be placed on these buttresses heavy planking spiked as close together as possible, said planking not to be less than three inches in thickness. On the upstream side there should be placed a considerable

quantity of gravel mixed with clay and extending for a considerable distance upstream. This adds to the strength of the dam by reason of its extra weight on top of same and also by reason of its imperviousness to seepage. This last is one of the most important features in any type of dam construction, for as soon as the water percolates under the base of the dam it lessens the weight thereon by just $62\frac{1}{2}$ pounds per cubic foot, thus increasing the force tending to overturn or slide the dam on its base.

The dam described above is used successfully where it has not to extend for any great length nor has to be very high. Other types of timber dams where the height is an important factor to consider are constructed either by cribbing after obtaining a satisfactory foundation on rock and filling against the upstream side of the dam as already described, or by constructing a triangular structure.

Where the dam assumes any considerable height or length it is not conceded to be economy to build this type inasmuch as it requires so much necessary cross-bracing to insure complete rigidity and it is so hard to obtain a satisfactory foundation that unless the cost of labor and timber is very low it is cheaper and more satisfactory to build a concrete or masonry dam.

These dams are generally used only where there is abundance of adjacent timber and can be constructed in shallow water with labor at \$1.50 per day, timber not exceeding \$20 per thousand, stone \$1.00 per cubic yard, and gravel 50 cents per cubic yard, iron for bolts 2 cents per pound complete at from \$3.25 to \$3.50 per cubic yard of crib.

There are innumerable types of concrete dams which have proven to be entirely satisfactory. Some of the various types are briefly as follows: Buttress type, arch type, gravity type, the hollow construction type, and revolving type.

The gravity type of dam is one which resists sliding and overturning by the action of its weight alone, the center line in plan being straight and perpendicular to the general direction of the flow of the impounded waters.

An arch dam is one that is built so that the center line is curved with a concave surface upstream. This type is securely mortised into the rock at each side of the stream and is only to be used where the sides of the stream are more or less perpendicular and are composed of solid rock. It will be readily seen that this dam can necessarily be of much lighter construction than the gravity dam, inasmuch as the force of the water against it brings into action the same resisting forces that an arch has and transmits same directly to the abutments at each side. This of course is an assistance to gravity in resisting the tendency to slide or overturn. It has a much prettier appearance than the straight gravity type and while the materials used in its construction are less than those in the gravity type, yet the difficulties attending this construction offset more or less the saving in the material.

Naturally when the two types, the gravity and arch, are combined, although the cost is increased, yet the structure is much stronger than either one of the above types and such insurance of security is sometimes to be desired regardless of the increase in cost.

I will not attempt to discuss in detail either the hollow or rolling type of dam inasmuch as they are ordinarily only used on very large work, particularly for hydro-electric development and where it becomes necessary to maintain a more or less uniform water level. The features of importance in either of these are similar to those already mentioned.

The most common cause of failure of a dam is where a defective foundation has allowed the water to percolate under the dam. Thus it becomes absolutely important to have the foundation on bed rock and a core wall of sufficient size as to successfully intercept any seepage that might occur. On very large dams, as, for example, the Ashokan dam in the lower Catskill region, which was completed in 1912, the height of which is 220 feet and the width of base 190 feet with a top width of 26, there has been placed in this dam two openings which are called inspection galleries, one near the top of the dam and the other close to the bottom. By a system of drains any seepage which occurs can be observed at once and the proper steps taken to handle it in the event of its becoming necessary to do so.

Another feature in dam construction which is important to observe is the construction of the downstream side of the structure. On the concrete types this side is usually constructed on a curve which allows the water to flow over the surface of the dam rather than falling sheer. This is for the reason that it is desirable to prevent the water's washing away the material in the river bed at the heel of the dam, thus weakening the dam at that point.

This is easily remedied by designing the dam so that the water either strikes the side of the dam about half way down or follows it the entire way. Another important consideration in the event that the water falls from the top of the dam to the bottom without touching the face is that there is a partial vacuum formed in that space which very materially increases the pressure on the back of the dam. This of course is something that is not to be desired as it decreases proportionately the factor of safety considered in the design.

Nothing has been said so far about rubble dams or cyclopean masonry having ashlar facing. A rubble dam is a masonry dam with very heavy cement joints; cyclopean masonry consists of large stone imbedded in concrete; ashlar facing consists of cut masonry laid with cement joints on both sides of the dam.

As before mentioned the costs of these types vary with the locality and the size, difficulties attending the foundation and construction, and also the difficulties of handling the water during construction. A fair average cost per cubic yard taken from a great many dams situated all over the country is as follows: Ashlar facing, first class, \$20; second class and backing, \$12 to \$14; rubble, \$8.50 to \$10; concrete, \$6.50 to \$10.

There are seldom two spillways constructed along the same line, owing to the fact that local conditions govern almost entirely the construction of this part of the project. The essential features to be considered in designing spillways are to keep

in mind the amount of water likely to be required in determining the size and the grade, and in the question of the last item it will be kept in mind that unless the spillway is lined with either timber, stone or concrete, that there will be a decided tendency to wash or erode. Besides the spillway there should be adequate arrangements made to take care of the draining of the impounded water behind the dam in order that the water surface may be lowered and any repair work or cleaning necessary can be readily done.

As to the headgates, the size and type of these will vary according to the size of the project and the essential features to be considered in their erection are that they are easily operated, water-tight, and designed sufficiently strong so as to allow for extraordinary conditions. There also should be a grading device which would allow the individual raising or lowering the gate to estimate very closely the quantity of water which was passing into the main ditch. Headgates on smaller ditches may be constructed in various ways, all of them being on the principle of weirs without end contraction and graduated so as to show by inspection the amount of water that is passing through.

In conclusion will say that in constructing a

dam the essential features to be considered are as follows: The point where the foundation is the safest, distance across is the shortest, the accessibility of the material, also as to the type to be considered, the size of the dam as well as the above items must be carefully considered in order to determine as to just what type will prove the maximum efficiency at a minimum cost.

It may sometimes be necessary to make two or three estimates on different types before it can be clearly shown as to just which type is the best to use, but a little time taken in doing this preliminary work, together with the comparatively small cost of same, is more than repaid by getting the right type of structure, economically designed, and the cost as compared to the putting in of a type that is expensive to start with and eventually fails is too small a per cent to be considered.

It is hard to emphasize the fact strong enough that there should be careful preliminary work before the construction of any dam for any purpose, for the reason that in the event of a failure the reconstruction is a great deal more expensive than the original, and the work that has been done in the first place is practically always more or less a total loss.

LEGISLATURES TRYING TO AID IRRIGATION

SEVERAL of the legislatures of Western states are tackling the irrigation laws situation with vigor this year. All are working toward conformity of irrigation laws among the various states and for more stability of irrigation securities.

The lower house of the Oregon legislature has passed one bill allowing the state to purchase irrigation district bonds, and another allowing irrigation districts the right to sell electric power developed within the project.

Governor George A. Carlson's recommendations to the Colorado legislature promise to bear fruit. He said:

"It is recommended that the laws respecting irrigation districts be investigated and revised. Great injury has been done outside investors and the state through the sale of valueless irrigation securities. The wording of the present laws on the subject leaves opening for unscrupulous promoters to sell worthless irrigation securities by representing that the sums paid therefor are expended under the direction of the county treasurers in the counties included in the particular district. It is unconscionable for the state to permit longer the use of its name in aid of fraudulent stock selling schemes.

"Many of the districts of the state are now under a very heavy bonded indebtedness and without sufficient water supply. This often results in ruin to the land owners in such a district, great injury to the credit of the state, and much loss to the investor.

"Irrigation is of prime importance to the development of Colorado and should be kept a safe field for capital to enter. The wrongs done already are of such magnitude as to menace seriously

further irrigation development in the state, and we cannot afford to permit the continuance of this condition. The state should provide an effective supervision over the issuance of irrigation securities so that all stocks and bonds issued represent bona fide and sufficient water supply."

MORE IRRIGATION IN IOWA

Muscatine Island, near Muscatine, Ia., a noted truck gardening spot, is rapidly becoming an irrigated area. Irrigation plants were installed this fall on the farms of Thomas Seright, William Corbin, R. F. Parmalee, and extensions have been made to the plant on the F. X. Schaefer farm.

Although irrigation has been used on Muscatine Island previous to the past summer, it was not until then that the real need of it was demonstrated. The sweet potato crop was helped especially by irrigation, as the growth of the potato was quicker and more steady than without.

Some of the non-irrigated potatoes could not be sold this fall because they were cracked by quick growth. The irrigated potatoes were all smooth and in good condition, and matured more quickly than the others, giving them an earlier and better market.

IRRIGATION COMMISSION

Senator Seegmiller has introduced a bill in the Utah legislature to create an irrigation and water rights commission. The duty of the commission is to investigate conditions and report on needed legislation. The state engineer, attorney-general and president of the Agricultural college, with two others to be named by the governor, are to make up the commission.

WINDMILLS THEN BIG PUMPS IN PANHANDLE

By D. L. McDONALD
of the Bessemer Gas Engine Company of Grove City, Pa.

HEREFORD, Deaf Smith county, Texas, lies on the banks of the peaceful, meandering Tierra Blanco—an unassuming little stream, the real head of the Red River. The Tierra Blanco is famous as a watering place for buffalo, antelope and wild mustangs in the old times, later for cattle and today for its magnificent black bass. It is the only stream on the Texas Plains inhabited by real live fish, because all other water courses during dry periods "go dry." During periods of prolonged drought—and prolonged drought here doesn't mean a few weeks or a month, but years—the Tierra Blanco has always remained bank full of pure, clear water.

Hereford derived its name from the immense herds of white face Hereford cattle which have always grazed the millions of acres of fine buffalo grass of the plains country. It was located on the Tierra Blanco on account of easy water conditions. In 1898, a little before the Santa Fe built in, a hotel was built, a water tank put up and a well drilled. Water was found at forty-six feet, a windmill erected and the town was off. When a new house was built a new windmill went up, and this was continued until over four hundred windmills could be counted. In addition to the great number of windmills the town now

has a splendid water works plant of half a million gallons daily capacity.

While the town was well watered, as much could not be said of the surrounding cattle range, which, by this time, was being cut up into small tracts. These cattle ranches were surveyed off into farms and during two years of good rains were sold to a land hungry people for agricultural purposes. A great boom was on—such rich, productive land must go to \$100 an acre in a couple of years—but it didn't. Drought came—five years of the severest drought ever experienced in any part of the west.

It just simply couldn't rain—sunshine month after month. The cattle men knew it never was a farming country and never would be. The land is good, but it doesn't rain, and you can't farm without rain.

But the four hundred windmills in Hereford continued to deliver their three million gallons of

water every twenty-four hours and the Tierra Blanco never slipped an inch "Oceans of water" there must be to feed all these windmill suckers and the endless flow of the Tierra Blanco. It's easy—we'll drill a big well, get a big pump and drive it with a big engine. We'll get our rain from underground in place of from the uncertain clouds. A great idea—but, listen! "Who wants irrigation?" "It'll spoil the land business." "If we try to irrigate it's a sure sign we don't have rain enough." "This grass is too good grazin' to break up for any farm." "Then don't you 'spose if God Almighty had a wanted this land wet He wouldn't a made it rain?" "Go ahead and put in your big pump and you'll suck every stock well dry in the country—nobody but a damn fool would try it." Encouragement from the natives—always.

When some fellow comes along and wants to grow ten hogs where one jack rabbit had a hard time making a living there is always sure to be a remarkably efficient co-operative spirit hatched up. In spite of this enthusiastic feeling on the part of the natives, the big pump went in, she belched forth a mighty stream of water and not a windmill well went dry. Hundreds of these big wells are in operation today, delivering water for thousands of

thirsty acres. There has not been the least indication of a diminishing water supply—the windmills continue to water their stock just as they did before the big irrigation well was thought of.

Some remarkable results have been achieved from this system of farming. That it is a modern, twentieth century way of operating a farm there is no doubt. The moisture question is so certain that a maximum crop may be grown EVERY YEAR. The crop never sees the time when it really needs water, because it has been supplied regularly with moisture and attains its growth without delay or stunt.

Alfalfa is the main money crop, either sold as hay or used for the production of pork. In 1913 alfalfa produced as much as \$90 worth of hay to the acre at \$18 a ton. During 1914 hogs grazed on alfalfa made as much as \$100 an acre, and there is not a man who hasn't made money at the



One of the Texas panhandle gushers. Courtesy of the Bessemer Gas Engine Co., Grove City, Pennsylvania.

hog-alfalfa game. Hogs in this climate are remarkably healthful, very little trouble and grow like weeds on alfalfa and this pure well water.

Henry Scheutte grazed ninety-four head of hogs on a six-acre patch of alfalfa and with a light grain ration made excellent gains. D. P. Vaughn raised 141 pure-bred Jersey Durrocs on seven acres of alfalfa—made money. J. R. Robinson ran two hundred head on twenty acres of alfalfa until they were put in the fattening pen—no other feed except the grazing. These hogs were finished on kafir corn, sold in competition with corn-fed hogs at $7\frac{1}{2}$ cents, and averaged 247 pounds, in Fort Worth.

J. R. Webster got 1,728 pounds per acre on a bunch of pigs grazed from June 15 till November 1, which, at 6 cents, makes \$103.68 from each acre of alfalfa. In these days of high priced meat hog-raising is a very profitable branch of irrigation farming.

Kafir corn and milo maize are successfully and profitably grown under irrigation and are excellent substitutes for corn. Hogs, cattle and sheep are full fed on these grains and when finished sell right along with corn-fed stuff. For finishing cattle the kafir and milo are ground to a chop and supplemented with silage, alfalfa hay, cane hay and cotton seed meal. This makes a well balanced ration as well as a cheap one and gains of $3\frac{1}{2}$ pounds a day are not uncommon.

Wheat, oats and barley do well. All the fruits and vegetables grown in a temperate climate grow to perfection, as is well demonstrated by the four hundred gardens watered from Hereford's battery of windmills. With a small patch of ground and a windmill the "wolf" will not bother your door.

With the development of this country under irrigation, great strides have been made in the perfection of power for driving pumps as well as in the pumps themselves. The operating cost of these engines is so low that water pumped from wells compares more than favorably with the cost of water from many of the best gravity systems of irrigation. The average cost of irrigation from wells at Hereford for 1914 is \$1.50 an acre. This cost is based on the total yearly operating cost as given by the farmer and includes all charges paid



Another "rain-maker" of the southwest. Courtesy of the Santa Fe Railroad.

out by each farmer without regard for waste, leakage or any finely drawn test. To show the cost of water pumped from several wells just a few examples are given.

The D. P. Vaughn well, two miles north of Hereford, is equipped with a 40 H. P. Bessemer Oil Engine driving a number five Layne turbine pump. The well delivered 1,200 gallons a minute on a total head of sixty-five feet. The engine used five gallons of 4-cent fuel oil per hour, which, with lubricating oil, makes an

hourly cost of 22 cents. It required 4.6 hours to pump an acre foot of water at a cost of approximately \$1.00.

The Weliver & Pollock well is driven by a 60 H. P. Bessemer Oil Engine and puts the water into the ditch for \$1.10 an acre foot. This engine consumes seven gallons of 4-cent oil per hour and with a flow of 1,500 gallons a minute requires 3.6 hours to pump a foot of water.

The J. R. Robinson well, located $2\frac{1}{2}$ miles southeast of Hereford, was accurately tested by the Santa Fe railroad engineering department and under a 24-hour run showed 1,180 gallons per minute, or 5.2 acre feet every twenty-four hours. The 40 H. P. engine consumed $4\frac{1}{2}$ gallons of 4-cent fuel oil per hour, or 92 cents for each acre foot of water pumped. The pump used is a two-stage turbine.

The C. W. Sowers well, two miles south of Hereford, was also measured by the Santa Fe engineers and showed 1,400 gallons a minute. On every day irrigation Mr. Sowers says his engine uses four gallons of fuel oil per hour. On this consumption the water cost is approximately 70 cents an acre foot with oil at 4 cents a gallon. The 50 H. P. engine pulling this well operated on a shade under .6 pint per horsepower hour.

The engines require little attention. Each engine is started in the morning by the irrigator, who then goes down the ditch with the water. No further attention is paid to the engine or pumping plant until night, when it is shut down until the next morning. Some of the farmers run both night and day, but this is done only in emergencies. The installations include perfect cooling arrangements, mechanical lubrication for both engine and pump, automatic stopping device which shuts off the fuel

oil in case trouble should develop in the circulating system, and, in fact, the entire installation is as nearly foolproof as can be made. Upkeep has been very light and, from experience gained through the actual operation of a large number of irrigating plants, the life of a pumping plant as installed here should be at least twenty years.

There are 250,000 acres of fertile land in the

Hereford district, all underlaid with water at an economical depth. Water can be found at the high point on any tract without fail and the amount developed is governed absolutely by the equipment used. The water-bearing formation is very deep, heavily saturated, and not the least bit freaky. We have had no bad wells and never made a failure in getting water in irrigating quantities.

AUTO TRUCK MAKES FARMER A BUSINESS MAN

By GEORGE F. WHITSETT
Of the International Harvester Co. of America

WONDER is expressed by some that motor trucks are becoming used on the farm. Many who are unfamiliar with present rural conditions imagine that development is peculiar to the city, and that farming conditions are the same yesterday, today and forever.

It is inevitable that as the nature of farming itself changes, the machines of the farm will display a corresponding change. Agricultural need always precedes the machine which fills it.

Tell me what kind of farming a man does and I will tell you what kind of delivery he uses, or will use within the next few years. The farmer who has graduated into some one of the numerous specialized forms of farming—the kinds that put fertility back into his farm, and daily profits into his pockets—will find motor truck delivery necessary in his business.

There appeared recently in the Pennsylvania Farmer an account of one instance of motor marketing which nicely illustrates the new regime. S. L. Kester of Clearfield County, Pennsylvania, has used a motor truck to his profit and convenience for two years in conveying his produce from Homestead Farm to market.

"He produces fruit, berries, garden products, butter and eggs," says the account. "The products are carried more safely and arrive in better condition than when hauled in a market wagon. About one-third as much time is spent on the road and one team is dispensed with. Towns that were practically out of reach by team are within easy distance by motor truck."

The writer prefacing his remarks on Mr. Kester's delivery success with this statement: "The number of users of the motor truck for marketing purposes is rapidly increasing and their success bids fair to make this method the popular one for conveying farm produce to market. As a saver of time and horses it is economical."

And this is the age of all ages, and the year of all years when economy is an argument. With shrapnel shooting the price of horseflesh skyward, the specialized farmer, as well as the city merchant, will listen to arguments for economy. Financial and economical crises are beneficial in that they force us to substitute for our extravagant ways



Two views of a big metal flume at Taos, New Mexico. Courtesy of the Klauer Manufacturing Company, Dubuque, Iowa.

methods which will stand the test of profit and loss.

When we consider the advantages of farm marketing by motor as compared to the advantages of city gasoline delivery, it is hard to see why the city man beat his country brother to the method. The man in town has better streets and shorter hauls, yet he was first to adopt motor truck delivery.

But the difference is fast disappearing. Rural competition is increasing and ways and means for increasing the speed and decreasing the cost of delivery are becoming as popular among the orchards, lettuce fields and poultry farms of the countryside, as they are among the manufacturers, wholesalers and retailers who make their deliveries over brick pavements and asphalt.

The man who raises berries and fruit soon comes to wonder how he ever managed to stay in business with his old-fashioned methods of delivery. His motor truck enables him to rise later in the morning and get to market at the customary time. It enables him to gather his tender fruit, such as berries and peaches, in the cool of the day, and get it to market or shipping point the same afternoon. It not only moves him up closer to his customary market, but puts him within easy striking distance of other markets.

These conditions apply with equal force to the producer of truck and garden vegetables. The motor truck makes the raiser of radishes, green peas and roasting ears master of his early morning marketing. It lets him get as much sleep as every man deserves, and yet enables him to get into market before it already is glutted. It makes him independent of local buyers, and enables him to go where he can get the best prices and conditions. Furthermore, it enables him to get there more easily, quickly and economically.

Every man who produces milk, cream, butter or cheese to any extent is, or soon will be, the owner of a motor truck. It gives him the power and speed necessary to make quick deliveries in the cool of the day and cover, if necessary, long distances. The motor truck as now built will travel over all kinds of roads in all kinds of weather, and will encounter any hill. The motor truck has become an all-year proposition, and one which will relieve the dairyman of the tortures of slow and tiresome delivery.

The poultry farmer is a natural member of the motor truck club and finds that his business can be handled with alacrity and economy by the aid of gasoline. It enables him to market daily, when desired, and to answer and to fill special orders on short notice. It makes a full-fledged business man out of the otherwise handicapped poultry farmer.

A farmer need not be an all-fruit, all-vegetable, all-dairy or all-poultry farmer to come in under the classification of those who need specialized delivery. Being engaged in several lines of specialized farming does not keep a man from being a candidate for specialized delivery.

No one need be surprised then to observe an increase in the number of motor trucks purchased for farm use. As the kind of materials marketed change, the means of marketing will differ. The more farmers who become engaged in specialized farming of any sort, the more farmer owners of motor trucks will there be. What is more, motor truck delivery holds as it grows. More than 90 per cent of all who take up motor truck delivery keep it up and never go back to the ways of their forefathers. The motor truck builds up the very businesses which demand it, and therefore becomes a self-perpetuating species.

NATURE LAID FOUNDATIONS FOR BIG PROJECT

By J. R. MONROE
Of San Antonio, Texas

IN my travels up and down the Rio Grande river of Texas, many people have asked me how and where it is proposed to store the flood waters of the Rio Grande and the creeks running into it. Many such people only come up as high as Mission and see nothing but the great valley extending from the river north for miles, and see no place where water can be stored.

Let me explain the plan proposed and hope I can do so that any man can easily see how the gravity canal proposed can be constructed and furnish all the water required to irrigate every acre of land subject to irrigation in Cameron, Hidalgo, and Starr counties, Texas.

It is proposed by international agreement with Mexico to declare the Rio Grande a non-navigable stream and to dam the river somewhere above the town of Roma. We are certain there will be no trouble in making the agreement with Mexico, as that government would be equal if not more interested in the proposition than ours, as there is as much, and possibly more, land along the river on the Mexican side than ours.

It is proposed to construct a canal beginning

at this dam and thence to the Gulf, or so far as may be necessary to reach all the irrigable land, passing somewhere near Raymondville. The water will be flowing in this canal continuously, and possibly, by a system of dams and locks, will be at all times full of water and will be used for two purposes: To irrigate the lands north and south of it, and by a system of laterals from it the great basins and canyons in the chain of hills of Starr county will be kept full at all times.

From these basins and canyons the water will flow into another great canal constructed at the foot of said chain of hills in Starr county and thence on into Hidalgo and Cameron. From this canal all the land between it and the river can be irrigated, and it will be constructed along such a line that the land north of it can be irrigated to the point where the water will meet that flowing from the main canal, the two canals being possibly fifteen or twenty miles apart. Expert engineers can determine by leveling the place where the two canals should run so that the water will reach the land.

But the question may arise as to whether the quantity of water will be sufficient to irrigate all

the land under the proposed system. Of that no one should have the slightest fear. There are basins and canyons in the hills in Starr county where water sufficient can be stored to irrigate all of the irrigable lands in the three counties named.

It seems that the Great Architect, when he formed this earth, in his divine eye, foresaw the condition that would exist in these three counties. Of the silt used in constructing the earth he formed the larger portion of Cameron and Hidalgo counties, not forgetting to deposit a portion if not so much of the silt in Starr county. He foresaw that the broad, rich bodies of land in Cameron and Hidalgo counties would attract men of brain, muscle and money, and it has. But he says to these men: "I have given you the silt of the earth, great bodies of the richest and most fertile land of my creation, but one thing I have not given you, and that is sufficient rainfall. But few, if any part of my broad dominion, is as rich as yours, but to those people less favored in the richness of their soil, I have furnished water and have given you the most fertile soil of any I have, and you must water it, and thus equal justice is given all. I have so formed Starr county so that all the water required can be stored. I have formed the Rio Grande; I have formed the great basins and canyons in Starr county; I have made every natural preparation for you to utilize to obtain all the water required to irrigate these thousands of acres of fertile land. I have formed the natural, now you do the artificial work."

I have given you the land for corn, two crops a year producing from fifty to seventy-five bushels each crop, roasting ears often eaten for your Christmas dinner; cotton, a bale to the acre; alfalfa, seven to eight cuttings per year, a ton to each cutting; sugar cane, equal to any grown in Louisiana; onions, cabbage, in fact, every known vegetable grown, and grown the year round, thus supplying the Northern markets with vegetables fresh and green when that part of your country is covered with snow and ice. It is the land of the citrus fruit, none better in California. All of which is proven and fully demonstrated, now seen and growing under the present system of irrigation.

Now put all the broad domain I have given you in cultivation and under irrigation. Construct a gravity canal; store the floodwaters in Starr county where I have prepared every provision for the storage of these waters, and then, and not until then, will you have an abundant water supply, sufficient to irrigate every acre of irrigable land in Cameron, Hidalgo, and Starr counties. Do this and you will not only have sufficient water, but as cheap, if not cheaper, than any irrigation system in the world, and then thousands of acres in said three counties, today undeveloped and will never be developed under your present system of irrigation, will be turned into vast fields, orchards, and gardens, and furnish thousands of happy homes for the people. Continue your present system and every acre you place under irrigation you approach nearer your doom, for you must and will reach your water limit. Go to work, and work in earnest for the proposed gravity canal, the only way and means not only of securing the work done, but in safely and securely developing and opening up for habitation and cultivation your broad domain of the richest and most fertile land on earth.

Under the gravity canal system as proposed you can irrigate for at least thirty miles from the river. Can you do it under the present system? Examine conditions and see if it is possible. Today you depend entirely on the water flow in the river for irrigation. Will the river supply the water at all stages to irrigate all these lands? The river at Rio Grande City is 380 feet wide and a small fraction over an average of five feet deep. Put in a few more 36- and 60-inch pumps, such as are now established in Hidalgo county, and where would you reach your limit in acreage? Suppose you place under irrigation 100 miles along the river, beginning with the irrigable land below Brownsville. To each mile from the river you would have 64,000 acres. In ten miles you would have 640,000 acres, and in twenty miles you would have 1,280,000 acres. Could you reach twenty miles before you came to the water limit? No, not to the ten miles, and possibly less, much less. These are facts, undisputable facts, which no man can question.

GROWING 38 TONS OF BEETS TO THE ACRE

By PERRY STEVENSON,
A Rancher Near Grand Junction, Colo.

FOR the benefit of beet growers, I want to make some suggestions which I have learned for myself during the past few seasons. I raised thirty-eight tons of beets to the acre in 1914.

The first thing of all is deep plowing. Ten to fourteen inches is about right, working the soil down to fine seed bed. This gives a drainage for seep water.

Don't allow water to stand on beets more than twenty to twenty-four hours, and keep the ground stirred up once every ten days till the beet tops come together. Then ditch them out and don't allow the beets to get so dry that the tops will lay flat on the ground in the heat of the day. Do not

plow any rough trash under for it will cause a mould to collect on the fiber of the beets and check their growth. This mould will occur in any ground. If it gets too dry the tops are not big enough to cover the ground.

By all means, avoid deep cultivating, as it breaks off the fibers of the beets and stops their growth.

I space my beets out to eight and ten inches, always leaving the strongest plant. I raised 116 tons of beets on three acres of land this season—land that had a crop of beets last year. There was no fertilizer used. I have had fourteen years' practical experience in the beet business, and following the above advice will succeed.

EFFECTS OF IRRIGATION ON PLANTS

THE following statement concerning the effect of irrigation upon the product of a field is made by Dr. J. A. Widsoe of Utah State Agricultural College.

During the life of the plant, large quantities of water are passed rapidly from the soil into the plant, and from the plant leaves into the air. As has been shown, hundreds of pounds of water are thus passed through the plant for the production of one pound of dry matter.

That the vital processes of the plant may proceed unhindered, the cells of the green plant must be fully filled with water. The more water is in the soil, the more completely are the plant cells filled with water. That is, on a moist soil, under conditions of abundant irrigation, the green plant probably contains a larger proportion of water than on dry soils, where the quantity of irrigation water applied is small. This effect is felt most in the stalks of plants.

In the leaves, which naturally contain less water than do the stalks, the effect of varying quantities of water is not so apparent; but the water content of every part of the plant is somewhat affected by the water supply. The underground parts of plants, such as potatoes and sugar beets, contain usually a slightly larger percentage of moisture, when grown on land abundantly irrigated.

Since most crops are not sold green, this effect of irrigation has little commercial value. True, in the case of fruits, tomatoes and similar crops, which are usually disposed of in an undried condition, the increased percentage of water in crops grown with much water may make considerable difference in the final weight.

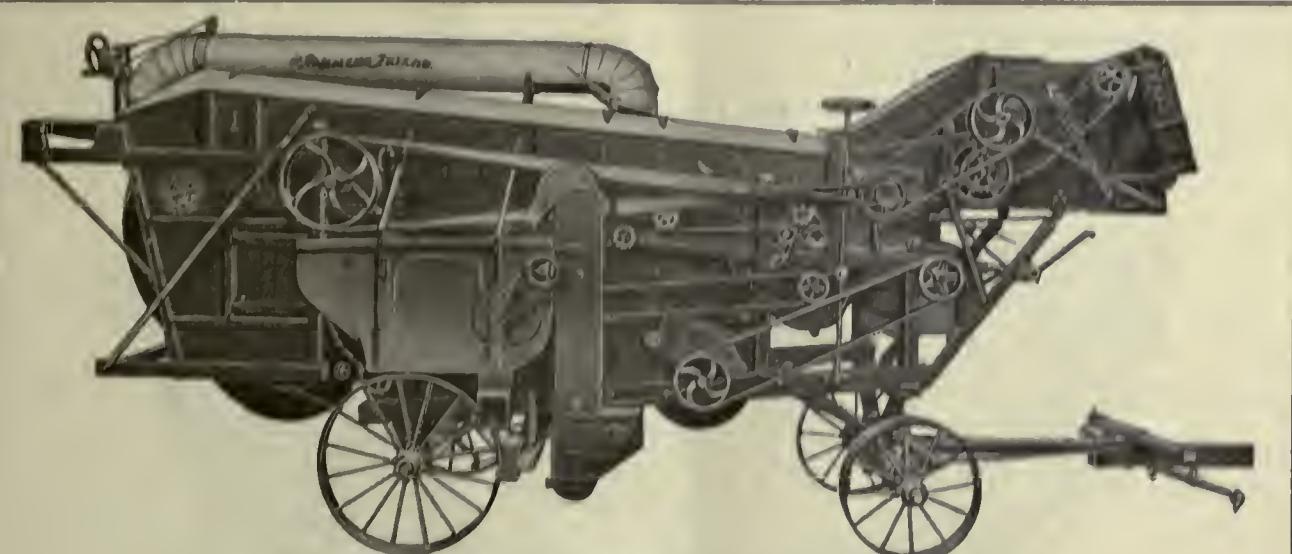
Potatoes and sugar beets, when irrigated heavily and late, may weigh more per acre, but the increased yield is obtained only at the sacrifice of quality. In most cases the difference is so small as to be negligible.

FROM NO. 27,896

Editor of THE IRRIGATION AGE: "The Primer of Irrigation" (D. H. Anderson) reached me today and I appreciate your kindness in sending same in approbation. I am pleased to say that it is exactly what I desired, and therefore you will find enclosed Wells-Fargo money order in amount of one dollar (\$1.00). My subscription for THE IRRIGATION AGE was placed through a S. F. news agency about a week ago. I am looking forward to the initial issue.

Yours truly,

JOSEPH FISCHER,
No. 27,896,
San Quentin, Cal.



HULL YOUR SEED QUICKLY, PERFECTLY and ECONOMICALLY With
"MATCHLESS" CLOVER and ALFALFA HULLER

That's just what you will do if you use a "Matchless" Huller on the job. It's the one huller that will hull all the Clover or Alfalfa you can get to it without sacrificing the quality of the work. Here's the reason: We use square steel bars in our hulling cylinder. This construction has every advantage over bars of spikes, because no set of spikes will knock the seed out of the damp pods. Rasp gum up and are easily destroyed. Our system of separation is unique and effective. This consists of a series of rotating troughs with perforation in the bottom, with provision for adjustment to meet the various conditions of clover. The Patented Steel Bars are attached to the bottom of these troughs thoroughly scrape the separator bottom and insure a steady and positive delivery of the pods to the hulling cylinder, regardless of the condition of the clover. This construction enables you to hull seed under conditions in which no other huller can operate; enables you to hull earlier in the morning and later in the evening, than with any other. This insures a longer day, thus increasing your earning power. Give us an opportunity to prove to you right on your own farm that the "Matchless" is the speediest and cleanest huller on the market. WRITE FOR CATALOG TODAY, or call at our nearest Branch House.

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PROVE IRRIGATION DOES NOT HURT FRUIT

IT is a generally widespread belief that irrigated fruits are more liable to decay and possess less flavor than non-irrigated fruits. Since this inferiority is attributed to abnormally high percentages of water and correspondingly low percentages of solid matter, analyses were made of the content of dry matter, sugar, acid and crude protein in various fruits grown under these two systems, with a view to testing the truth of these suppositions. It was not presumed, however, that chemical analyses alone could settle questions relating to quality in fruits.

The material used in these analyses was not obtained from specially controlled plots; all irrigated samples were grown in districts where climate and soil render irrigation imperative, all non-irrigated samples in districts where the annual rainfall varies from 25 to 35 inches and where the soil and topography of the country render irrigation methods impracticable. The comparisons are therefore made between normal irrigated and normal non-irrigated fruits.

In the case of drupaceous fruits analysis shows distinct differences in favor of non-irrigated fruits, especially when the results are calculated on the dry matter, but they are not considered sufficiently large to seriously affect the taste, except in the case of Italian and Petite prunes.

In the case of apples the non-irrigated almost invariably contain greater percentages of acid and sugar, but the differences are small and practically

disappear when calculated on the total dry matter. Irrigated apples contain a smaller percentage of solids insoluble in water, but in intensity and uniformity of color, and in percentage of waste, they have somewhat the advantage over the non-irrigated.

Of the small fruits, strawberries alone show any marked difference in composition due to irrigation. When irrigated they are decidedly inferior in dry matter, sugar, acid and crude protein, and they lose their freshness and keeping qualities much earlier. In the case of blackberries and raspberries irrigation results in an increased percentage of sugar and a decreased percentage of acid when calculated on the total dry matter, and is therefore a distinct advantage in growing these fruits for marketing in the desiccated condition.

In general, it may be said that no marked differences in food and market value of fruits can be attributed to the effects of irrigation.

TALK 3,400 MILES

New York is now talking to San Francisco—3,400 miles—by telephone. This is an achievement that reflects credit upon the American Telephone & Telegraph Company. It is an enduring monument to Theodore N. Vail, president of the company, and his co-workers in the Bell system. Such achievements as this deal a rather hard blow at arguments for government ownership of telephone lines in this country.

THE KLAUER FLUME



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KLAUER MANUFACTURING CO.
DUBUQUE, IOWA

IOWA IRRIGATION IS SUCCESS

Professor Emery of the Iowa State Agricultural college at Ames is investigating the irrigation experiment of Charles Callahan of Red Oak, Ia. Callahan installed a pump on the bank of the Nishnabotna river and ran a pipe line to his fields, where he did his irrigating work. He used this scheme to carry his market garden crops over the dry periods, and it worked so well that he is planning to install a larger pump and place more land under irrigation.

Irrigation in Montgomery county, Ia., is something new. Ames college is much interested in the experiment and has asked Mr. Callahan to keep careful data on his experiments.

Last year the plan was used mostly on vegetables, but there is no reason why the same plan would not work as well on corn, potatoes and other field crops, after the plant is once installed, Mr. Callahan says.

ASK BLACK CANYON REPORT

The committee on irrigation of the House of Representatives has asked the Reclamation Service to prepare a report on the Black Canyon Irrigation District of Idaho land project and to report on the amount of money necessary to complete the surveys of that project, taking into consideration the surveys already made by the Reclamation Service and those made by the district itself. Upon the result of this survey and final estimate will depend the action of the Secretary of the Interior looking ultimately to the construction of this project by the Reclamation Service. The Black Canyon district is the disowned "Payette" sister of the Payette-Boise project, now known as the Boise Federal project. If constructed, thousands of settlers who have waited many years for the government to act, will be benefited. Many of them have been brought to the verge of poverty by their long wait.

ATTACK IRRIGATION BOARD

The irrigation committee of the lower house of the Kansas legislature wants to abolish the state board of irrigation.

It has passed a bill which not only does away with the board, but provides for the abandonment of the present plan of irrigation work. The mat-

ter is to be turned over to the state board of administration and carried on under its direction in connection with the engineering department of State Agricultural college at Manhattan. All land deeded to the state for the purposes of the board of irrigation is to be deeded back to the counties or individuals. The revolving fund of the department is to be returned to the general revenue fund of the state.

Pending the sale of the property the irrigation work is to be carried on by the irrigation engineer, who shall have charge of the operation of irrigation plants

PROBE SACRAMENTO COMPANY

A complete investigation into the stock transactions and other financial operations of the Sacramento Valley Irrigation Company will result from the petition of owners of land in Glenn county adjacent to the company's holdings, which is now before State Railroad Commission of California.

The land owners have asked the Commission to order the irrigation company to furnish them with water, but the company claims it is not a public service corporation and that such an order will detract from the selling power of their lands.

Mr. J. W.
Lough, Scott,
Kan., writes:

"My 60 H.P.
Charter Type
"R" Oil Engine
burns about 100
gallons of oil
every 15 hrs.,
costing 2½c
per gallon
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The Enterprise Tent-Cot will protect you from all the discomforts and dangers of sleeping out. You sleep 17 inches above the ground under a storm-proof covering that enables you to use the Tent-Cot every night in the year, and all the doors and windows are fitted with both storm and mosquito curtains that can be raised and lowered at will of the occupant. For anyone afflicted with lung trouble there is nothing equals the Tent-Cot. It also has a splendid appearance and can be set up on your porch, lawn or roof and taken down when not in use. Can be set up in a space 30x78 inches and only requires about 30 seconds to operate. It is ideal for hunters, fishers and campers as it eliminates all the annoyance of "making camp." With Tent-Cot you carry your camp with you under your arm and sleep safe and sound any place.

SPECIFICATIONS—Length of cot open, 6 ft. 6 in.; width of cot, one person, 28 in.; width of cot, two persons, 44 in.; height of bed from ground, 17 in.; height of tent over cot, 32 in.; size of cot folded, for 1 person, 28x36; size of cot folded, for 2 persons, 44x36; weight, 1 person, 29 lbs.; weight, 2 persons, 44 lbs.; frame is of hard maple, painted green; covering is of heavy waterproof canvas in colors, tan or olive green.

PRICE—Tent-Cot 28 in. wide, open 1 side, \$9.00; Tent-Cot 28 in. wide, open 2 sides, \$9.50; Tent-Cot 44 in. wide, open 2 sides, \$11.50.



THE TENT-COT
OPEN AND FOLDED



Manufactured
Exclusively by **ENTERPRISE BED COMPANY, HAMMOND, INDIANA**

BRIEF NOTES FROM IRRIGATION PROJECTS

Washington

A movement was inaugurated some months ago for an irrigation project for the Kettle river valley of Washington. The plan is to utilize the waters of Curlew lake for the purpose. The department of the interior sent D. L. Redmond, an engineer, to look over the project. He says in his report:

"The project is recommended as being feasible. It is thought that the cost should not exceed \$30 per acre, and irrigation would at least double this value to the land watered."

"The project can be handled best by the Indian service on account of the percentage of Indian land involved. The white land owners could form an irrigation district under the state law and all business with the Indian service carried on through this organization."

The decision of Clay Tallman, commissioner of the general land office, to attempt to save for public use the Lake Wenatchee water supply will be good news to those who have spent labor and money in the effort to finance the Quincy valley irrigation project in Washington.

The advantage of putting under irrigation the vast area in Central Washington covered by the project without question will outweigh in public good any other use that might be made of the water of the lake. The voters of the state were unwilling to assume the burden of financing the project, but if there is a possibility of saving the resources so that the project may be realized in the future it should be done.

Judge Frank Rudkin, in federal court at Yakama, Wash., reduced the minimum price which may be accepted for the property of the Hanford Irrigation & Power Company, estimated to be worth \$1,000,000, by Receiver Benson when the property is next offered for sale March 20, to \$45,000 cash. The former minimum was \$380,000, of which \$45,000 to cover receiver's costs was to be in cash and the balance might be in bonds of the company. While the assets are large the purchaser is bound to fulfill contracts with water users which are considered a heavy liability, as \$100,000 must be immediately expended in improvements. The company has an indebtedness in bonds and otherwise of \$900,000.

Kansas

There is never a scarcity of water on a 640-acre Broad-acre ranch, five miles west of Garden City, Kan. Alfalfa is the leading crop, there being 400 acres on the place. The live stock includes 250 hogs and 356 head of cattle, largely Herefords. W. H. Wheeler is general manager and part owner.

Three systems supply water. From the Arkansas river by a direct ditch, from the river through a reservoir

and by pumping the underflow. Water is received. The ranch owns stock in the Garden City ditch, which leads directly from the river, and this water is used when it is possible. Water is available from this ditch much of the time.

Another system, the Great Eastern ditch, is used to supply water when it can not be obtained directly from the river. A reservoir furnishes this water. Sometimes both systems fail to supply the water needed. The pump is then started, and the water is lifted directly from the underflow. This pumping plant, on account of its huge size, has attracted much attention.

The plant consists of a battery of twenty-three wells connected to one pump. This is a No. 2 American pump, with 12-inch discharge pipe.

Senator Paul Klein has introduced a bill in the Kansas legislature for a

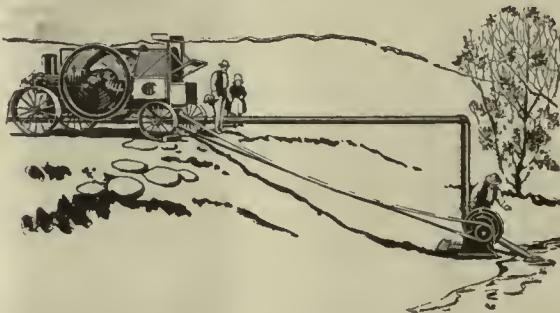
state appropriation of \$500 for the purpose of constructing a dam across the Walnut river near Ness City, for use in irrigation experiments.

Schuyler Jones of Wichita, Kan., is such a firm believer in the advantages of irrigation in the Arkansas Valley, that he has placed an order for another irrigation outfit. Mr. Jones put in a fine irrigation plant on his alfalfa farm near Valley Center a year ago last fall. It was such a success that he cut twice as much alfalfa from it last year as was cut by his neighbors on land not irrigated.

He owns a 65-acre farm just north of Wichita along the Little Arkansas river and he proposes to put this all under irrigation in time to insure a crop this year.

"You may tell the world for me that I am a firm believer in irrigation," said Mr. Jones. "I believe the time will come when a majority of

International Harvester Engines for Irrigating



WHEN you put in an irrigating plant of your own, the most important thing to get is an engine that will run your plant at any time you want water. Make the safest selection and buy an I H C oil and gas engine—Mogul or Titan.

An I H C outfit delivers the most power on the smallest fuel consumption. It uses the fuel that is cheapest or most convenient for you to buy. In case of accident you can get repairs in a few hours.

The same engine may be used for running a saw, cream separator, feed grinder, hay press, or any other machine to which power may be applied.

I H C engines are made in sizes from 1 to 50-horse power and in styles suitable for every form of irrigating outfit or for general farm work.

The I H C local dealer near you should be able to show you I H C engines. If he cannot, write us, and we will tell you who handles them.

International Harvester Company of America

(Incorporated)

CHICAGO

Champion Deering McCormick Milwaukee Osborne Plano

U.S.A.



the live farmers in the Arkansas Valley will irrigate their farms and the sooner they begin it the sooner will find their farms yielding a handsome profit."

Idaho

Practically all of the irrigated land below Bellevue, Idaho, aggregating something over 10,000 acres, is included within an irrigation district that has just been organized.

The plan contemplates the construction of the main central canal with permanent headworks and diversion dams. All of the water rights of the persons owning land within the district will be carried through the new system.

While no detailed plans and specifications have yet been prepared, engineers who have examined the project have estimated that the cost of an efficient ditch system can be put in at an outlay of from \$3.00 to \$5.00 per acre.

Storage of water was begun Feb. 25 at Arrow Rock dam, highest in the world, on the Boise federal reclamation project in Idaho.

California

The first of the contracts for the extension of the Oakdale (Cal.) irrigation system has been awarded by the board. The contract amounted to about \$15,000. The main work of extension, which includes canals and laterals to cost nearly \$200,000, will be contracted for within a short time.

Sutter county, Cal., is entering the bean-growing field on a broad scale this year.

Thousands of acres will be cultivated. Irrigation ditches are being extended around the bean fields and every available plot of ground given over to them. The majority of growers are increasing their acreage wherever possible.

Several large deals transferring lands suitable for the growing of beans have been consummated. Perhaps the largest single land lease is to W. W. Benchley and a number of other capitalists of San Francisco, who have taken a five-year lease on the Spencer ranch in West Sutter, near the Sacramento river. The

FOR THE "LAND'S SAKE"



which has TELESCOPE enabling you to read the Target a quarter of a mile away and you will

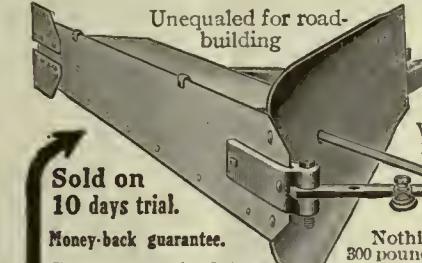
Ditch, Tile Drain, Irrigate, Terrace your land properly. It is used and endorsed by farmers from coast to coast, because it is the most

Simple, Accurate, Durable and Complete
outfit ever made for Farm Leveling work. Write for illustrated description of Level and details of our MONEY-BACK GUARANTEE and then have your home merchant order you one from his hardware jobber on those guarantees.

BOSTROM-BRADY MFG. CO. 119 Madison Ave., ATLANTA, GA.

ranch contains 1,120 acres, and the entire acreage will be planted to beans. Plows and ball tread tractors are now being shipped to facilitate planting.

Near Live Oak, a thousand-acre tract has just been purchased by a number of Eastern capitalists and will be set out to beans.



Sold on
10 days trial.

Money-back guarantee.

Cuts 1,200 yds. 2-foot
ditch in one day with
one man and one team.

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Wonderfully efficient and amazingly simple. Cuts V-shaped ditch up to 4 feet in depth. Ideal for levee work, terracing, and cleaning out old ditches.

NO WHEELS OR LEVERS

Nothing to break or get out of fix. Weighs only 300 pounds. Does all, and more than the big, intricate machines. Price, only one-fifth. You can't afford to be without this genuine farm necessity, which will save No. 4 its cost in a few hours' use. Write TODAY for Illus-

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Only \$2 DOWN and One Year To Pay

For any Size—Direct from Factory

You can now get one of these splendid money-making, labor-saving machines on a plan whereby it will earn its own cost and more before you pay. You won't feel the cost at all.

\$24 BUYS THE NEW BUTTERFLY

No. 2 Junior—a light running, easy cleaning, close skimming, durable, lifetime guaranteed separator. Skims 95 quarts per hour. We also make four other sizes up to our big 600 lb. capacity machine shown here—all sold at similar low prices and on our liberal terms of only \$2 down and a year to pay.

30 DAYS' FREE TRIAL GUARANTEED A LIFETIME

You can have 30 days' FREE trial and see for yourself how easily one of these splendid machines will earn its own cost and more before you pay. Try it alongside of any separator you wish. Keep it if pleased. If not you can return it at our expense and we will refund your \$2 deposit and pay the freight charges both ways. You won't be out one penny. You take no risk. Postal brings Free Catalog Folder and direct from factory offer. Buy from the manufacturers and save half. Write TODAY.

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Over 20,000
now in use

There has been much rejoicing among the land-owners in the section surrounding Santa Rita, Cal., because of the large flow of water recently discovered. The credit of the discovery belongs to Duncan McKinnon, who owns a large slice of the Natividad rancho. He had a small three-inch well at his home ranch house, put down thirty-five years ago. It has never been considered for extensive service.

McKinnon put a small engine on the well in an endeavor to get more water for his house. The first day the well was pumped dry in a few minutes, and the results were the same on the second day, but on the third the engine pumped all day and night without reducing the water level in the well.

McKinnon immediately installed a large engine, and it has been running 2,500 gallons a minute ever since. On account of the small size of the well only a small acreage can be put out to alfalfa, but before the year is out McKinnon expects to sink several large wells and have at least 400 acres in alfalfa.

The find of underground water in such large quantities in the eastern section of the Salinas valley will put a different complexion on the 20,000 acres in the locality, for now, instead of being limited to barley and oats, as in the past, the farmers can plant alfalfa and other irrigated crops.

A syndicate of Boston capitalists has begun active development work on an irrigation system for an 8,000-acre tract lying north of Montague, Cal. The land will be subdivided into farms, ranging from forty to sixty acres in size.

Two other projects, involving 28,000 acres, are under way in Shasta Valley, and plans are being made for the appropriation of 35,000 inches of water from available sources for the irrigation of an immense tract in the southern part of the valley.

The Byron and Bethany irrigation project of California is making rapid progress. Fourteen thousand acres will be under ditch.

Of utmost importance to the water users of the west sides of Merced, Stanislaus and Fresno counties, California, is the settlement of the long pending litigation between the San Joaquin and Kings River Canal & Irrigation Company and Merced, Stanislaus and Fresno counties. The company has agreed to put in force the same rates as the irrigators have signed up for this year, namely, \$1.25 per acre for Fresno, \$1.75 for Merced and \$2.25 for Stanislaus, and to waive claims for unpaid amounts, being the difference between their old rates and the rates fixed by the Supervisors in 1910.

The twenty-five-mile ditch of the Tarr Mining Company, built at a large cost to carry water from Wolf creek to the Smartsville district for use in a mining enterprise which proved a failure, may be utilized for

irrigation. It is claimed that about 20,000 acres in the Union Lime Kiln, Pleasant Ridge and Indian Springs, Cal., districts may be served from this ditch.

Nebraska

The Nebraska Irrigation Association has asked the legislature to appropriate \$25,000 to defray the expenses of litigation to determine the

priority right of appropriations in interstate streams regardless of state boundary lines.

A great many pumping irrigation plants are to be installed this year around Kearney, Neb., in the Platte Valley. This should make an ideal pump irrigation district as the water level is from 15 to 25 feet and the water can be handled very economically at that depth.

Alfalfa for profit

"One-Half the Alfalfa Seed Sown is Wasted Every Year"

This statement has been made by many recognized Alfalfa experts—men who know what they are talking about.

They say that they secured better stands of Alfalfa with 10 pounds of seed, drilled with the Superior Special Alfalfa and Grass Seed Drill than with 20 pounds of seed sown broadcast.

SUPERIOR



THE SUPERIOR 20 X 4 SPECIAL ALFALFA AND GRASS SEED DRILL

There are 20 discs on this machine set 4 inches apart. The construction is such that all the seed is sown at an even depth, and an equal amount of seed in every furrow.

None of the seed is wasted, when drilled in the ground with a Superior Alfalfa and Grass Seed Drill

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PRODUCES BEST STANDS OF MILLET

INCREASES YIELDS OF WINTER WHEAT BY CULTIVATION and SOWS CLOVER AT SAME TIME

Saves More Than Two Dollars an Acre on Seed Alone

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Go to your local dealer and ask to see the Superior Special Alfalfa and Grass Seed Drill. If he will not supply your needs, we will.

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FREE—A copy of "Boyd's Farmers' Alfalfa Guide," price 10c, will be mailed free to any reader of Irrigation Age who will write for the book and mention Irrigation Age.

Colorado

The San Luis Valley Irrigation District Association was organized at Alamosa, Colo., recently. The membership of the association is composed of the directors of the six irrigation districts of the valley, and will have for its object the general advancement of district affairs.

All the districts of the valley were represented at the meeting, Leonard A. Hardie acting for the Terrace, A. M. Weaver and Mr. Hughes for the Trinchera, G. G. Rushton and J. N. Coleman for the Moffat, Mr. Dunshee for the Kirber Creek and A. Elmer Headlee for the Mosca Irrigation districts. G. M. Corlett of Monte Vista, acted as representative for the San Luis Valley Irrigation district.

The officers of the Twin Lake Land & Water Company and the two farmers' organizations, the Twin Lakes Reservoir and Canal Company, located in the district around Ordway, Colo., which have been maintained as one, have separated.

F. A. Townsend, who has been the secretary for all three, will be the secretary for the Twin Lakes Land & Water Company, the original holder of the water rights. This company owns several hundred acres of land under this system.

New Mexico

J. W. Shank, Benjamin, Mo., will install several pumping plants to irrigate land near Alamogordo, N. M.

Oregon

The Empire Manufacturing Company, Spokane, Wash., and the Pendleton Iron Works, Pendleton, Ore., have been amalgamated under the name of the Empire Manufacturing Company, Pendleton, which has a capital stock of \$125,000. The iron works will be shut down for a short time, to make needed repairs, and an addition will be made. Philip Laber is president, and Charles L. Kik, vice-president. A rotary pump for irrigation purposes will be one of the principal products of the plant.

An irrigation and power dam, estimated to cost \$10,000, will be built by the Neenah-Oregon Land Company, Ridgle, Ore. It plans to ultimately develop power for the operation of pulp mills which will be constructed. I. P. Gardner is manager.

One of the biggest deals of this year in Oregon was concluded when final papers were signed whereby W. J. Furnish, of Portland, disposes of the 5,000-acre Furnish irrigation project at Stanfield, in Umatilla county, and 5,500 acres of dry lands in territory contiguous to the project. The purchaser was J. O. Storey and associate of Tacoma, who in part trade, transferred about 8,000 acres of timbered lands 25 miles from Tacoma, along the line of the Milwaukee railroad. The value set by Furnish on the project and dry lands involved was considerably in excess of \$500,000.

Immediate development of 20,000 acres of irrigable land in Umatilla County, Oregon, will be made possible through arrangements completed by the directors of the Teel Irrigation District, which controls land on the Camas Creek and its tributaries. The district lies between Echo and Butter Creek, to the south and west of Echo.

Plans are going ahead for the resumption of work on the Thief Valley irrigation project, near Baker, Ore. Not as much work will be done this year as expected, because financial conditions resulting from the war have made it impossible for the Evans-Almirall Company of New York to carry out its plans for financing it in full. Construction work will be started on the big dam, it is announced.

Utah

Work on the St. George and Cottonwood reservoir has begun and it is hoped it will result in the storage of water which will make possible the reclamation of most of the unused land in the St. George Valley of Utah.

Several entries have recently been made under the new Berry Springs project just west of Hurricane, Utah. The Dixie Irrigation Company has been incorporated, and the canal has been surveyed to cover upwards of 6,000 acres of land in that vicinity.

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THAT sounds good, doesn't it? Well, that's just what an AULTMAN-TAYLOR GAS TRACTOR will do for you right on your own farm. It has done it for thousands of other good, hustling farmers and it will do it for you. It will save you money plowing and do a better job than is possible with horses. It will save you money harrowing, discing, harvesting, threshing, seeding,

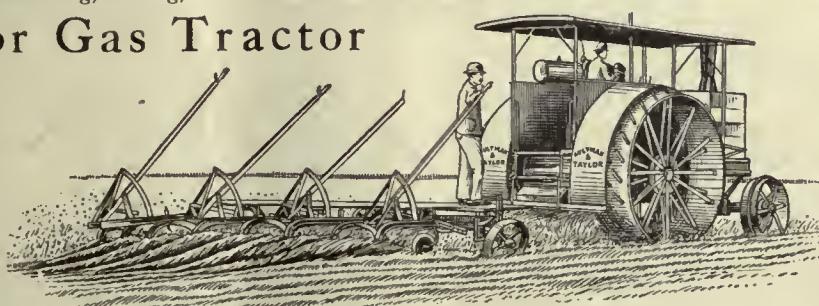
Aultman-Taylor Gas Tractor

(Built in 2 sizes—30-60; 25-50)

and then you can farm better, cheaper, and with more satisfaction. You can get your seed bed ready when the ground is in prime condition. You can sow when conditions are just right, and you can gather your crops when they should be gathered. All this, and lots more can be done quicker, cheaper and better than you can do it with horses. You'll be astonished at what can be accomplished with this great tractor. No other tractor can give you such wonderful results—such entire satisfaction, for the simple reason that the Aultman-Taylor Gas Tractor is particularly adapted to the power needs of the farm—built for this particular work at no spared pains or expense. It's the tractor that makes good everywhere at all kinds of work. The Aultman-Taylor burns either gasoline or kerosene under all loads. Go see this great tractor work. There's

hauling, etc. In fact, it will save you money at every power job, large or small, on the farm, and the beauty of it all that it is, costs you nothing when not working.

Right now is the time to get rid of the greater part of four horses. Don't let them eat their heads off. Dispose of these expensive animals now. The proceeds of the sale of feed which you would otherwise have fed to these animals will make a good substantial payment on an



one in your neighborhood. We want you to see this tractor in operation. Seeing is believing. Its performance will convince you that it's the best tractor ever built, or if you cannot locate one in your immediate vicinity, write for catalog and other literature at once, and get all the facts about the Aultman-Taylor Gas Tractor.

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Crossbars 4 inches apart.

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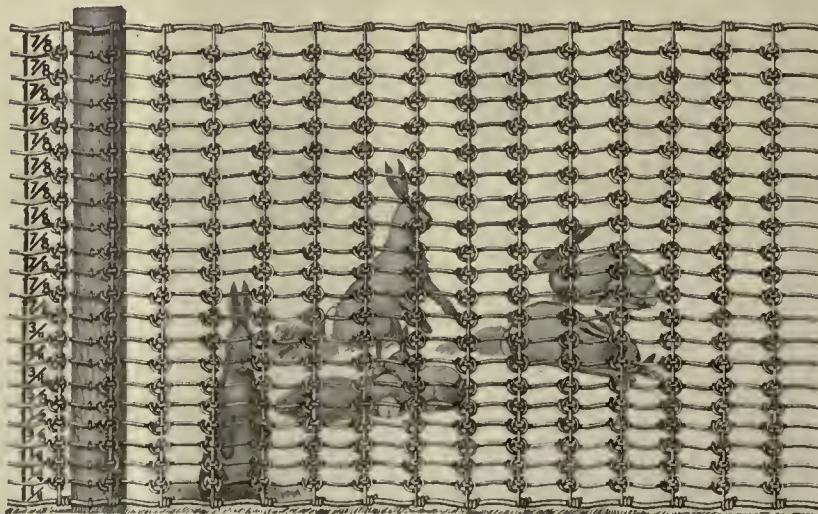
Extra close spacing between the line wires, holds the small chicks and keeps animals out.

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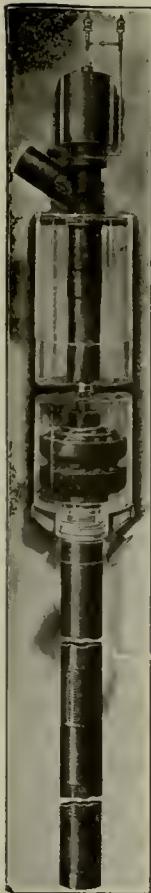
You will find a number of good, substantial styles which are attractive in appearance and effective fences in the Peerless Lawn Fence line.

Peerless lawn fence is carefully woven on perfected machines, of the best grade of galvanized wire it is possible to procure. The crimps in the wire are deep, adding to its appearance; the line wires are given an extra turn, making a close twisted strand that prevents slipping of the crosshairs.

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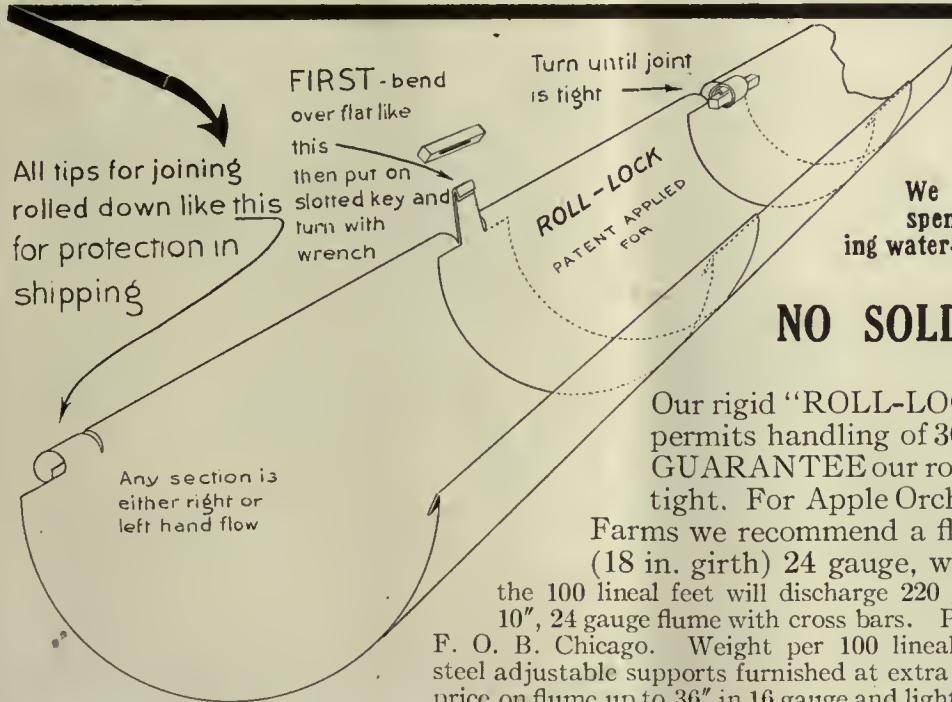
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With water-tight joints
Every Farmer who sees
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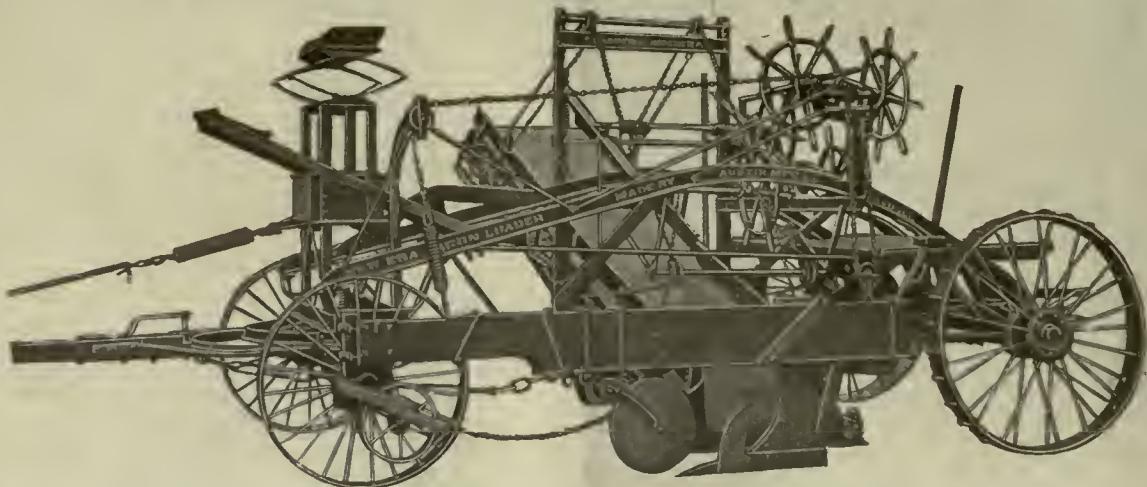
We ship 10 foot lengths; you
spend scarcely 10 seconds mak-
ing water-tight, "ROLL-LOCK" joint.

NO SOLDER REQUIRED

Our rigid "ROLL-LOCK" flume in practice permits handling of 30-foot sections and we GUARANTEE our roll-lock to remain water tight. For Apple Orchards and Small Truck Farms we recommend a flume 10 in. across top, (18 in. girth) 24 gauge, when pitched 3 ins. to the 100 lineal feet will discharge 220 gallons water per minute. 10", 24 gauge flume with cross bars. Price 8½c per foot crated F. O. B. Chicago. Weight per 100 lineal feet 190 lbs. Portable steel adjustable supports furnished at extra cost to you. Will quote price on flume up to 36" in 16 gauge and lighter. *District Agents Wanted*

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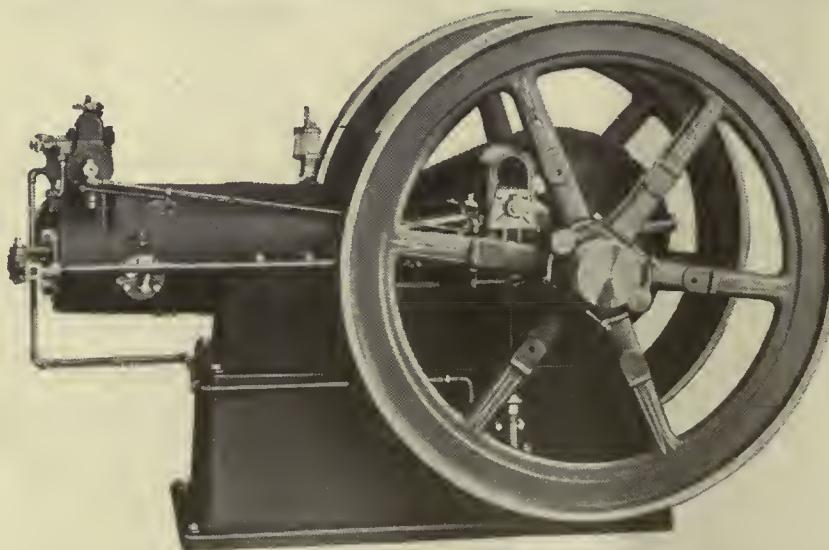
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Delays mean excessive cost that must be added to the first cost of an engine. That is why a cheap engine is expensive at any price, compared to a Lauson.

Lauson Kerosene Engines are built to give long, continuous service, year in and year out. You will find more drop forged parts used in its construction than in any other engine offered you.

Built in sizes from 2 to 50 H. P. horizontal and 25 to 100 H. P. two and four cylinder vertical.

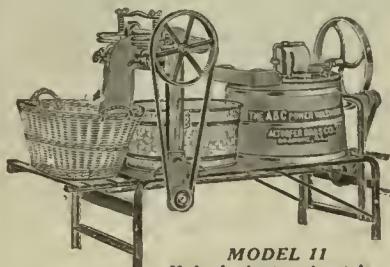
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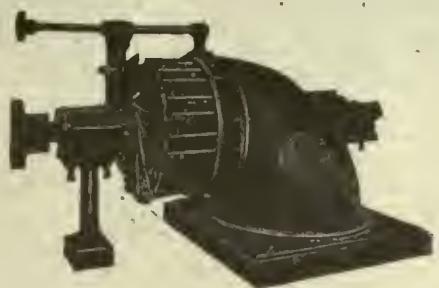
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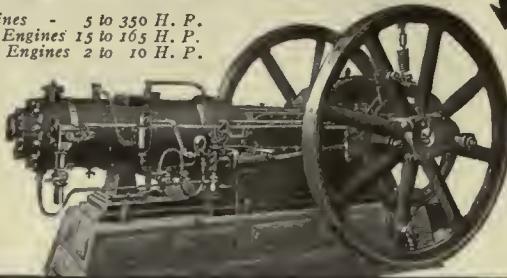
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Thirtieth Year

THE IRRIGATION AGE

VOL. XXX

CHICAGO, APRIL,, 1915.

No. 6

THE IRRIGATION AGE

With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARID AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

D. H. ANDERSON

PUBLISHER,

Published Monthly at 30 No. Dearborn Street,
CHICAGO

Entered as second-class matter October 3, 1897, at the Postoffice
at Chicago, Ill., under Act of March 3, 1879.

D. H. ANDERSON, Editor

ANNOUNCEMENT.

The "Primer of Hydraulics" is now ready; Price \$2.00.
If ordered in connection with subscription \$2.00.

Now Is the
Time for the
Settlers to Make
Their Case

It looks as if the hour had come to straighten out affairs in the Reclamation Service. The water users seem to have decided to take the project revaluations seriously, and make the forty dollars per day or more costs to each project pay legitimate returns. The returns, which the settlers ask, are fulfillment of their solemn contracts with the United States government and the assessment of charges for only those works which are of actual benefit and which represent legitimate expenditures.

It required several conferences with Will R. King, chief counsel of the Reclamation Service, to induce that eminent lawyer to agree that the settlers should be permitted to "plead" their water contracts with the government as part of the records of the revaluation hearings. Good! This is the first foundation stone in the case, which the settlers must build up if the final verdict of Secretary Lane's supreme court on revaluations or Congress, where, no doubt, the issue must go for ultimate settlement, is to be favorable to the water users.

Every water user, as THE IRRIGATION AGE has urged since Secretary Lane first suggested the revaluation idea, should make it his personal business to see that the revaluation hearings are thorough and not merely a farce in accounting. Even

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Associations has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Interesting to Advertisers

It may interest advertisers to know that The Irrigation Age is the only publication in the world having an actual paid in advance circulation among individual irrigators and large irrigation corporations. It is read regularly by all interested in this subject and has readers in all parts of the world. The Irrigation Age is 30 years old and is the pioneer publication of its class in the world.

though a revaluation board may look lopsided and leaning in favor toward the Reclamation Service, make yourself heard. If a settler knows of the expenditure of one dollar upon unnecessary or incompetent work, or of any wrong-doing, foolishness or blue sky engineering, he should insist upon placing this information before the revaluation board. This is no time to be a shrinking violet.

Officers of the Lower Yellowstone project figure that the sustaining of their present water right contracts will be worth at least \$1,500,000 to the settlers.

On another project a \$2,000,000 diversion canal has proven practically valueless because there is little or no water to run through it during the irrigating season, and the Reclamation Service has been forced to spend \$2,000,000 more to build a storage dam, not figured on in the original project estimates. Should the settlers be forced to pay \$4,000,000 for something from which they are obtaining only \$2,000,000 worth of benefit?

There are similar monuments of asininity on other projects. Each one of these, large or small, should be marked in glaring letters and brought into the full light of day. The revaluation boards should be forced to sift such matters to the bottom and learn just how much, if any, value these pieces of work may have for the water users.

The settlers should not be made to pay one dollar for any piece of work which does not represent actual value to them.

Any attempt to make the revaluation political buncombe should be resented sharply by the settlers. They have to pay its costs and they have accepted it as a sincere effort to right the wrongs which the Newell bureaucracy inflicted or attempted to inflict upon them. But without most earnest participation by every settler, these revaluations are liable to prove of more damage than good, for if only the Reclamation Service presents evidence of cost and values, what opportunity will the settlers have when the day of judgment comes—the day when either the present administration or some other must go to Congress and ask permission or legislation to charge off the charges for "lost work" or excessive costs, probably \$40,000,000.

This will be a bitter pill for Congress to swallow and one around which much politics will be juggled, but if the settlers have made out a good case at the revaluation hearings, Congress will have to accept it. And while the amount which probably will be charged off looks very big, if considered in the right light, it will not be such a tremendous loss to the United States.

Much of it will come back indirectly from the homes and farms established on the previously unproductive desert. And then there is the knowledge which the United States has been able to obtain and give to the world through this irrigation construction. The cement tests which have been made and are being made on the various projects alone are worth millions, if utilized in future construction work by the government and its citizens.

**8,500
Co-operative
Associations
In the U. S.** Co-operation an idle dream? Well, that is what the wise men called co-operation not very long ago.

Facts offer a different answer today.

There are now 8,500 marketing associations of a co-operative nature in the United States. Of this number, 2,700 are co-operative and farmers' elevators, 2,500 are co-operative and farmers' creameries, and more than a thousand are fruit and produce associations. More than a billion dollars' worth of agricultural products are marketed annually by co-operative and farmers' marketing associations.

The meanest man in the world is the one that will misuse a cow in the spring of the year when she is all of a quiver over the little thing that has been born to her. Her whole life is bound up in that calf and she must show it. So be kind, be gentle and be a man.

Irrigation
Investment
Market Soon
Must Open Up

We have met two or three men this month with courage enough to talk to Eastern bankers about investments in irrigation securities.

They met with more encouragement than even—Western optimists that they are—they had hoped to receive.

This is a good sign. Due to the stabilizing influences, which have been at work in state legislatures in the West and in Western banking circles, irrigation securities are beginning to be looked upon more favorably by the man with money to invest.

And we believe the American bankers are soon going to take off their coats and help finance the big projects of the West, which, if handled in a practical manner, will show sufficient profit to warrant investment by private capital.

The money market, however, is still unsettled. Sentiment is still influenced by the war news. There is no definite light as yet in this direction. The best judges do not believe that this country will get drawn in either in Europe or in Mexico, although the bare possibility of such an outcome is sufficient to restrain the disposition to increase commitments on the constructive side.

The security market continues to reflect the general uncertainty prevailing. Those interests that have the greatest faith in the early termination of the struggle abroad lack the courage of their convictions. Undoubtedly the supply of securities is being increased by reason of foreign liquidation and by new financing.

There is still good investment buying on recessions, but the market remains narrow, and under such conditions it is difficult to detect the absolute trend. The market becomes over-bought as well as over-sold at times and prices respond easily to the technical position.

Apparently the large financial interests are not favorable to the activity and strength in certain specialties, notably the motor stocks. This may account partly for the recent setback in the standard shares.

The wheat market holds strong on continued export demand.

The domestic trade situation is surely improving, even if slowly. There is a disposition to increase the capacity of the steel plants, which is an important consideration. But people will not see fully the returning prosperity until railroad earnings improve more largely, until clearing house exchanges increase perceptibly, and until there is a larger demand for money from commercial sources.

Clean Up**Your Place; Fight the House Fly**

It is fly swatting time.

Begin war right now on this pest and carrier of disease.

The house fly is known to carry the germs of typhoid fever, tuberculosis, dysentery, cholera, cholera infantum—in fact, any dangerous bacterial disease with which it comes in contact.

As a transmitter of disease, the fly carries the germs in two ways: First, by the germs clinging to the hairs on the body and feet, the fly having previously come in contact with some infested material, and second, in its alimentary canal. Numerous records have shown that there may be carried from 550 to 6,600,800 bacteria by a single fly. Too much stress cannot be laid on the exclusion of this insect from dwellings, and especially from eatables, where it will leave, simply by contact, some of its deadly germs.

The house fly passes the winter in the adult stage, hiding in cracks and other secluded places. When spring opens it emerges, lays its eggs (about 120) in stable manure and in decaying animal or vegetable matter. These eggs hatch in from 8 to 12 hours and reach maturity in about 10 days. In some localities there are as high as 13 generations in one season.

There are several methods of ridding premises of the adults, but the most successful is prevention. Well screened houses will do their part in the control of this pest, but cleanliness of premises which destroys the breeding places of the flies will do more toward removing the dangers herein mentioned than all other remedial measures.

Arbor Day Celebration Now Compulsory in Spain

Trees are an asset to any country. Practically every state in the Union fosters tree-growing at least one day each year by observing Arbor Day. Spain has gone still further.

A royal order has just been issued declaring the annual celebration of arbor day obligatory in every township and municipality. The date on which this celebration is to occur is to be fixed by the competent local authorities and brought to the attention of all the inhabitants in the neighborhood. It shall be incumbent on the municipal or town councils to invite all the local authorities, associations, and unions, official as well as private, to participate in the ceremonies.

Furthermore, the various councils must enter in their estimates for current expenses for each succeeding year such amount as they consider neces-

sary for the purchase of land, where it may be possible, for irrigation and for other indispensable disbursements in connection with the tree planting. The governors of provinces can not approve an estimate of expenses for any city or town unless it specifies some amount to be devoted to Arbor Day.

Forcing a Man to Be a Good Farmer

Here is a story of how a banker made a good farmer out of a poor one.

A number of years ago a North Dakota wheat farmer, whose exclusive grain growing had put him deep in debt, desired from his bank a

loan of a thousand dollars. Except the horses there was no livestock—not a cow, a pig, or even a chicken—on the place. The banker, a very shrewd business man, was able to analyze the problem and to discover the cause of the farmer's financial difficulties, and he agreed to make the loan only on condition that the borrower change his system of farming.

The system outlined by the banker required that a portion of the loan should be used to purchase two cows, half a dozen pigs, and a small flock of poultry. It also provided for a fair sized vegetable garden. Grain farming was to be continued as before. The banker figured that the livestock and the garden would, in poor as well as in good seasons, fully support the farmer's table. He figured that in poor years the farmer would be able to play even, and that in the good, and even in the average year the farm would produce enough to gradually wipe out the debt.

The farmer reluctantly agreed to the banker's terms, received the loan, and met the conditions. In five years he was out of debt and rated as a substantial and prosperous farmer and business man. To him farming had ceased to be a game of chance and had become a business.

Don't get the laying hens too fat.

Balance the food ration for poultry and feed them with regularity.

When you go to town, get a rug and some furniture for your boy's room. He will perhaps think you are losing your mind by showing him the least attention, but you will find that he will stay on the farm longer if you treat him like he is human.

You are laying the foundation for the coming season's success right now. Get your cows up in good flesh and keep them so, if you expect them to do their best when they go out to pasture.

IRRIGATION WATER MEASURING DEVICES

**By California Agents of Irrigation Investigations, Office of Experiment Stations, U. S. Department of Agriculture*

THIS is the first of a series of articles prepared from a bulletin issued by the College of Agriculture of the University of California, at Berkeley. The articles are illustrated with photographs and drawings of the various structures and devices used in compiling the data.—THE EDITOR.

The public and private advantages attending the measurement of individual deliveries of irrigation water have for many years been appreciated in the older irrigated countries

and in some portions of the western United States where irrigation water has had a high sale value. Now the rapidly increasing utilization of the available water supplies and the better understanding of the principles underlying the wise making of rates to be charged for irrigation water are causing these advantages to be better understood in every irrigated section of the West. Citing only California as an illustration of this, it needs only to be said that while, outside of the southern citrus sections, appliances for measuring water deliveries were seldom considered in the design of irrigation systems ten or fifteen years ago, today no competent California irrigation engineer laying out an irrigation project would fail to give due consideration to necessary means for measuring the water supplied to irrigators. Furthermore, the recent giving to one central public authority the power to fix rates charged for irrigation water by California public utilities has made a more general understanding of



Concrete standardizing box, used in irrigation measuring device tests at the Davis Field Laboratory.

very satisfactory that does not accomplish such a result. Sometimes, and especially in the flatter valleys, irrigation ditches are but very little higher than the land to be watered, making measurement over a weir or other device requiring a free overflow of the water impossible. In such cases some form of the submerged orifice or some kind of mechanical registering meter must be used. With almost any one of these, silt or debris carried in the water, as well as temporary changes in the canal or ditch above or below the measuring point (as from checking up the water to get it on to the higher land) sufficiently change conditions to alter results and to impair the accuracy of measurements if they are not taken account of. An additional element of difficulty is found in the fluctuations in flow that almost invariably occur on every system, the same device sometimes being required to measure less and sometimes more than the quantity it is best suited to take account of.

been arranged for publication by Frank Adams, irrigation manager.

The installation of the Davis field laboratory and the testing of the devices have been jointly paid for from funds contributed by the state engineering department of California, the office of experiment stations of the United States department of agriculture, and the California agricultural experiment station. Co-operation with the state engineering department of California has been effected through agreement between that department and the office of experiment stations, the irrigation investigations at Davis having formerly been carried on by those two agencies without financial aid from the California agricultural experiment station.

*The installation of the measuring devices described in this series of articles has been carried out chiefly by S. H. Beckett and R. D. Robertson, irrigation engineers, assisted by Roy Wray. The tests of the devices have been made under the immediate direction of S. T. Hardling, irrigation engineer, in charge of irrigation investigations in Montana, temporarily on duty in California, who has also prepared the reports of the tests. The weir tables have been prepared by Wells A. Hotchkiss. The drawings and diagrams have been prepared by Stephen C. Whipple, scientific assistant. F. L. Bixby, irrigation engineer, in charge of irrigation investigations in New Mexico, temporarily on duty in California, assisted in designing the general plan of installation. The full study has been planned and, in general, supervised, and the data has

practicable means of measuring irrigation deliveries at least exceedingly desirable.

The measurement of irrigation water, while theoretically simple, is rendered quite perplexing in practice because of the varying conditions almost any irrigation measuring device is required to meet. While extreme accuracy is not expected and thus far is almost never reached, measurements within, say from two to five per cent of correct, are reasonable to expect, and no device can be considered



General view of the Davis (Cal.) Field Laboratory of Irrigation Measuring Devices.

Besides measuring water with reasonable accuracy, under sometimes widely varying conditions, a satisfactory device for taking account of farm water deliveries must be extremely simple in design, and be made of materials that are available and inexpensive. It should at least in part be susceptible of construction by the farmer to be served, and to be widely used, should not cost above, say, from twenty-five to fifty dollars. Where all of the farmers under one lateral receive the same flow of water in rotation, each retaining it for a length of time proportional to his interest in the system or the number of acres he irrigates, a device that both measures the rate of the flow and holds that flow constant is the ideal to be sought for. While there are few devices in use that hold the flow of water constant, reasonably satisfactory results are obtained under the rotation plan by measuring or gauging the turnout with sufficient frequency to enable its being held about uniform. Where rotation on laterals is not feasible, or where independent individual deliveries are preferred, the measuring device, to be fully satisfactory, should register the total amount of water passing rather than the rate of the flow. While this result can be accomplished by using a water register in conjunction with a weir or other device that takes account of the rate of flow, water registers require too much care and are too expensive for use in making deliveries of water to farms. The Dethridge, Grant-Michell, Hill, and Hanna meters described in these articles are all of the type that register the total flow rather than measure the rate of flow, and to the extent that they

can be made to meet the conditions already named, are preferable to the more simple weir or orifice taken singly.

In planning and carrying out the installation at Davis three main purposes have been held in view: To assemble in one accessible place, and largely for demonstration uses, examples of the principal irrigation measuring devices so far developed; to make such tests of these devices as would demonstrate their accuracy under ordinary field conditions when compared to a standard weir and to each other; and incidentally to furnish an opportunity to students at the University Farm to make practical working tests in agricultural hydraulics. In installing the various devices the effort has been made to follow practical field rather than ideal laboratory conditions; also, in describing the devices and the tests made of them, technical language has been wholly eliminated.

The purpose of these articles is to describe fully, illustrate by drawings and photographs, and point out the relative accuracy of some types of the devices that have already become standard or that have been in use for a sufficiently long time or on a sufficient scale to make them of enough public interest to warrant their installation at the Davis field laboratory. This field laboratory offers opportunity for the installation and testing of other irrigation measuring devices, and since these articles were prepared the designers of two devices have made installations there for such impartial testing as it is desired to subject them to. It is hoped to add to the demonstration from time to time, so that

ultimately an example of any irrigation measuring device of merit may be seen installed under practical field conditions on the University Farm.

There are various units of water measurement, which figure in experiments such as are here described. These water measurement units include:

The Inch.—This is a variable unit having different meanings in different states

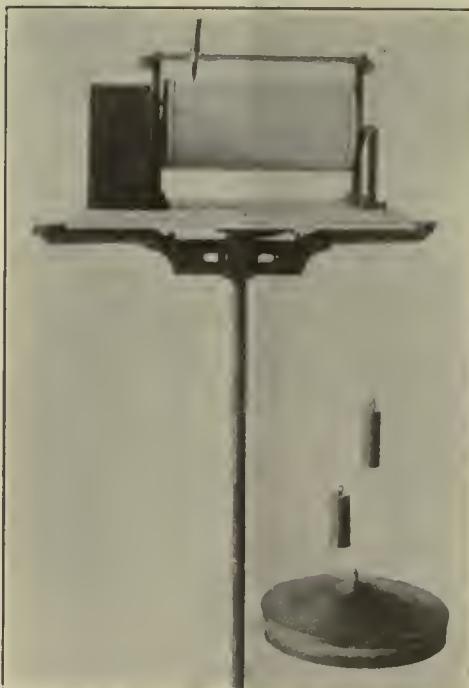
and even in different sections of the same state. The old miner's inch of California was the quantity of water flowing freely through an opening 1 inch square, the center of which was 4 inches below the surface of the water standing above the opening, and which is equivalent to a flow of 9 gallons per minute or $1/50$ cubic foot per second. The present statute inch of California is defined as a flow of one and one-half cubic feet per minute. It is measured under a 6-inch pressure and is equivalent to a flow of $11\frac{1}{4}$ gallons per minute or $1/40$ cubic foot per second. While the meaning of the inch varies with local practice, it is *not* a stream of water 1 inch deep and 1 inch wide, regardless of pressure. Where its meaning is clear the inch is a convenient unit for measuring small streams up to, say, 50 to 100 inches, and is quite commonly used for such streams, particularly on many of the southern California systems. For larger streams its use is generally discarded in favor of the more definite cubic foot per second.

The 24-Hour Inch.—This is a very common unit, especially in southern California, and is, as its name implies, 1 inch (the exact amount of which varies with locality and local custom) running for 24 hours. Variations of this unit found on some California irrigation systems are the 1-hour inch and the 12-hour inch.

The Cubic Foot per Second.—This unit represents an exact and definite quantity of water, viz.: the equivalent of a stream 1 foot wide and 1 foot



Reinforced concrete reservoir at the Davis Field Laboratory.



A water register. Experimenters at the Davis Laboratory declare these instruments require too much care and are too expensive for use in making delivery of water to farms.

deep flowing at the rate of 1 foot per second. It is therefore the most satisfactory unit for streams of one or more cubic feet per second.

The 24-Hour Second Foot.—This is one cubic foot per second, running continuously throughout a 24-hour period. It is equivalent to approximately 2 (exactly 1.9834) acre-feet.

The Acre-Foot.—This is the equivalent of

a body of water 1 acre in area and 1 foot deep, or 43,560 cubic feet. As already stated, one cubic foot per second, or 50 southern California inches, or 40 California statute inches, running continuously for 24 hours will supply approximately 2 (exactly 1.9834) acre-feet.

The Acre-Inch.—This is one-twelfth of 1 acre-foot, or the equivalent of a sheet of water 1 acre in area and 1 inch deep. It is the unit sometimes used instead of the acre-foot, especially in expressing quantities of less than 1 acre-foot.

The Gallon.—As many irrigators receive their water supply from pumps, and as pump manufacturers usually estimate discharges in gallons per minute or gallons per second, this is sometimes a convenient unit to use. One cubic foot is approximately equal to $7\frac{1}{2}$ gallons (exactly 7.4805) and 1 cubic foot per second is ap-

proximately equivalent to 450 gallons per minute or $7\frac{1}{2}$ gallons per second.

One Thousand Gallons.—This unit is quite common in irrigation practice in San Diego County, Cal., where the cost of irrigation water is perhaps higher than anywhere else in the United States.

In addition to the various measuring devices subsequently described, the Davis laboratory consists of the following elements:

(1) Reinforced concrete lined reservoir 96 feet long, 16.5 feet wide, and 5.5 feet deep, with side-slopes of 1 to 1, and with elevation of 94.8 feet

(Continued on page 188.)

The Federal Water Users



A Department Devoted to the
Interests of the Farmers on the
Government Irrigation Projects

EDITED BY GEORGE J. SCHARSCHUG

SETTLERS WATCH REVALUATIONS CLOSELY

EVALUATION of the Federal Irrigation projects is under way. What the outcome will be only a Biblical prophet could foretell.

One thing seems certain. The settlers are thoroughly awakened. They are determined not to accept any increase in charges for their water rights over the figures fixed in their contracts with the government. Precautions have been taken already on several of the projects to prevent any such action, or at least to pave the way for court fights against any attempt to raise the water charges.

After refusing for months to accept the new Twenty-Year law, the directors of the Belle Fourche Valley Water Users' Association of South Dakota agreed to order an election of a member of the revaluation board, protecting the water users, however, by the following resolution:

"That it is expressly understood that in appointing this representative the individual water user and the Water Users' Association are in no way bound by the findings of this board; and that neither the Association nor the individual water users thereby agree to any increase of construction or operation and maintenance charges that have heretofore been fixed by contract or public notice."

Perhaps the best idea of the feelings of the settlers and what they have done during the past month of preliminary work can be gleaned from statements printed in newspapers published on the various projects.

Burton S. Adams, secretary of the Lower Yellowstone project in Montana and North Dakota, says in the Sidney, Mont., Herald:

"Meeting of board of review, and the Maintenance and Operation Congress for the Northern division of Reclamation Projects was held in Billings, March 4, 5 and 6. The

delegates from this project met Will R. King, making our request to be permitted to go into all matters relating to our original contract with the Government in its relation to what this project should properly return to the Government, and after three sessions with him, it was decided that we would be permitted to plead our contract. This is considered the most important step in the review of costs of the project, as there is over one and one-half millions of dollars involved in that matter of our legal and moral rights under original contract.

"The local board of review for this project will probably begin work on or about April 1, and it is important that every one that knows of anything charged to this project that should not be so charged, because excessive or improper for any reason, should furnish the information without

delay, as this will be the last opportunity to show the excessive costs that have been charged to the water users."

In an earlier communication to the Sidney Herald, Mr. Adams says:

"Letters will be sent to each person on the Lower Yellowstone project who was here during construction, asking for any definite information tending to show excessive cost of any definite part of the works, showing the time, place and by whom built and the cause of excessive cost, also as to any items that have been improperly charged to the project for any reason, and as to any works that were defective, and have had to be rebuilt for any reason.

"Mr. Newell and Mr. Savage are both removed from any official connection with the service, in so far as administration is concerned."

Secretary Lane's selection of Project Manager P. M. Fogg as the Reclamation Service representative on the Minidoka, Idaho, project did not



A gas engine pumping plant at Fresno, Cal.

THE IRRIGATION AGE.

meet with favor and he was forced to name another man. The Rupert (Ida.) Democrat says:

"Word reached President Randolph of the Minidoka Irrigation District from Washington that the storm of protests that arose when it became known that the Interior Department had selected Mr. Fogg as a member of the Board of Revision has borne fruit in the rejection of Fogg and the naming of former Project Manager Paul."

"The Minidoka Irrigation district, through its officers, notified Secretary Lane that his selection in this instance was not at all satisfactory to the settlers, inasmuch as matters will come under the review of the board which were parts of Mr. Fogg's administration. In addition to this protest, scores of individuals are reported to have written the department, with the result as stated."

The Okanogan (Wash.) Water Users' Association wants action or they will quickly abandon their interest in the revaluation. The Omak (Wash.) Chronicle says:

"In the matter of the board of review, the trustees were instructed to go into the matter only just so far as they saw that some good could be done the members and to be very careful that the expense of the inquiry did not exceed the benefits derived. It has been estimated that this review will cost somewhere in the neighborhood of \$40 a day, so there will be little chance of its lasting very long here unless something pretty big is turned up. The preliminary steps in this matter have already been taken and the wheels set in motion to recover from the Indian Reclamation Service some \$4,500 expended and charged to the project for the survey of the 3,600-acre Indian project on the east side of the river at Omak."

When the Reclamation Service and water users' members of the revaluation boards in the Central division met at Denver to pick candidates for the third member of the boards, it was found that only two representatives of the water users were present. One of these was H. G. Stewart, of the North Platte project in Nebraska, and a Mr. Wallace, from the Grand Valley project. The Mitchell (Neb.) Index says:

"In the selection of candidates for third member to be appointed by the Secretary, Mr. Wallace acted generally in accord with the wishes of the Reclamation Service members. Mr. Stewart could not agree to their recommendations, but finally it was decided that they would agree on a candidate proposed by him and he would vote for two candidates proposed by them. He named J. O. Baker, of Mitchell. The other candidates are A. J. McCune and P. J. Preston, engineers, of Denver. One of these men will be appointed as the third member

of our Local Board of Review to act with Project Manager Andrew Weiss and Mr. Stewart for the North Platte project, and also to act with the two other members on each of the other projects of the Central Division.

"Should the Secretary of the Interior see fit to appoint one of the nominees recommended by the Reclamation officials, the farmers under the project may have about as much hope for a revaluation downward as there was in Taft's time for a tariff revision downward 'by its friends.' Mr. Weiss is entitled to be held in the highest esteem by all under this project. He has been conscientious and painstaking in all that he has done. Being an honest man, he could not report adversely to his own best judgment. Neither he nor anyone else—not the fairest man that ever lived—is the best person to investigate and review his own course of proceeding and pass unbiased judgment upon it. With another member on the Local Board likewise prejudiced, as it is natural to be expected that all members of the Reclamation Service would be, the time and expense of the so-called 'review' will be money thrown away for a report of approval of all the expenditures that have been made. We do not believe that was what was designated by Secretary Lane when he first proposed that an investigation should be made.

"The water users will be charged with the costs of the proceeding.

"Here's hoping that the Secretary will appoint as third member of our Local Board J. O. Baker, or if one of the Denver men, that he may be wholly unprejudiced in order that the whole proceeding may not be an expensive farce."

The Uncompahgre Valley (Colo.) Water Users' Association has refused to participate in the revaluations. The board of trustees adopted the following resolution:

"Resolved that it is the understanding of this board that this project is not intended to be included in the list of projects which are requested by Secretary Lane to appoint a member of the Board of Review of the cost or opening thereof announced by the Secretary, nor has the construction so far progressed as to make it desirable to our water users to participate in an audit of accounts or cost of construction at this time. For these reasons only we have not elected a member of the audit board."

Commenting on this action, the Montrose Enterprise says:

"There seems to be a fear that the report of this board of review will be the same as an acceptance on the part of the water users under the project as to the findings of the board, and the additional fear that the board will be dominated too



Alfalfa hay raised by pump irrigation near Hereford, Texas.

much from the government end, which has a tendency to cause the water users to hesitate in going into a proposition which they are afraid might block the way for further protest against some of the charges now made against the project. And in view of the fact that the project is not done yet, it is feared that subsequent charges against the project could not be objected to.

"R. C. Walter, supervising engineer of the Reclamation Service, says that he is at a loss to know why our local people are standing back on this proposition. He says we have everything to gain and nothing to lose by our participation in the proposed review of the project. He says the charges for the construction of the project are always there against it and if we fail to participate in the review Secretary Lane will naturally take it for granted that we are satisfied and will make

his recommendations to Congress on that basis. Mr. Walter says that if we have any objections to certain charges against the project now is the time to make them, this being the purpose of the board of review."

The directors of the Yuma, (Ariz.) Water Users' Association voted to refuse to participate in the proposed revaluation of the Yuma project. This action was put to a referendum by the settlers and was overwhelmingly sustained.

Water users on the Tieton project, around North Yakima, Wash., passed a resolution demanding that C. H. Swigart, supervising engineer of the project, be eliminated as the representative of the Reclamation Service on the revaluation board. The settlers insisted that Mr. Swigart has had too much to do with the construction of the project to be an impartial judge.

WATER USERS READY TO TAKE OVER PROJECT

BY F. G. BURROUGHS,

Editor of the Rupert, Idaho, Democrat

THE directors of the Minidoka Irrigation District are anxiously looking for the receipt from the Secretary of the Interior of the contract under which the management of the Minidoka project will be turned over to the officers of the district, an action which will result in an annual saving to the settlers of thousands of dollars. Without in the least detracting from the splendid work of the government in building the Minidoka project, it may be properly stated that the work has now reached a stage where the district organization can step into the shoes of the project management and complete the work so well begun.

As demonstrating the possibility of saving to the settlers under the district plan, a brief review of the cost of the present management may be cited.

The number of government employes in the classified service, holding appointments from the Secretary of the Interior, is sixteen, carrying a total pay roll of \$26,400. The number of employes holding positions in the registered service on the project total forty-six, whose wages add up \$4,102 each month more. A few more unskilled laborers are employed at certain times in the year. This makes a grand total of \$75,624 that the settlers are paying yearly for the maintenance of the project.

There is not the slightest question whatever but that under a judicious district management the direction of the project can be done for a quarter of this huge sum. There is not the slightest doubt but that the work of the government has been carried along to such a point where a district management is feasible and opportune and where the Secretary of the Interior should permit the settlers to manage their own affairs through such an organization. The cost of operation and management, under any other form than that of a district organization, is going to be a big yearly drain upon the resources of the settlers, while the cost of operation and maintenance by the district will be an insignificant part of the present charge.

Requests have been made to the Interior Department that the contract drawn up and forwarded to the government be returned to the officers of the district that they may submit the same to the water users for their approval at a special election. When Mr. King, Chief Counsel for the Reclamation Service, was in the Minidoka project last year he approved the proposed form of contract and promised that when he got back to Washington he would push the matter through. The directors of the irrigation district heard from Mr. King on the subject recently, and he made the following statements:

"After my very agreeable visit to your section, I found on further examination of the laws applicable to reclamation projects that before you could take over the project along the lines discussed by us while I was there, it is necessary that your state laws relating to irrigation districts be amended in some particulars. I have taken the necessary steps to bring about these amendments and after the adjournment of the Idaho legislature, if these amendments are adopted, we will re-consider the situation and I hope to be in a position to arrange affairs so as to permit your project to be taken over by your district. However, as above indicated, before doing so the Idaho laws must be so amended as to permit your district to act as fiscal agent for the Reclamation Service."

To sum up the situation, it looks as though within the next thirty or sixty days the long looked for contract may be sent on from Washington for the approval of the water users. The necessary amendments are under consideration in the legislature.

Besides providing the machinery for the efficient and economical management of affairs of the project, the district organization becomes the mouthpiece of the settlers as a body before the government, and its request or protests will meet with the instant attention of the Reclamation officials. The latter recognizes its authority to speak for the homesteaders as their attorney-in-fact.

GREAT PROJECT MAY CEMENT TWO NATIONS

THE proposed gravity canal system to irrigate the lower Rio Grande country is feasible.

It is a 750,000 acre international proposition.

It is a project which may prove greater than just a development and conservation of resources of the two nations—it is almost certain to become a lasting bond of friendship between the United States and Mexico.

Construction of the dam across the Rio Grande will require a special treaty.

The lands on the United States side are developed sufficiently in intensive two-crop-a-year farms, with railroads and markets established, to warrant the United States government in getting behind this vast project for wider development of Southeastern Texas and for cheaper water for those who are already taking water from the Rio Grande river.

The above pointed statements are from the lips of Lon C. Hill, builder of Harlingen, Texas, and the 13,000 acre irrigation project which surrounds it. Dreamer, yet man of great actual accomplishments, lawyer, irrigator, international statesman and one of the most powerful men in the state of Texas, Mr. Hill paved the way long ago for the construction of the Rio Grande gravity system project.

Remarkable as it may seem to those acquainted with the recent organization of a campaign in Southeastern Texas to induce Congress to take up the project, Mr. Hill made surveys at his own expense in 1902 and 1903, covering practically all the ground on the American side of the river, which it is proposed to include in the project. He also had tested the proposed dam site at Roma, finding a blue sandstone bedrock there that will furnish a satisfactory foundation for the proposed dam.

"The proposed Rio Grande gravity system is not only practical, but it will prove one of the most valuable and cleanest projects which the United States government ever undertook," said Mr. Hill, who was in Chicago recently. "There are sufficient flood waters coming down the Rio Grande each year, which, if stored, will irrigate more than a million acres of land. There are about 750,000 acres of high class agricultural lands on the United States and Mexican sides which can be irrigated from this project."

"Conditions are ideal in every way for the construction of the project. Back from the river and easy of access are several excellent sites on both sides for storage reservoirs, big enough to hold all



Hogs enjoy alfalfa and get fat on it. Photograph made on J. R. Webster farm, south of Hereford, Texas. This pasture contains 1½ acres and furnished grazing for sixteen pigs and three sows from June 15 to November 1, 1914. The gain in the pigs during this period was 2,160 pounds; at 6 cents a pound, this totaled \$129.60—not bad for an acre and a quarter.

the water the project will need. The land has a fall of about twelve inches to the mile to the east and northeast.

"This country, the richest agricultural empire in the world and a most ideal place in which to live, is already largely developed, with railroads traversing it and thriving towns and markets established for the produce of the farmers. The United States government cannot find any better security, therefore, in picking out a develop-

ment project, that it will get in the lower Rio Grande county.

"The construction of the project will require a special treaty between the United States and Mexico concerning the damming of the Rio Grande. As the brainiest men in Mexico have given this project much thought, as concerns the tremendous benefits that will accrue to Mexico from development on their side of the river, little or no difficulty will be met with in the treaty negotiations, as soon as stable government is established in Mexico. And the establishment of stable government in Mexico is very close at hand."

In preparation for the work that must be done by the Reclamation Service, when the United States government takes up this project, Mr. Hill drafted a bill (H. B. No. 576), which is certain of passage by the Texas legislature at the present session, amending the present irrigation law so as to facilitate Federal co-operation. This was necessary because Texas is not a public land state.

Because of his other and varied interests, Mr. Hill played only a small part in the recent organizing of the lower Rio Grande farmers to boost the proposed project. To obtain the \$10,000,000 to \$12,000,000 appropriation from Congress that is necessary and to otherwise bring the project to the point of actual construction, strong leadership will be needed in the Rio Grande country.

With his tremendous fund of first-hand information of the country, his record as a successful project builder and financier, his friendship with the powerful men of both the United States and Mexico, Mr. Hill stands head and shoulders above every other man in the lower Rio Grande country. He is the ideal man to lead the project to success. The farmers should put Mr. Hill in the saddle, induce him, if necessary, to sacrifice part of his private interests for the greater public good, and push this great project to early consummation.

CONGRESS HOLDS DOWN WATER RIGHT COSTS

WHERE the cost of a Federal irrigation project has been fixed by public notice by the Secretary of the Interior, no new work which may increase the cost of water to the settlers can be undertaken by the Reclamation Service, unless the settlers agree to accept such increased costs. Congress incorporated such a provision in the Reclamation Service appropriation bill. It reads as follows:

"No work shall be undertaken or expenditures made for any lands, for which the construction charge has been fixed by public notice, which work or expenditure shall, in the opinion of the Secretary of the Interior, increase the construction cost above the construction charge so fixed, unless and until valid and binding agreement to repay the cost thereof shall have been entered into between the Secretary of the Interior and the water right applicants and entrymen affected by such increased cost, as provided by section four of the act of August 13, 1914, entitled, 'An Act extending the period of payment under reclamation projects, and for other purposes.'"

Appropriations for the Reclamation Service for the fiscal year of 1916, beginning July 1, 1915, total \$13,530,000. Appropriations for the various projects are as follows:

Yuma project, Arizona-California, \$87,000.
Grand Valley project, Colorado, \$702,000.
Uncompahgre project, Colorado, \$469,000.
Boise project, Idaho, \$1,650,000.
Minidoka project, Idaho, \$410,000.
Jackson Lake, enlargement work, Idaho-Wyo-

oming. For maintenance, operation, continuation of construction, and incidental operations, conditioned upon the deposit of this amount by the Kuhn Irrigation and Canal Company and the Twin Falls Canal Company to the credit of the Reclamation fund, \$476,000.

Garden City project, Kansas, \$2,000.

Huntley project, Montana, \$150,000.

Milk River project, Montana, \$1,100,000.

Sun River project, Montana, \$1,100,000.

Lower Yellowstone project, Montana-North Dakota, \$70,000.

North Platte project, Nebraska-Wyoming (including \$800,000 for the Fort Laramie unit), \$1,140,000.

Truckee-Carson project, Nevada, \$236,000.

Carlsbad project, New Mexico, \$128,000.

Hondo project, New Mexico, \$6,000.

Rio Grande project, New Mexico-Texas, \$1,265,000.

North Dakota pumping project, North Dakota, \$25,000.

Lawton project, Oklahoma, \$50,000.

Umatilla project, Oregon, \$366,000.

Klamath project, Oregon-California, \$317,000.

Belle Fourche project, South Dakota, \$144,000.

Strawberry Valley project, Utah, \$393,000.

Okanogan project, Washington, \$51,000.

Yakima project, Washington, \$1,250,000.

Shoshone project, Wyoming, \$478,000.

Secondary projects: For surveys and investigations of secondary projects, \$50,000.

FORCED TO RECALL OPERATION CHARGES

OPERATION and maintenance charges announced recently in the various projects by Secretary of the Interior Lane have caused much dissatisfaction in some of the projects. So serious was the feeling in the Truckee-Carson project in Nevada that the Secretary telegraphed the project manager to refrain from putting the order into effect and notifying him that changes in the public notice were being considered.

The charges vary in the different projects. Those announced in the Truckee-Carson are:

Minimum charge, 75c per acre, one acre-foot allowed; second acre-foot 20c, third acre-foot 30c, fourth acre-foot 50c, fifth acre-foot, and each acre-foot additional, 75c.

In discussing the charges the Churchill County Eagle, of Fallon, Nev., says:

"The proposed ruling loaded an outrageous charge on all classes of sandy soil where a large quantity of water is essential for the production of crops—a charge that is practically prohibitive. As most of our readers are aware, the original maintenance and operation charges were 40 cents per acre per year. This was advanced to 60 cents and last year it was 75 cents.

"The contracts with the government call for

three acre-feet, or as much thereof as may be necessary. However, there are many classes of lands that do not need anywhere near that much, while others require even six acre-feet per irrigation season to produce crops successfully.

"This paper asked one of the most thoughtful and conservative ranchers of the Fernley district what he thought of the new ruling and he replied that he could hardly talk about it. When pressed as to what difference it would probably make in his maintenance charges, he replied that where it cost him \$90 for water for his land last year, the charge under the new ruling would be between \$300 and \$400. Under the proposed schedule he did not believe it possible, considering the condition of his land, to produce crops with a quantity of water that would come under \$300.

"This instance may be one of the extremes, but we believe there is a great deal of land that will come under the same class. In such cases it would be equivalent to the government confiscating the land.

"Under the administration of Secretary Franklin K. Lane the settlers of the Truckee-Carson project have fared better than under any former sec-

(Continued on page 183.)

IRRIGATED GRASS PASTURES PAY PROFITS

By J. S. WELCH

of the Agricultural Experiment Station, University of Idaho

THE old English admonition, "Drive your crop to market" is, with all that it implies, good advice to the farmers of any locality. It is especially appropriate to those on the irrigated lands. There is little doubt that the permanence and ultimate profits of a system of agriculture depend largely upon livestock production, and that successful livestock production necessarily involves the growing of grass pastures.

In most irrigated sections alfalfa is the great forage plant, and for the production of both quality and quantity of cured hay it is unexcelled. But because of its tendency to cause bloat in sheep and cattle it is very unsatisfactory for pasture purposes for these animals. During the summer months cured hay furnishes only a small part of the average livestock ration and hence most farmers will have to look to some other source other than alfalfa for their summer feeds.

The growing and feeding of soiling crops or the use of the summer silo is occasionally practiced to very good advantage in dairy farming. These systems, however, find their greatest use only where dairying is the farmer's sole business. On most irrigated farms time and labor must be divided between a diversity of interests. Many good farmers desire to keep in addition to their horses and dairy cows a small flock of sheep or possibly some beef steers. In such cases a good irrigated grass pasture will undoubtedly prove very profitable.

The irrigated land of southern Idaho is peculiarly adapted to the growing of pasture grasses. Ample water which can be applied whenever needed keeps the grass green and succulent during the entire season. The comparatively high lime content of our soils fits them well for grass production. These conditions with almost continuous sunshine insure a rapid, vigorous growth.

Pastures fit well into a system of crop rotation and are very effective in building up and conserving soil fertility. The humus that is so necessary in soil maintenance is furnished in abundance by a decaying grass sod. A good pasture will, of course, be maintained for a number of years, but when finally plowed up its beneficial effect upon the soil



This vitrified tile silo has put its owner in the money-making class. It is located in southwest Texas.

will be remarkable.

During the past four years the Gooding Sub-Station has conducted a number of experiments with grasses. These have included a comparison of different varieties and mixtures, experiment, seeding-time, and grazing tests with dairy cows, beef steers, and sheep. In the course of this work a great many observations have been made regarding

the various phases of pasture management.

It is a mistake to assume that the pasture should be located on land that is "good for nothing else." Grasses do fairly well on new soil, but will respond as readily as any other crop to increased fertility. Where practicable, it will pay to locate the pasture on land that has grown a leguminous crop or has had an application of manure.

The farm sometimes contains a piece of ground that is rough or stony and on this account hard to work; or there may be a piece of wet, poorly drained land that fails to respond to ordinary cultivation. There are among the cultivated grasses varieties that are fairly well adapted to such conditions. If properly seeded to the right grasses these pieces of land can be made to take their place in the farm economy to much better advantage than if handled in any other way.

A question has arisen concerning the advisability of devoting our best and comparatively high-priced irrigated land to grass growing. In the light of the results that are being secured at the station and on many other farms, because of the small outlay of time and labor necessary to produce these results, and, in consideration of its lasting importance to our agriculture generally, we must conclude that the grass pasture deserves a foremost place in the list of very profitable farm crops and that very little of our land is too expensive to be used for pasture.

While a great many different grasses are used for pasture purposes, the list of really valuable and important ones is not very extensive. The following ten varieties have been tested at the Gooding Station in southern Idaho:

Kentucky Blue Grass is very extensively used and is one of the most valuable pasture grasses. It

starts slowly and requires considerable time to form a sod, but when formed the sod is compact and tough. It is not a deep-rooting grass and hence requires frequent irrigation. It grows best on well-drained soils. During the early and late parts of the season it is a good producer but does not grow vigorously during the hottest weather.

Bromus Inermis or *Smooth Brome Grass* is not as well known as some other varieties but is very valuable. It starts growth early in the spring and grows late, forming a tough sod. It is one of the deepest rooting grasses and hence a good resister of drouth. It produces a great amount of very palatable feed.

Orchard Grass.—This well-known grass has proved to be one of the very best. It starts early and grows vigorously through the hot weather. It does not form a close, compact sod, but grows in bunches. It is comparatively deep rooted.

Timothy is usually grown for hay but is a fairly good pasture grass. It is a medium and late grower, forming a sod that is not as close as blue grass nor as open as orchard grass. In pastures it is not quite so permanent as some other varieties.

Meadow Fescue is sometimes called English Blue Grass. It forms a sod much like timothy. It is a fairly good producer and is well liked by the animals.

Red Top is shallow rooted and forms a very tough, compact sod. Because of a smaller production it is not as valuable on good irrigated land as the grasses previously mentioned. It is particularly adapted to low, wet, poorly-drained soils and for such conditions is the best grass we have.

Tall Meadow Oat Grass starts readily, early and late, and produces a great amount of feed. It is comparatively coarse and not as readily eaten as most other grasses.

English or Perennial Rye Grass forms a medium sod and is a fairly good producer during the first season. It is easily choked out by other grasses and after the second or third season is of no value.

Italian Rye Grass forms the same sort of sod as the English but is not as hardy nor as permanent and hence is of little value.

Canada Blue Grass has proved the least valuable of all grasses tested. It produces only a scant, indifferent growth and furnishes very little feed.

Because of the fact that alfalfa often causes bloat in sheep and cattle it is not advisable to sow

any at all in the pasture. The following clovers have been tested separately in pasture mixtures:

White Clover. This variety has given very good results. It fills in between the grasses, grows vigorously, and adds to the palatability of the pasture. Through its power to store up atmospheric nitrogen by means of the bacteria on its roots it helps to feed the grasses and increases the fertility of the soil. If the proportion of clover is large it may cause bloat but with only a small amount we have had no trouble.

Alsiike Clover. Under ordinary conditions this variety has given much the same results as white clover. It will grow on much wetter land, however, and is admirably adapted to the low, poorly-drained soils.

Red Clover has been the least desirable of the three. It does not fill in among the grasses as well or start as quickly when eaten off as the others, and it is more apt to cause bloat.

As will be noted in the foregoing discussion, the various grasses have different characteristics. There is no single one, however, that furnishes all of the conditions that are desirable in an irrigated pasture. For a number of reasons a mixture of grasses will be found more satisfactory than any one kind seeded alone.

Cultivated grasses may be divided roughly into two classes according to their habits of growth; first, those grasses which spread out by means of creep-

ing root stalks and form a close, compact sod, of which Kentucky Blue Grass and Smooth Brome Grass are good examples; second, those which tend to grow in clumps or tufts as Orchard Grass.

If a pasture is seeded to the first kind alone the sod will soon become so filled with the creeping root stalks that it will be too tough and compact and will fail to produce as much feed as it should. On the other hand, it is apparent that if composed of only the tuft-forming grasses the sod will be rough and uneven. The soil between the bunches of such a sod would not be used but would be tramped by the animals and washed by irrigation water.

If a mixture of the two types be used a sod can be secured that will cover the ground completely but still not be so tight and compact as to become sod-bound.

The various grasses show considerable difference in time of growth. Since with the aid of irri-



Just a corner of one of the pear orchards in the Grand River valley of Colorado.

THE IRRIGATION AGE.

gation water we can keep the pasture in good growing condition throughout the entire season it is essential that it contain some early, some medium, and some late-growing varieties.

Loose, sandy soils or lands that have considerable slope will require a large proportion of those grasses which form a tough sod to insure protection against blowing or washing.

Pieces of high or rough land should have more of the deeper rooting varieties since the moisture supply is apt to be deficient.

Low-lying, poorly-drained lands should be seeded to those grasses whose natural characteristics adapt them to excessive moisture.

The following mixture will be found very satisfactory on ordinary loam soils, such as are generally found throughout southern Idaho:

Kentucky Blue Grass.....	8 pounds
Orchard Grass	5 pounds
Smooth Brome Grass.....	5 pounds
Meadow Fescue	4 pounds
Timothy	4 pounds
White Clover	2 pounds

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Total.....	28 pounds
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These grasses in nearly these proportions, plus two pounds each of Italian Rye Grass and Red Top have been grown for the past four years at the station with excellent results. The Italian Rye Grass has disappeared entirely and the Red Top is not as productive as the others and hence these are eliminated from the mixture. The proportions have been changed from the original mixture to the one given above because our observations have indicated that such changes would make profitable pasture. When well started this mixture will produce a sod that will be close enough to prevent blowing or washing of sandy soils.

For the low, poorly-drained lands the following mixture is desirable:

Red Top	8 pounds
Timothy	8 pounds
Meadow Fescue	6 pounds
Alsike Clover	4 pounds

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Total.....	26 pounds
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For high lands that are apt to be dry this mixture is recommended:

Smooth Brome Grass.....	18 pounds
Orchard Grass	10 pounds

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Total.....	28 pounds
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These two grasses can be seeded deeper than most others and hence a stand can often be secured even on land that cannot be irrigated. Of the common cultivated grasses they are the best resisters of drouth because of their deep roots.

In each of the foregoing mixtures the amounts given are for one acre. While it may appear that a great deal of seed is being used there are a number of reasons why such an amount is necessary. Grass seed sometimes contains considerable chaff and other inert matter and too often is rather low in germinative power. An unevenness in the seed-bed or in the moisture supply might result in a low germination. Under the best of conditions it requires practically all of one crop season to get the pasture started. It would be poor economy to run

the risk of having to go ahead with a thin, unprofitable stand in order to save a few pounds of seed.

Farmers will do well to avoid "seed house" mixtures. They often contain inferior grasses under fancy names. As will be explained later, it is impossible to secure an even distribution of grasses if the seed is mixed before planting. Buy your grass seed separate and insist that it conforms to the State Pure Seed Law.

Thorough preparation of the seed bed is absolutely essential in starting a grass pasture. The great majority of failures to secure a satisfactory stand of grass are due directly to a poor seed bed. Grass seeds are very small and the tiny rootlet that is sent out at germination is not able to reach very far. The new plant must be self-supporting at once because these seeds are not supplied with a great store of plant food as are some of the large seeds. If the soil is fine and firm all will be well, but if it is loose and open, or rough and lumpy, the small plants will dry up and die and a thin stand will be the result.

Different types of soils require different methods of handling, so that no exact plan can be outlined for the preparation of a seed bed that will fit all conditions. In general, it is preferable to have the land fall-plowed and left rough through the winter. As early as practicable in the spring it should be double-disked, harrowed, and floated with an ordinary plank float. This should leave most soils in a very good condition. On heavy clay, however, such an amount of tramping would probably result in too much packing and on very sandy soils less would be just as efficient.

There are special cases that require special treatment. For example, in blowsand the amount of work suggested above would be detrimental. Good results are often secured on this type of soil by seeding in an old grain stubble which will help to hold the sand particles down.

Under most southern Idaho conditions grasses can be seeded to advantage any time from early spring to the middle of July. Of course, the later seedings have to be irrigated up as will be explained in the discussion on irrigation. If grasses are not to be irrigated up they should be planted as early in the spring as the land can be worked. A good moisture supply is absolutely necessary and they will survive a light frost better than a dry seed bed.

Where the land can be irrigated readily the seeding can be done to best advantage in the late spring or early summer. This will allow weed seeds to sprout and the young weeds can be killed easily by occasional harrowing. The warm weather with ample moisture which can be applied as explained later furnishes ideal conditions for rapid, vigorous growth. Grass varieties alone and mixtures have been seeded on the Station farm on May 4, May 11, June 22, July 8, and July 14, and in each case have produced excellent, uniform stands.

On October 3, 1911, a pasture mixture containing Smooth Brome Grass, Meadow Fescue, Italian Rye Grass and Red Clover was seeded on a carefully prepared seed bed. The weather following this seeding was comparatively cool and none of the grasses came up before winter. In the spring of 1912 none of them appeared.

On September 17, 1912, we seeded a similar mixture on well prepared land. By October 10 a fair stand of all grasses was secured and all grew well until the opening of winter. In the spring of 1913 the grasses failed to start growth and a close examination showed that they had almost entirely winter-killed.

From these results we conclude that under our conditions fall seeding of pasture grasses is not advisable.

Grass-seeding attachments can be secured for some grain drills but on ordinary soils their use is not recommended. Grass seed should be covered lightly and drilling will almost invariably put it in too deep. In addition, drilling involves a great deal of time and labor, since it will be necessary to go over the ground as many times as there are varieties in the mixtures. It is evident that if, for example, Timothy and Smooth Brome Grass seed were mixed the feeding mechanism of any drill would not be able to distribute them evenly. The smoother, heavier Timothy would work to the bottom and run out on the first few rods while none of the light, coarse Brome Grass would be seeded until the last.

We have found broadcasting with a hand seeder of a good type to be the most satisfactory method. As with the drill, it will be necessary to go over the land a number of times because an even distribution of the grasses cannot be secured if the various kinds are mixed before planting. One man with a good broadcast seeder can go over an acre in a small fraction of the time that would be required for a man and team with a drill.

The seed can be covered to good advantage with a spike-tooth harrow or a good brush drag, after which it should be corrugated for irrigation.

In many localities it is the common practice to seed alfalfa and clover with a grain crop. While there is a question as to the advisability of this plan there can be little doubt that grasses will do much better without the so-called nurse crop. The grain starts quicker and grows faster than the grass and is sure to rob it of most of the available moisture. If there is insufficient moisture the grass and not the grain will die. Even if there is plenty of water for both to grow the grain will soon cover the grass completely. Instead of stooling out to form a sod it grows a long slender stalk in its attempt to get a share of the light and sunshine. In the hottest part of the summer when the already weakened grass plant requires plenty of moisture the land is left dry for the grain to ripen and gets no more water until after harvest. By this time a great deal of the grass is dead. Actual practice has shown that this is the case and that the use of a nurse crop results in half or a third of a stand, in most instances.

With a blowsand soil, however, it may be necessary to use the grain to hold the sand particles. In this case a good deal of water should be applied and the grain should be clipped for hay early in the summer.

As has been stated we have secured excellent results by planting grasses in a comparatively dry seed bed and irrigating to bring them up. Our experiments have shown conclusively that if any crop is to be irrigated up the water should be applied by the corrugation or furrow method. This applies

especially to pasture grasses. If flooded, most soils wash to some extent and also form a hard crust that the young grass plant cannot penetrate. Even if the grasses are planted early enough in the spring to be sprouted by the winter moisture the first season's irrigation should be applied in corrugations, because a baked surface will interfere seriously with the growth of the young plants.

During its first few weeks the pasture should be irrigated frequently. The time between applications will depend upon the type of soil but the seed bed should be *kept moist* until the grasses are well started. Thereafter the soil should be supplied with sufficient moisture for good growing condition.

After the first season it is not necessary to make fresh corrugations. The old ones will not be entirely filled and will help to lead the water. Since the sod will prevent washing or baking the land can be flooded with good results.

For the old pasture we use the border method of flooding and find it very satisfactory. When this plan is to be followed the borders or dikes should be made before the pasture is seeded so that the grass can be sown right over them.

Since grasses are comparatively shallow rooted, light, frequent irrigations will give better and more economic results than larger amounts applied at greater intervals. Pasture grasses require more frequent irrigation and a greater total amount than most other farm crops. On the Station farm our grasses require water at least once every ten days and the total amount during the season averages about two and one-half acre-feet per acre.

Grasses seeded early in the spring should furnish a small amount of feed during the latter part of the first summer. If such is the case, light grazing will not only be profitable but will be beneficial to the pasture. Weeds will be eaten off and prevented from going to seed and the grasses will stool out more extensively than if they are allowed to head and produce seed. Care should be taken, however, that the young sod is not grazed too closely or tramped too severely. If seeded in the early summer the pasture may not furnish any feed, but it should be clipped with a mower in the latter part of the summer.

At the beginning of the next season the pasture should be divided into lots. If it is small two parts will be sufficient, if large and maintaining a great number of animals more divisions will be necessary to prevent herding in one place and excessive tramping. In any case the cross fences will be amply paid for in increased forage production. The use of divisions makes it possible to irrigate one part while the animals are on the other. This will avoid cutting up the sod, tramping the grass into the mud and seriously checking its growth. Alternating from one pasture to another insures fresher, better, and more abundant feed.

The pasture should not be grazed too closely. Plenty of leaf surface is just as important for plant growth as an extensive root system. Grass two inches high will make a great deal more growth in a day than grass one inch high. For this reason a pasture that is grazed off and then allowed to grow unmolested for a couple of weeks by the system of alternating will produce a great deal more feed than if it is kept close to the ground all the time.

THE IRRIGATION AGE.

If any weeds should appear or if some of the grass is left in clumps and begins to go to seed it is advisable to clip with the mower.

The pasture is possibly not much in need of manure as some other parts of the farm because it receives a considerable amount during the summer. If there is plenty, however, it can be used to very good advantage on the grass. It should be spread evenly and not too heavily in the fall and harrowed thoroughly with a spike-tooth harrow in the spring. Whether any manure is applied or not, a good spike-tooth harrowing in the early spring will be beneficial.

Since the animals spend the hottest part of the year on the pasture it is necessary that some shade be provided for them. Some good willows or Carolina poplars planted along the ditch banks will grow very quickly and add greatly to the value of the pasture.

In order to demonstrate the value of grass pasture and to furnish accurate information concerning the number of animals that a given area will maintain we have conducted grazing tests with dairy cows, sheep, and steers.

In May, 1911, we seeded an acre of old alfalfa land to a mixture very much the same as that recommended above for ordinary conditions. The same directions that we have outlined for starting a grass pasture were followed and an excellent stand was secured. The pasture afforded a considerable amount of feed late in the summer of 1911 but the actual tests were not started until the spring of 1912.

At this time one-half of the acre plat was fenced in three parts for a cow-grazing test. One cow was pastured on these plats and was moved from one to the other as often as was necessary. In a number of instances the cow had to be moved from one plat before the next was ready to receive her. In these cases she was taken to outside pasture, but was always returned to the experimental plats as soon as the amount of feed warranted it.

Each plat was irrigated as often as seemed necessary and the water was carefully measured. In no case was a plat irrigated when occupied by the cow.

The experiment began on May 6 and extended to September 6 with the following results:

SUMMARY OF 1912 RESULTS

Total days included in test.....	123
Total days in pasture	112
Total days off pasture	11
Total number of changes from plat	
to plat	19
Average days on each.....	6
Average number of irrigations per plat	10
Average water applied per plat.....	2.574 acre-feet

Since the Station owned no cow we were obliged to borrow one and this was the only cow obtainable. She was a mature grade Shorthorn and was not in milk when the experiment began. She freshened, however, so as to begin milking on June 1 and from then until the close of the test, 99 days, she gave 2,826.5 pounds of milk. At the time she began milking the cow weighed 1,290 pounds and at the close of the test, 1,260, showing a loss in weight of 30 pounds.

During the summer of 1913 the entire plat (one acre) was used for cow pasture. It was divided into three equal parts and the experiment conducted as in 1912. The spring of 1913 was late and cold and we were unable to begin the grazing test until May 12. On that date two cows were placed on the first sub-plat.

In this season it was not only unnecessary to seek outside pasture but the two cows were unable to eat all the grass afforded them. The entire pasture was clipped once, producing 1,043 pounds of cured hay. From June 21 to July 2, a period of eleven days, three cows were kept on the pasture.

SUMMARY OF 1913 RESULTS

Total days included in test.....	123
Total days two were in pasture.....	123
Total days third cow was in pasture	11
Total number of changes from plat	
to plat	14
Average days in each.....	9
Average number of irrigations per plat	9
Average water applied per plat.....	2.727 acre-feet

Cow No. 1 was a two-year old high grade Jersey. She weighed 760 pounds at the beginning and 830 at the close of the test, showing a gain of 70 pounds.

Cow No. 2 was a two-year old of ordinary stock. She weighed 1,052 pounds at the beginning and 1,100 pounds at the close, showing a gain of 48 pounds.

Cow No. 3 was a mature grade Jersey weighing 940 pounds.

The total milk produced on the pasture was 4,831.75 pounds.

In the summer of 1914 this test was continued. As in 1913, two cows were unable to eat all of the grass and a third had to be brought in part of the time. It was not necessary, however, to clip the pasture this season.

SUMMARY OF 1914 RESULTS

Total days included in test.....	135
Total days two cows were in pasture	135
Total days third cow was in pasture	17
Number of changes from plat to plat	15
Average days in each.....	9
Average number of irrigations per plat	10
Average water applied per plat.....	2.482 acre-feet

Cow No. 1 of the 1913 test was owned by the Station and was used in 1914. She weighed at the beginning of the test 840 pounds and at the close 860.

As in other years, we were obliged to borrow cows and the only ones obtainable in 1914 were mature grade Herefords, and were very thin at the beginning of the test, so that they used more food for beef production than for milk.

Cow No. 2 weighed 820 pounds at the beginning of the experiment on May 1. On August 17 her owner sold her to the butcher. On this date she weighed 1,000 pounds, showing a gain of 180 pounds in 109 days.

Cow No. 3 was first placed on the pasture on June 1, at which time she weighed 810 pounds. She remained until June 17, when she weighed 840 pounds. She was brought to the pasture again when No. 2 was sold and at this time she weighed

920 pounds; at the close of the experiment 26 days later she showed the same weight.

A total of 4,517.0 pounds of milk was produced during the experiment.

As will be noted from a careful study of these

tests we have used average cows throughout this work. After having conducted this experiment we are sure that the farmer will be able to count on maintaining two good dairy cows per acre on irrigated mixed grass pasture.

NEW DEVICE MAKES IRRIGATION EASIER

By E. L. LINXWEILER

Of all the resources of the West undoubtedly the most vital is its water supply and the one worthy of the utmost care in its conservation. It is estimated by the highest authorities that, on an average, about one-third of irrigation water is lost by seepage from the ditches, and in many places from one-fourth to one-half is lost by the unscientific application of water. The ideal system of irrigation is one where the top five or six inches of the soil remains dry or nearly so and only so much water be applied as will saturate the soil to the depth of the lowest roots of the crop to be irrigated, say from four to ten feet.

This ideal is hardly possible of realization in actual practice, but may be approached by the even and sufficient application of water into deep furrows and the cultivation of the soil immediately after the soil has become dry enough to permit it, thus preventing the rapid evaporation from wet soil surfaces. By using deep furrows the surface soil will not become saturated as is the case in flooding or in using shallow furrows.

One of the obstacles in the more common use of the furrow method of irrigation has been the difficulty experienced in its application, especially on the more compact soils, which require a continuous run of forty-eight hours or more for the water to penetrate to the proper depths. Some of the government irrigation experts have found that in some soils the water did not sink more than three feet after a seventy-two hours run.

The writer believes from his own experience that the duty of water in the United States can in most instances be doubled by the proper application of the irrigation water into deep furrows and the early cultivation of the soil afterwards. As an indication of what the scientific application of water may accomplish, it may be cited that there are cases in southern California where 400 acres are irrigated by a flow of a cubic foot of water per second. These cases of course are extreme and rare, but cases of a cubic foot per second for 200 acres are not uncommon.

In furrow irrigation the mistake is generally made of turning far more water into the furrows than the soil can absorb and consequently the excess which often is more than half of the water turned into the furrow, runs to waste at the lower ends.

The trouble with the primitive methods generally in vogue, which consist in feeding the furrows from small cuts in the bank of the feeding ditch, has been the impossibility of maintaining a proper and uniform flow, especially at night, when, on account of the much less evaporation, irrigation is the most effective.

This object, the uniform and automatic distribution of water into furrows, has been accomplished by a device recently put on the market, but which has been thoroughly tested by various persons during the past two years. It is in the nature of a canvas hose. It is styled the "New Era Auto-Irrigator." They are made in various lengths and of various capacities—the standard size being seventy-five feet long and of one-half cubic foot per second capacity.

The peculiar features are: the side apertures, for the feeding of the furrows, spaced twenty inches apart; the regulating devices fitted to each opening for regulating or shutting off the flow, if desired, and the tapering shape of the hose, which insures an even flow from the openings. The hose tapers about in proportion as the water diminishes as it escapes from the openings. The hose tapers to about one and one-half inch diameter at the small end. The standard size is of about six inches diameter at large end.

The large end of hose is connected with a galvanized iron pipe of same diameter as hose and which is sunk into a cut made across the ditch bank so that the water will flow into it after a dam has been placed below this intake pipe. A cylindrical screen of galvanized wire and about fifteen inches long, is placed over the end of the intake pipe which is in the ditch. This excludes leaves and other foreign matter that might clog the side openings in the hose. On an 80-acre farm generally from two to four of these irrigating hoses will be needed, depending on how much the soil requires the water to be divided. After the hose is connected with the ditch it rarely needs attention and can safely be left to run all night if the furrows are clean so that they won't overflow.

Some of these hoses that have been in continual use for two irrigating seasons, are still in a pretty good state of preservation and will probably last for four years altogether.

Those who have given this device a thorough trial are enthusiastic in its praise, as it makes the work of irrigation more pleasant, saves much labor and water, and produces better crops because of the even distribution of the water.

THE AGE IS BETTER THAN EVER

Editor of THE IRRIGATION AGE:—Enclosed please find \$1.00 for which continue sending THE IRRIGATION AGE to my address.

I was a subscriber to the AGE back in '89, and have read it most of the time since. I believe it is better than ever.

Yours very truly,
Minatare, Neb. DAN D. DAVIS.

CALIFORNIA'S LESSON FOR EASTERN FARMERS

By RALPH W. WOODARD
President of Woodward Co., Fresno, Cal.

A FEW years ago the great inland valleys of California—the San Joaquin and Sacramento—were desert wastes. We call these valleys but they are really great level plains between two mountain ranges. These two valleys are roughly seventy miles wide and six hundred miles long—or as large as the states of Vermont, New Hampshire, New Jersey, Massachusetts, Delaware and Connecticut combined.

A few years ago these valleys were considered as of no value except for grazing purposes. A little later great canals were constructed and water taken from the rivers to irrigate the plains. This put thousands of acres under cultivation and what was once a desert became a veritable garden. In a short time these valleys were producing twice as many raisins as are produced in Spain, three-fourths of the nuts produced in the United States, all of the dried apricots produced in the United States and other products on a similar scale.

But there still remained thousands of fertile acres which could not be reached by the canal systems. Some of this land is foothill land, where it is impractical to build long canals, and some of it is a great many miles from the source of the canal systems.

Then the gas engine came, and the result is described as follows in a government report:

"Before the first irrigation of grain was attempted near Fresno the land could scarcely be sold at \$2.50 an acre, but as soon as the results of irrigation became known, land sales increased, and \$25 to \$30 per acre was given freely for the raw land, which now, when in deciduous trees or vines, is worth \$250 to \$500 per acre. The citrus lands of the foothills, that now sell for \$1,500 to \$2,000 per acre when in full bearing groves would be valueless without irrigation."

In 1910 nearly three hundred thousand acres were irrigated by pumping in this state, and while these are the latest figures available, it is safe to say that in five years this figure has been doubled. So irrigation by pumping is no longer an experiment.

The first gas engines that were manufactured were crude and troublesome affairs. But the gas engine of today—that is, the high grade gas engine; I am not speaking of the cheap clap-

trap engine—costs less to operate in proportion to the service that it gives than any tool on the farm.

The average cost of repairs on hundreds of Lauson engines which we have sold during the last few years was, during the year 1914, eighty-two cents per engine. These engines are doing all sorts of work under all sorts of conditions.

Now, let us figure the total cost per acre of irrigation with a gas engine and centrifugal pump. The amount of water required varies with different crops and different kinds of soil. Under average conditions, however, where the water in the well is twelve feet from the surface a fourteen horsepower engine and a six-inch pump will deliver one thousand gallons per minute, or six hundred thousand gallons in a day of ten hours. This will flood five acres a day with water four inches deep, or in other words is equal to four inches of rain, and will soak down in the ground about four feet from the surface. Engine distillate costing seven cents per gallon can be used in the regular type of Lauson engines, as it burns clean because of the perfect mixture and the large, hot spark that is generated by the high grade Sumter Magneto.

It requires fourteen gallons of this fuel for a ten-hour run with a fourteen horsepower engine—the Lauson is economical in fuel consumption—and about thirty cents' worth of cylinder oil, or a total oil cost of one dollar and twenty-eight cents—less than twenty-six cents per acre. A plant of this size sells complete for about eight hundred and fifty dollars and is sufficiently large to irrigate forty acres. Assuming that the land is irrigated three times a year and allowing eighty-five dollars, or ten per cent, for plant depreciation, it makes a total cost of less than one dollar per acre for each irrigation. Remember these figures are based on the cost of this pumping plant in the west, where the



One thousand gallons of water per minute. This 6-inch centrifugal pump is driven by a 14 H. P. Lauson screen cooled portable engine.

freight alone on the equipment adds at least ten per cent to its cost.

In addition to these large pumping plants, a great many of our farmers here are installing water supply systems for their country homes. This water is used for domestic purposes and for irrigating lawns and gardens about the house. These systems are greatly increasing our sales of two and three horsepower engines.

We figure that a certain amount of service is sold with every gas engine. The buyer expects the seller to see that the engine is properly installed and he expects to be instructed in the operation of this engine. If anything goes wrong he immediately calls upon the seller to make it right. Often-times this means an expensive trip of from fifteen to twenty miles in the country to make some simple adjustment. Now, on a cheap engine these adjustments are many and are not easily made—on a simple high grade engine these adjustments are very few and we do not have to give one-third the service that we would with a cheaper or more complicated engine.

A few years ago the writer made a trip through Oklahoma, Kansas, Iowa and other middle western states. It was in the month of July in a dry year.

I saw thousands of acres of corn burning, withering under the fierce heat of the summer sun. A few days later a rain came—but it was too late—the crops for that year were destroyed. Thousands of farmers had seen the product of a year's hard labor shrivel up before their eyes. And they were powerless to prevent it.

A little water then would have been priceless. It occurred to me at that time that pumping plants would have saved much of this loss.

Since then I have discussed this matter with a great many farmers who formerly resided in the middle west, and while they are not all agreed, I am of the opinion that pumping plants could be successfully and efficiently operated in a great many sections where they are not even thought of now. These plants would be operated as emergency plants, just as a fire engine is used to put out a fire. And a pumping plant would pay for itself in one irrigation in a dry year.

Here in California we find it profitable to pump from wells where the water is one hundred feet or more from the surface and carry this water in galvanized pipes for several hundred feet to irrigate land that lies some distance from the pumping plant.

NEW SETTLERS! STUDY NEIGHBORS' FARMS

By L. G. HOWELL,

of the Farm Management Office of the U. S. Department of Agriculture

THE man who takes up a farm business in a community with which he is not familiar is likely to fall into error on matters seemingly very simple to the residents of the region. The new man often follows the planting dates of the region from which he came, and thus the crops may be injured by early or late frosts or other climatic conditions especially prevalent in the region.

Accurate climatic data are often of great value to a farmer starting out in a strange neighborhood. Tables showing the dates of the last killing frosts in the spring and the first in the fall, together with rainfall by months and total rainfall for the region, are usually available from the United States Weather Bureau, Washington, D. C. These should be consulted before deciding on the crop practice for the new locality. It would be still better to obtain such information before deciding upon a locality in which to purchase a farm.

Another mistake which is often made is through the endeavor to bring the type of farming of the old region to the new location, where, in the majority of cases, not only different conditions of soil and topography prevail, but new problems relative to transportation and market demands are met. These new conditions determine the profitableness or unprofitableness of the type for the region. The general type of soils of the neighborhood should be studied and compared with the soils of the individual farm and crops planted which are best adapted to soil and topography of the farm as shown by the general farm practice of the neighborhood.

As a general rule, it is the safest practice for

any farmer starting out in a new location to grow largely the same crops and keep the same breed of livestock as his neighbors, unless there is an especially good reason for following another practice. As one grows familiar with the region, experience may suggest improved methods.

If farmers, when changing to a region with which they are not familiar, would give more thought to climatic and soil requirements as shown by the type of farming and planting dates generally practiced in the new neighborhood, many hardships and disappointments would be prevented.

RECALLS OPERATION CHARGES

(Continued from page 175.)

retary, and this paper, while opposed to the Democratic administration, has willingly given Mr. Lane and those officials associated with him due credit for the excellent judgment they have heretofore shown. But we now come to a ruling that is so manifestly unfair, unjust and devoid of good common horse sense that the water users would send to Washington a mighty protest the like of which has never before vibrated through the finely appointed apartments of the Department of the Interior.

"Mr. Lane has been very fair with the people of the Reclamation projects and we do not believe that this man whose soul pulsates in harmony with the West and with Western conditions will tolerate such a measure when once he is fully apprised of the actual conditions."

KNOW WHAT BECOMES OF THE WATER APPLIED

BY FRANK ADAMS,

Irrigation Manager, Office Experiment Stations U. S. D. A.

THE application of more water than the soil will retain or than the crop irrigated requires is injurious to the soil and wasteful for both the individual and the state.

The purpose of irrigation is to get adequate moisture into the rooting zone of the crop irrigated and not merely to apply water to the soil surface. (Buy and use a six-foot soil auger and know what becomes of the water applied.)

Long irrigation furrows and long checks make even application of water impossible.

In orchard irrigation it is as important to irrigate directly in the tree rows as to irrigate between them.

Basin and flooding irrigation of orchards result in unnecessary puddling and excessive evaporation and may double the cost of cultivation after irrigation.

Orchards should be irrigated by means of furrows if you can get the water where you want it with furrows. (Use your soil auger to find out.)

The principal wastes in irrigation come through leaky farm ditches, runoff at the lower ends of furrows and checks, excessive application, resulting in too deep percolation, and surface evaporation due to too little or too shallow cultivation. (Look out for them!).

Plants require most water when they are making the most rapid growth.

Crops should be irrigated before they begin to suffer for lack of moisture.

The ideal in irrigation is, in general, to maintain uniform moisture content of the soil.

Beyond a certain point the application of additional water does not increase yields and may decrease them.

PAY \$550,000 FOR PROJECT

The transfer of the extensive holdings of the Pueblo & Rocky Ford Irrigation Company, under foreclosure proceedings, was made in the County court at Pueblo, Colo., recently. The bondholders, headed by the chairman, Galen L. Stone, of Boston, are in possession of the large project by decree of court and it is said on good authority here that they contemplate extensive improvements that will necessitate an expenditure of thousands of dollars.

The price paid is placed at \$550,000.

The irrigation project is in Pueblo and Huerfano counties, and comprises approximately 35,000 acres of land. Of that amount 22,000 acres was state land, 9,600 was obtained from the Colorado Fuel & Iron Company and 3,000 from other sources.

The construction of the project was started four years ago and much work was done. Large reservoirs were built at a heavy cost and miles of canals and ditches were dug.

In the meantime a land company, practically a separate organization, disposed of thousands of acres of land under the irrigation project. Financial

difficulties and many suits followed quickly and the result was that work was stopped and the company went into the hands of a receiver.

IOWA MAN STUDIES IRRIGATION

J. Lee, of Dows, Iowa, has made a circuit of the Western states this winter studying irrigation. Mr. Lee proposes to utilize the knowledge he has obtained in irrigating his lands in Iowa. He is convinced that he can greatly increase his production per acre by irrigation, both in garden truck and regular farm crops.

BUILD NEW BOOT FACTORY

America is full of examples of increasing prosperity. Especially those firms that cater to the needs of the farmer are working full or extra time.

Take the case of the Mishawaka Woolen Mfg. Company of Mishawaka, Ind. This company manufactures the famous "Ball-Band" Rubber Footwear.

They have never made light rubbers. Now they are about to make them. In order that deliveries can begin January, 1916, work on an enormous new plant has begun and will be pushed with all possible speed. This means the employment of at least 1,000 more persons when the new buildings are completed, or a total of 3,600 employed for this company.

MAY SELL BIG KUHNS TRACT

Between 200,000 and 220,000 acres in Glenn and Colusa counties, California, may be sold in large blocks by the Bond Holders' Committee of the Sacramento Valley Irrigation Company, a Kuhns company, according to reports. The land will be placed on the market, it is said, as soon as the bond holders legally foreclose their mortgages on the property. The property to be sold will not include, however, any land now being purchased by contract.

NORTHERN PROJECTS ORGANIZE

A Federation of Water Users' Associations for the Northern Division of the Reclamation Service was organized recently at Billings, Mont. The Federation proposes to work for needed legislation both state and national as an organized body, instead of as individual associations. The organization should develop into one of the strongest arms of the National Federation of Water Users' Associations. The officers are:

President, S. A. Nelson, Shoshone, Wyo., Project Water Users' Association; vice-president, S. E. Whitcom, Sun River, Mont., project; secretary-treasurer, E. C. Hicks, president Lower Yellowstone, Montana, Water Users' Association.

All diseased wood in the orchard, together with weeds, should be removed and burned as soon as possible. This will materially aid in the control of the insect and fungus pests.

SHOOTING CEMENT LININGS INTO DITCHES

By CARL WEBER, C. E.

President Cement Gun Construction Co., Chicago

THE amount of water lost by absorption and seepage in irrigation canals and ditches varies with soil conditions and construction details. It may be an exceedingly small amount in old, well silted canals built in loamy soil, and it may amount to 100 per cent in pervious sand and gravel. Very often the loss is so great as to demand the lining of the canal with some suitable material, and although clay-puddle, wood planking and masonry have been used for this purpose, the adoption of concrete for canal linings has become general practice at the present day.

A concrete lining is also used frequently for old canals to increase the carrying capacity of the same and to prevent damage by gophers and other burrowing animals.

The construction of concrete linings is done by a variety of different methods, depending upon the materials available for this purpose, the cross section and general conditions of the ditch and the experience and skill of the builder. The thickness of concrete linings varies from 3 to 10 inches. For concrete aggregates sand, gravel, crushed stone and stone screenings are used. The proportions of the concrete mixture vary widely, and in some cases steel reinforcement has been used in these linings.

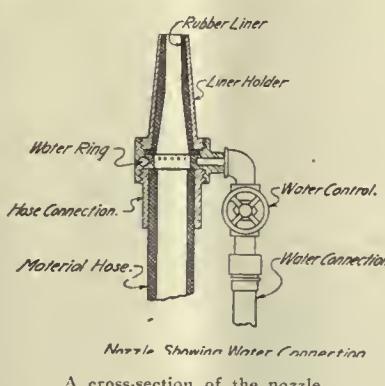
Before the concrete lining is placed it is necessary to trim the slopes and bottom of the ditch so that even surfaces are obtained. Then forms for the pouring of the concrete for the slopes must be provided and erected. These forms must be left in place from 24 hours to three days after the concrete has been poured, and therefore if any rapid progress is to be made the cost of the forms is a large item of expense.

After removal of the forms the surface of the lining must be plastered by hand or given a heavy cement grouting to obtain smoothness and fill the surface voids. As a rule expansion joints are provided in the lining at certain intervals in order to guard against cracks, and different types of such joints have been tried with more or less success.

A well constructed concrete lining admirably fills the purpose for which it is made. However, owing to the great cost of such work the tendency has been to reduce the thickness of the lining, the quantity of cement used in the mixture and other details to such an extent that a large amount of ex-



Fig. 1—The cement gun ready to fire.



A cross-section of the nozzle.

tremely poor work has been produced in recent years. A good lining must be amply strong to withstand occasional impact of driftwood, etc., and must be so dense as to prevent percolation. Special care must be taken to produce a dense concrete wherever alkali is present, for the reason that porous concrete easily deteriorates through the action of the alkali salts. It is extremely difficult to obtain a dense concrete lining on the slopes. The thin layer of concrete poured behind the forms has a tendency to become honeycombed, and in order to prevent this, an excess of water is used in the mixture to produce a sloppy concrete, which pours well but requires very tight and expensive forms. It is a well known fact that an excess of water greatly reduces the strength and quality of concrete and results in a spongy material quite different from what constitutes an ideal canal lining.

Within recent years great progress has been made with cement mortar linings applied with compressed air by the Cement-Gun process. These linings are, as a rule, reinforced with a woven steel wire mesh of sufficient strength to counteract expansion stresses, and therefore a continuous lining without any expansion joints becomes pos-

sible. Owing to this reinforcement the lining also possesses a large amount of elasticity and will allow a considerable amount of settlement and deflection without apparent cracks. This is of greatest importance for canal sections along hillsides and in filled ground.

The material is blown, or shot, against the slopes, no forms of any kind are required, and by the force of impact all superfluous air, water and sand are expelled. The result is an absolutely dense and waterproof lining of extreme strength and durability. Large water reservoirs which caused considerable expense on account of leakage have been waterproofed by this process, which is also extensively used for the encasing of steel work for rust prevention and for the fireproofing of wooden structures.

This work is all of recent origin, and although very little effort has been made so far to introduce the same for canal linings in the United States, a large amount of this work has been done in the Hawaiian Islands with great success.

The first of this work was done during the

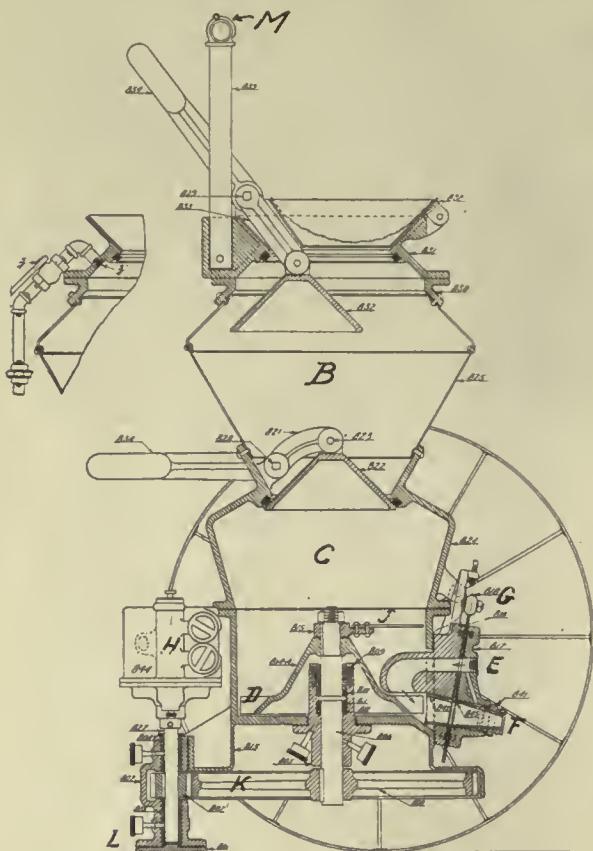
year 1912, and in his report to the Hawaiian Sugar Planters' Association for the year ending Sept. 30, 1912, H. B. Penhallow, Puunene, Maui, chairman of the committee on cultivation, gives the first description of such work. His report is based upon a paper presented to the Association by H. W. Collins, C. E., who was in charge of this work for the H. S. P. A.

Mr. Collins emphasizes the fact that the lining put on by the Cement-Gun process is far superior to similar work done by hand. He states that they have several miles of lining done by each method

the water has been applied. I have seen them mixing so much at one time that it would be impossible to get it on inside of 30 to 40 minutes. This initial set, especially with some cement on the market, is considerable and is, of course, lost under these conditions. The men repeatedly do this thing unless watched, although explicit instructions to the contrary have been issued. This fault is entirely eliminated with the gun method.

"Comparative tests of mortar made by hand and by the Cement-Gun have been made by a well-known engineering company. These show that the product of the Cement-Gun developed from 70 per cent to 260 per cent greater tensile strength, and from 70 to 720 per cent greater compressive strength than the product of the same mixture when applied by hand. These tests also showed that compared with the most carefully prepared hand-made cement mixture, 'Gunite' is far more impervious and waterproof.

"We have at this time finished 2½ miles of open ditch and three short tunnels, their respective lengths being 250, 400 and 750 feet. The work has been entirely satisfactory and very good results have been obtained. On our larger ditch we have averaged about 100 feet per day, a running foot being equivalent to 18 square feet. All the labor



Sectional Elevation

Fig. 2—Constructional detail of the cement gun.

and find the gun work far more watertight and not to contain any of the cracks found in hand work.

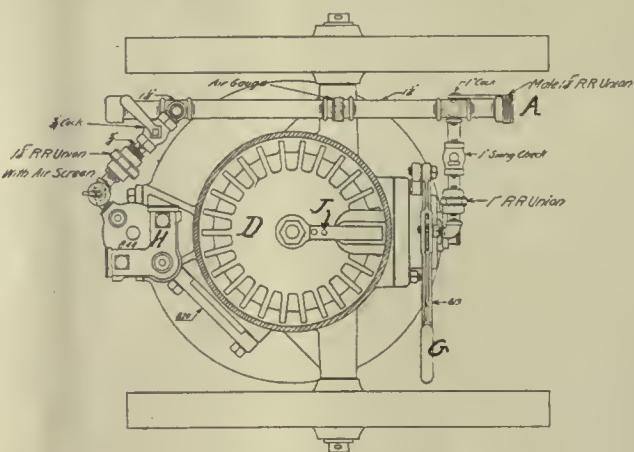
After giving a brief description of the Cement-Gun and the operation of the same, he makes the following statements:

"There is a marked difference between cement mortar applied by hand and the product of the machine. The latter is shot under a pressure of approximately 40 lbs. to the square inch, and leaves the nozzle at a velocity of 200 feet per second; consequently it is far denser and of a much greater tensile strength than that applied by hand. One very important point in favor of machine applied mortar is that the combining of cement and water takes place in transit, and the mixture does not have to be moved after an initial set. This is one of our worst troubles on concrete work in the islands. The laborers generally employed here do not realize the necessity of handling the mortar quickly after

on the job has been under contract, varying on this larger ditch from 15 to 20 cents per linear foot. This cost covers mudding where the section is uneven, wiring, man for nozzle, men mixing sand and cement and supplying the gun, a helper for the engine, and all labor for moving the outfit.

"The tunnel work has given us a good line on what is possible with the gun. In all three tunnels the engine and gun have been at least 100 feet from the end of the tunnel. This in the long tunnel would make an 850 foot delivery pipe or hose from the gun to the nozzle. Working at this distance, however, diminishes the output considerably, since the air motor cannot be run wide open as when working nearer. This means less material delivered to the discharge pipe and consequently less work.

"The following is the record of complete cost of work for a period of five weeks on a ditch of 18 feet cross section:



Plan of Base Section

Labor, 2,600 ft. at .15.....	\$ 390.00
Cement, 270 barrels at \$3.50.....	1,295.00
Sand	100.00
Gasoline, 870 gallons at .22.....	191.40
Wire, 5,200 ft., 6-ft. at .04.....	208.00
Wire, 2,600 ft., 4-ft. at .03.....	78.00
Superintendence	150.00
Incidentals	100.00
 Cost of 2,600 feet.....	 \$2,512.40

"We are constructing two new ditches, Haiku and Kauikoa, ten and $4\frac{1}{2}$ miles long. These are both practically all tunnels, ranging from 800 to 3,000 feet. We expect to cement-gun all possible. In some places where we have had cave-ins during construction or where the material looks dangerous, we will concrete both sides and roof. There will also be places where there is so much water coming in that a mortar will be insufficient and concrete will be used."

Before giving here a description of this work and going into details of the construction of the lining, its reinforcement and other items, it will be advisable to precede it with a short paragraph explaining the Cement-Gun and the characteristics of its work.

Fig. 1 gives a view of the gun, while Fig. 2 shows the constructional details of the same. It is operated with compressed air, and for canal linings where the machine has to be moved frequently, a portable gasoline driven air compressor is used to best advantage. Other kinds of air compressors can be used. However, it is desirable to have the whole outfit mounted on trucks to facilitate easy

moving. Another good combination is a belted air compressor driven by a steam tractor, which can be used for plowing, threshing and other agricultural work when not in use for the Cement-Gun. The air compressor can also be employed for pumping, etc. Required for Cement-Gun work is an air compressor giving from 160 to 250 feet of free air per minute at a pressure of about 40 pounds per square inch. The working capacity of the Cement-Gun increases in proportion to the amount of air available for its operation.

The Cement-Gun is connected with the compressor by a hose line usually about $1\frac{1}{4}$ inches in diameter. The distance between compressor and gun is immaterial, and may vary from 50 to 500 feet and even more. It is not advisable to have the gun placed too close, in order to prevent cement, sand and dust being blown into the machinery.

The gun consists of two superimposed conical tanks. The lower tank feeds the material hose and is under constant air pressure. The upper one is the charging tank and acts like an air lock in a caisson. It is alternately put under pressure, and enables continuous uninterrupted operation of the machine.

In the bottom of the lower tank there is a horizontal feed wheel with a series of pockets on its outer rim. This feed wheel is driven by a small air motor and revolves horizontally. As it moves it carries the material in small measured charges into the stream of air, which again conveys it through the material hose and blows it through the mixing nozzle to its place of deposit.

(To be continued.)



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WATER MEASURING DEVICES

(Continued from page 170.)

above datum. This reservoir has a capacity of 11,910 cubic feet and it has been carefully calibrated. Outlet from this reservoir into the standardizing box and through it to the measuring devices is through a 15-inch vitrified clay pipe and is controlled by means of a 15-inch Western steel headgate. The reservoir is filled from a near-by well by means of a 4-inch centrifugal pump.

(2) Concrete standardizing box 30 feet long, 9 feet wide, and 6 feet deep (all inside measurements) with partition 12.75 feet from the upper end containing an opening 5 feet wide, 1 foot above the bottom of the box, a similar opening 5 feet wide having been left in the lower end of the box. These openings are so equipped that weirs or orifices of desired sizes can be set in them, making it possible to use either a standard weir or a standard orifice in testing the various devices. Water from the reservoir is brought into the box with a downward flow into a slightly suppressed pool and must pass from the pool over a bulkhead 12 inches high and through a baffle before reaching the weir or orifice set in the opening in the partition already referred to. Four pieces of 4-inch channel iron 9 feet long are set directly below the baffle board and when desired furnish a spill with an aggregate length of 72 feet for aiding in keeping a constant head over the standard weir or orifice. When planning the installation this was considered a necessary part of the control on account of the water supply from the reservoir being fed to the standardizing box under a diminishing head. The channel-iron spills all discharge through a 6-inch iron pipe into a well on the side of the main box, out of which water spilled can be measured through a circular orifice of any necessary size. In the tests thus far made this spilling device has not been used because it has not been found necessary to maintain an exactly constant flow during the tests. The elevation of the bottom of this box is 90.6 feet above datum.

(3) Concrete main ditch 3 feet wide, 2 feet deep, and 80 feet long, with vertical sides, leading from the lower end of the standardizing box. All devices other than the Azusa, Gage, and Riverside hydrants lead from this main ditch. The elevation

of the ditch is 90.6 feet above datum and it has a slope of 0.10 foot in 100 feet.

(4) Twelve-inch concrete pipe leading from the bottom of the standardizing box to the Azusa, Gage, and Riverside hydrants, the flow into this pipe being controlled by a 12-inch K-T valve set flush with the bottom of the standardizing box.

The next article will discuss measuring devices for underground distribution systems.

Statement of the ownership, management, circulation, etc., required by the act of August 24, 1912, of THE IRRIGATION AGE, published monthly at Chicago, for April, 1915:

Editor, D. H. Anderson, 30 North Dearborn street, Chicago, Ill.

Managing editor, George J. Scharschug, 39 North Dearborn street, Chicago, Ill.

Business managers, none.

Publisher, D. H. Anderson, 30 North Dearborn street, Chicago, Ill.

Owners: (If a corporation, give its name and the names and addresses of stockholders holding 1 per cent or more of total amount of stock. If not a corporation, give names and addresses of individual owners.) D. H. Anderson, 30 North Dearborn street, Chicago, Ill.

Known bondholders, mortgagees and other security holders, holding 1 per cent or more of total amount of bonds, mortgages or other securities: (If there are none, so state.) None.

D. H. ANDERSON,
Publisher.

Sworn to and subscribed before me this 27th day of March, 1915.

Michael J. O'Malley,

Notary Public.

[SEAL] (My commission expires March 8, 1916.)

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BRIEF NOTES FROM IRRIGATION PROJECTS

Utah

The Utah legislature has passed an act creating a commission on irrigation and water rights; an act prescribing the duties of the state engineer on the completion of work on irrigation and reservoir projects, and an act regulating the amount of compensation to be paid water commissioners. Governor Spry has signed the measures.

Farmers under the ditches of the Realty Bond & Share Company, near Brigham City, Utah, have decided not to accept the offer of the company to sell its system for \$100,000.

The Draper Irrigation Company has begun the construction of a water works system that will produce about 1,500,000 gallons of water a day. The water will be piped from an intake in Big Willow Creek east of Draper, Utah. The system will be large enough to supply eight small towns besides Draper.

An innovation in reclamation work is to be launched by the Millard County Richlands Irrigation Company. The company will open a tract of 10,600 acres, just west of Deseret and Hinckley, Utah, to cultivation and irrigation this spring. Past experience has shown the danger of over-irrigation in the fertile tracts of Millard county. Therefore, this company is installing a complete drainage system under the supervision of the state engineer. Clay tile pipe will be used in the construction of the drainage system. Drain pipes will be laid at a minimum depth of five feet, and the outlet of the system will be in an old course of the Sevier river, which affords the necessary fall. Those interested in the venture feel that while they are launching the pioneer movement of its kind in forefending damage to the land by the irrigation necessary to its cultivation, they have hit upon a sure solution of the problem. It is a Carey act project.

The directors of the Kaysville Irrigation Company, of Kaysville, Utah, have been authorized by the stockholders to bond the company for \$30,000 to \$35,000 on the best terms obtainable, the funds to be used to liquidate the indebtedness incurred in the construction of the large reservoir that is to supply water for much of the semi-arid lands outside of Kaysville.

Kansas

The Kansas legislature has voted to abolish the state irrigation commission and has created the position of commissioner of irrigation. There is a revolving fund of \$50,000 to continue experiment work in the state.

An irrigation plant with a capacity of 1,000 gallons of water a minute has been installed on the fruit and truck farm of G. B. Smith, near Wichita, Kan. S. E. Brown, residing one-half mile north of the Smith fruit farm, has also installed an irrigation plant.

For the purpose of finding out

whether sub-irrigation is a success when used to beautify a lawn, the county commissioners of Wichita, Kan., have caused to be installed a small system in the lawn west of the Soldiers' and Sailors' monument. This part of the lawn has always given trouble to ground-keepers, as grass withers and dies during hot summer days.

A 700-gallon pumping plant has been installed for Mrs. Charles McConnell on her property adjoining Holcomb, Kan. This well will be used in developing forty acres, and it is Mrs. McConnell's intention to divide her holdings into tracts of this size, placing plants on each and putting them in shape to meet the demand, which is steadily growing, for the small farm equipped with adequate well irrigation facilities.

Finnup & Wonn have closed a contract to put in and equip a 2,500-gallon pumping plant which will be used

in irrigating 200 acres of their sweet clover land southwest of Deerfield, Kan.

Peter Marks, who owns 105 acres east of Garden City, Kan., has ordered a 2,000-gallon irrigation plant.

J. W. Lowe, of Ness City, is putting in a 2,000-gallon irrigation plant.

Washington

Representative farmers of the Bonaparte valley and McLaughlin flats met at Tonasket, Wash., recently and took the initial step toward forming an irrigation district. A petition asking the county commissioners to call an election in the proposed district was signed.

Nearly 800,000 feet of logs, board measurement, have been cut in the hills near Loomis for flume lumber to be used on the Whitestone irrigation project in Washington on which construction is to commence this summer. A total of a million feet is

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called for in the contract for lumber which is being filled by A. R. Tillman.

Announcement that Northern Pacific lands lying within a few miles of North Yakima, Wash., part of them under the Tieton irrigation project, will be placed on the market immediately at from \$5 to \$10 per acre was made recently by E. F. Benson of the land department of the company. This is the lowest price at which these lands have been offered in many years. Only one-tenth will be required to be paid down and the same amount during each of nine succeeding years.

The assets of the Hanford Irrigation & Power Company, of an esti-

mated value of more than \$1,000,000, have been sold by Receiver E. F. Benson of North Yakima, Wash., to Henry K. T. Lyons of Denver, for \$386,000. The company went into the hands of receivers several years ago. Of the total purchase price \$213,733.33 was paid in cash and the balance in bonds of the irrigation company at

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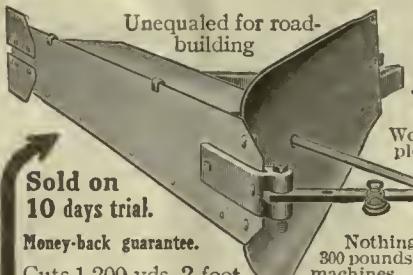
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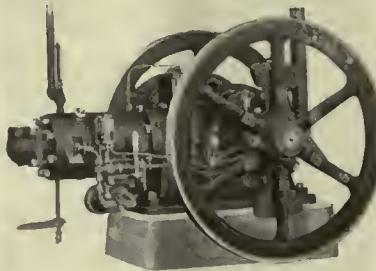
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face value and accrued interest. John J. Blake of Boise, Idaho, represented the purchaser, and it is rumored that the deal was made in the interest of the American Light & Power Company, one of the judgment creditors. The greatest asset of the company is its water power at Priest Rapids on the Columbia river. Lands near the rapids have been purchased by parties believed to represent the American Light & Power Company and the sale is regarded as registering another step towards the utilization of this water power for the electrification of the western end of the Chicago, Milwaukee & St. Paul Railroad.

California

One of the largest irrigation projects ever undertaken in northeastern California was inaugurated when the ranchers living around Calneva, Cal., formed a permanent organization which has for its object the creation of an irrigation district embracing 200,000 acres of land in Long valley, Lassen county, Cal., and Washoe county, Nev. Preliminary survey work will begin as soon as Congressman J. E. Raker can secure from the United States Reclamation Service an appropriation of \$10,000, to which amount the ranchers of the section will add \$10,000, to be raised by an assessment of 10 cents per acre on the land involved. Owing to the fact that ample water is available within a short distance of the land, it is estimated that the system can be built at a cost that will not exceed \$35 an acre for the construction of the ditches and the creation of the necessary reservoirs. This estimate is based on preliminary reports of engineers who are more or less familiar with the situation. The plan of financing the project contemplates the issue of irrigation bonds by the district, under state guarantee, bearing 6 or 7 per cent interest, to run on an interest-bearing basis for a period of ten years, after which interest and one-twentieth of the principal be paid yearly. The plan further contemplates securing permission of the California state authorities to allow the co-operation of the state of Nevada in the formation of a joint irrigation district, the Nevada people to take similar action, thus giving the bonds of the district the joint guarantee of two commonwealths. The most unique feature of this enterprise is the rural credit system which it contemplates bringing into being. The legislatures of both states will be asked to amend their present laws relating to the issue of irrigation district bonds so as to permit of the issue of bonds or certificates of indebtedness in the amount of \$10 an acre, to be used in improving the land and putting it in crop.

Stephen E. Kieffer, consulting engineer, has submitted to the organization committee an exhaustive report on the proposed Terra Bella irrigation district of California. Mr. Kieffer's estimate of cost per acre has been reduced to \$66, on a basis of 10,000 acres net or 12,500 acres gross, while the maximum charge per acre for tolls, sinking fund and interest is placed at \$7.28, reached in one year

only—the eighth year. Under his plan and recommendations the non-irrigated land will bear a lesser proportion of the burden than the irrigated land.

The Modoc County (Cal.) Irrigation Company's Surprise valley irrigation project is rapidly nearing completion. Cow Head lake, the source of supply for this system, is tapped by a tunnel 3,400 feet long and the water is brought in a main canal twenty miles long. Seventy miles of

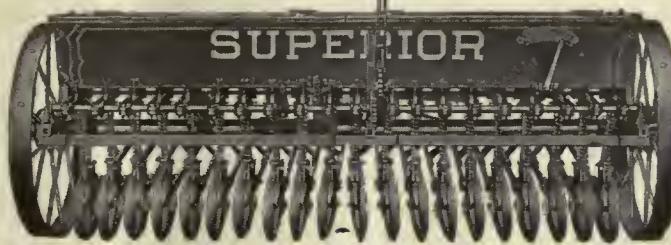
laterals are already constructed. The system will irrigate 70,000 acres besides supplying water for domestic purposes for the town, which will be established when the project is completed. This town will be modern in all particulars, electricity will be employed for lighting the homes, fuel and illumination. A modern sewer system will be constructed, and the streets will be paved and cement sidewalks laid throughout the business

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section. The townsite will be located at the foot of the Warner mountains, on a mesa sloping toward the east, and will command a splendid view of the entire valley.

With the recent discovery of water around Hanford, Cal., a large acreage thought to be unproductive will now come under the plow. Artesian water has been found at no very great depth, generally less than 1,000 feet, and as a result several hundred acres have already been planted to fruit and olive trees while many more acres will be put in this spring. So far, the planting has been mainly of olives, considerable Southern and Eastern capital having been invested. Several peach orchards are also being set out by development corporations and others. Land has suddenly jumped from practically nothing to \$200 per acre.

The Gillette Lemon Company is completing a \$17,000 irrigation plant to water its 240-acre lemon orchard, near Porterville, Cal.

E. T. Earl has purchased for his ranch at Palmdale, Cal., a new 15-inch centrifugal turbine pump to be installed at a depth of 150 feet, and also a 15-inch pump of the same type to be installed at a depth of 50 feet. William Dillar of Gardena, Cal., has purchased a 50-foot, 12-inch and a 35-foot, 15-inch pump for use on his ranch. They are of the centrifugal turbine type. Both plants were installed by the Layne & Bowler Corporation.

Oregon

Plans for the reclamation of 100,000 acres of arid land on Agency

Plains, Jefferson county, Oregon, are under way among the 100 settlers of that region. Under the new laws of Oregon governing irrigation districts, these people are preparing to bond their land and be in position to take advantage of whatever state and national aid may come their way.

Provided mortgages in the sum of \$500 can be placed on each property to be settled, H. E. Watson, of Portland, Ore., believes he can put over a scheme of giving the unemployed a chance to buy their own farms. Watson is head of a syndicate that has 6,000 acres of raw land in Morrow county, Oregon, two miles back from the Columbia river. The company is now boring wells with a view of securing water for irrigation purposes. It is the plan to divide the ranch into 40, 20, 10 and 5-acre tracts and sell them on the ten-year installment plan. On each tract the company will build a four-room house, a barn and provide a well on each 40 acres. "I am willing," said Mr. Watson, "to put a man without funds on the land and have him work improving other tracts providing we can obtain a \$500 loan on each tract so secured. This money would be used by us to keep the man going until he can get returns on his property to pay it off. What work he would do for us would apply as cash toward the purchase of his land. There is nothing of a charitable nature about the scheme at all. It is simply a business proposition looking at it from either side."

With a force of seventy-five men at work on the Bully Creek irrigation

project at Vale, Ore., it is expected that the project of building flumes, etc., will be completed in time for delivery of water for the first unit of 5,000 acres by this spring. The dam for the undertaking is said to be the highest in Oregon.

Nevada

A survey of 30,000 acres in the Shoshone reservation, in Nevada, will be made with a view of establishing an extensive irrigation system for the Indians.

Colorado

Work on the big irrigation project in the Omer district, near Fowler, Colo., was scheduled to start April 1. The Apishapaw Consolidated Irrigation Company controls the project. It is believed that the work on the project will be completed by Sept. 1.

Texas

The Reeves County Irrigation District No. 1, Saragosa, Texas, embracing a large tract of land, has been formed, and bonds will be issued for constructing reservoirs and installing pumping plants. The directors are W. W. Stewart, T. M. Delaney, A. W. Wigley, C. J. Ferguson and J. F. Meier.

The Stowell Canal Company, Beaumont, Texas, has increased its capital stock from \$40,000 to \$90,000 for the purpose of enlarging its irrigation system.

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THAT sounds good, doesn't it? Well, that's just what an AULTMAN-TAYLOR GAS TRACTOR will do for you right on your own farm. It has done it for thousands of other good, hustling farmers and it will do it for you. It will save you money plowing and do a better job than is possible with horses. It will save you money harrowing, discing, harvesting, threshing, seeding,

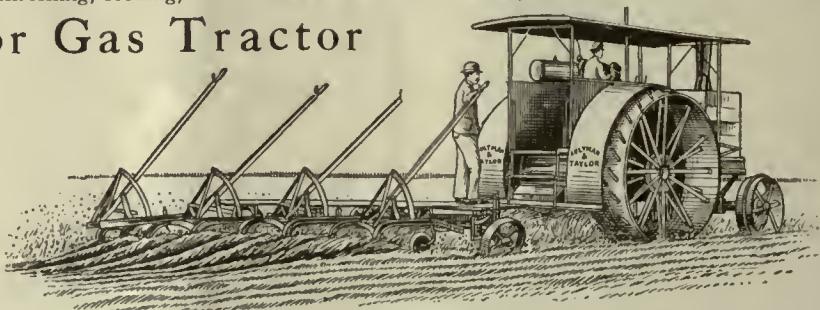
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(Built in 2 sizes—30-60; 25-50)

and then you can farm better, cheaper, and with more satisfaction. You can get your seed bed ready when the ground is in prime condition. You can sow when conditions are just right, and you can gather your crops when they should be gathered. All this, and lots more can be done quicker, cheaper and better than you can do it with horses. You'll be astonished at what can be accomplished with this great tractor. No other tractor can give you such wonderful results—such entire satisfaction, for the simple reason that the Aultman-Taylor Gas Tractor is particularly adapted to the power needs of the farm—built for this particular work at no spared pains or expense. It's the tractor that makes good everywhere at all kinds of work. The Aultman-Taylor burns either gasoline or kerosene under all loads. Go see this great tractor work. There's

hauling, etc. In fact, it will save you money at every power job, large or small, on the farm, and the beauty of it all that it is, costs you nothing when not working.

Right now is the time to get rid of the greater part of four horses. Don't let them eat their heads off. Dispose of these expensive animals now. The proceeds of the sale of feed which you would otherwise have fed to these animals will make a good substantial payment on an



one in your neighborhood. We want you to see this tractor in operation. Seeing is believing. Its performance will convince you that it's the best tractor ever built, or if you cannot locate one in your immediate vicinity, write for catalog and other literature at once, and get all the facts about the Aultman-Taylor Gas Tractor.

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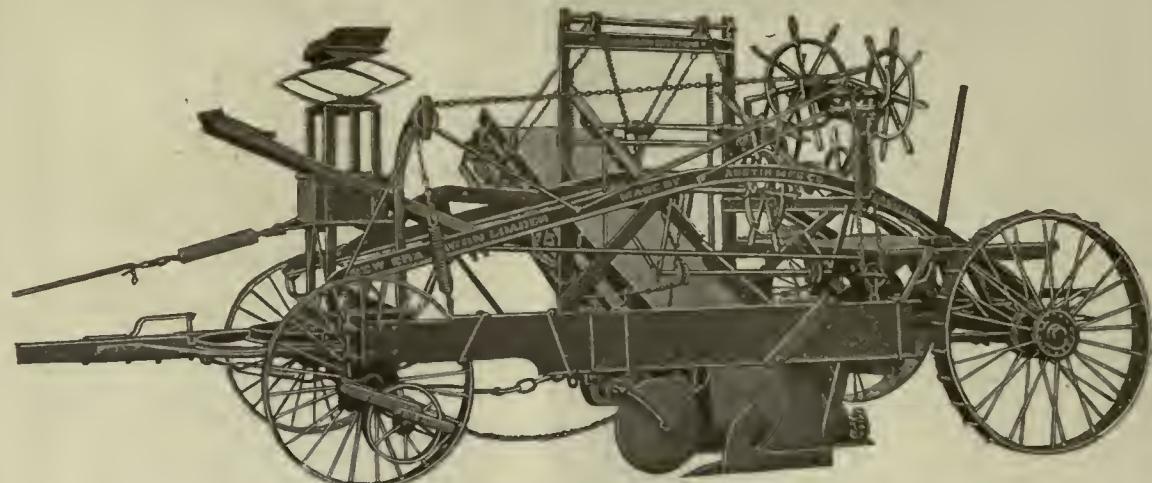
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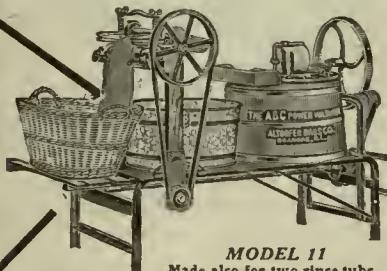


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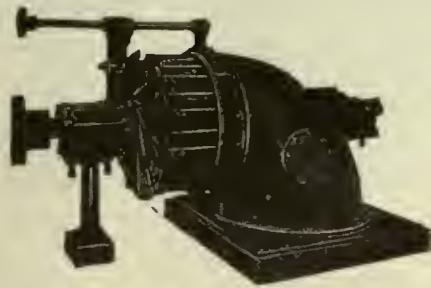
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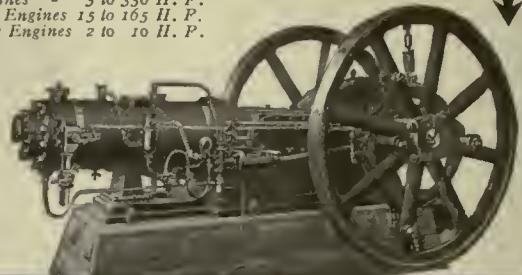
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THE IRRIGATION AGE

VOL. XXX

CHICAGO, MAY, 1915.

No. 7

THE IRRIGATION AGE

With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARID AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

D. H. ANDERSON

PUBLISHER,

Published Monthly at 30 No. Dearborn Street,
CHICAGOEntered as second-class matter October 3, 1897, at the Postoffice
at Chicago, Ill., under Act of March 3, 1879.

D. H. ANDERSON, Editor

ANNOUNCEMENT.

The "Primer of Hydraulics" is now ready; Price \$2.00.
If ordered in connection with subscription \$2.50.

Owens Valley Aqueduct Muddle
 Mr. F. C. Finkle, an engineer of prominence in the West, presents his views on the Los Angeles aqueduct in an article in this issue of THE IRRIGATION AGE under the heading, "Los Angeles' \$40,000,000 white elephant."

This article brings to mind the fact that the editor of this journal made a trip to the Owens Valley in California, in November, 1908, to investigate charges laid against the promoters of this plan, and at the time of this visit a lot of information was obtained which substantiates the statements in Mr. Finkle's article.

The citizens of Inyo County alleged at that time, first, that their ancestors settled the valley and braved many hardships while the greater part of California was unoccupied by white men; hence, the present generation in Inyo County had a sentimental attachment for its birthplace, and they felt that any benefits to come through its natural resources should be passed to the descendants of the pioneers before outsiders were invited to the table.

By their limited means these people succeeded years ago in irrigating and tilling 25 per cent of their holdings.

In the year 1906 a large area in Owens Valley was withdrawn from entry by order of the Secre-

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Associations has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Interesting to Advertisers

It may interest advertisers to know that The Irrigation Age is the only publication in the world having an actual paid in advance circulation among individual irrigators and large irrigation corporations. It is read regularly by all interested in this subject and has readers in all parts of the world. The Irrigation Age is 30 years old and is the pioneer publication of its class in the world.

tary of the Interior. During the year 1903 this same area was withdrawn or segregated under the Reclamation Act, and later, in 1904, several sites which were considered feasible for reservoir sites and intended to store the flood waters to irrigate the entire valley, were withdrawn from entry of any kind, and in that way taken entirely out of the control of the people of the valley. This move was made with full knowledge and acquiescence of the people of the valley, who were led to believe by the Government engineers that the Reclamation Service would take over the work and bring it to a successful finish—in fact, that statement was repeatedly made by representatives of the Reclamation Service.

After a long delay and repeated demands on the Service to release the reservoir sites and a release also from an agreement entered into whereby all of the rights of the settlers in the valley were placed under the control of Government officials, about 115,000 acres set aside for reclamation work were restored to entry, but this was not accomplished until through some manipulation or agreement between the Reclamation and Forestry Bureaus, 35,000 acres were immediately withdrawn and placed under the control of the Forestry Bureau, leaving only about 75,000 acres (a small tract around Bishop) free from all forms of withdrawal.

There were 70,000 acres of land withdrawn under a blanket order, which, eliminating the patented land under the description totals over 50,000 acres of fine agricultural lands, the order specifying that "the lands are withdrawn from any form of disposition whatever under the Public Land laws until further ordered by the Department for the benefit of Los Angeles, California," in connection with its Owens River project. (See Mr. Finkle's article for further light on this scandalous transaction.)

The trend of these orders would indicate a direct effort on the part of Government officials to favor Los Angeles, or, to speak more to the point, the money interests who loaded a \$23,000,000 bond issue on the shoulders of property owners of that city to further their plan for gain. This subject will receive further attention in the columns of IRRIGATION AGE as additional facts are brought to light and the names of all those engaged in this nefarious scheme will be given to the public.

**Remove
the
Elements
of Chance**

The business farmer of today tests his seed grain. In farming, as in every other business, elements of chance are being removed as fully as possible.

After a farmer has selected his seed grain by the use of the fanning mill, he should make tests for purity and germination. If he is not prepared to do this, he should communicate with his state agricultural college or experimental farm.

The only safe thing is to remove elements of chance by selecting good seed, and by testing for purity and germinating power.

**Potatoes
Valueless?
Feed Them
to Stock**

The heavy production and the low price of potatoes has directed attention to their value for stock feed. Hitherto this subject has not received much attention in this country because under ordinary conditions other feeds are undoubtedly much cheaper and better. Some estimate that even at 15 cents a bushel it is more expensive to feed potatoes to stock than it is to feed silage, while on the other hand it is scarcely probable that the farmer can raise potatoes for much less than 30 cents a bushel. Their actual value for feed depends upon many factors, but it is better to make some use of the potatoes on hand rather than let them rot.

In Germany, where the potato crop is proportionately far greater than in this country, the question has been more thoroughly studied. The tubers may be used for feeding cows, horses, sheep

and pigs, but they are best adapted for pigs. To secure the best results with swine the potatoes should first be cooked and then made into a thick mush mixed with the corn meal or other grain. If skim milk is added, the value of the feed is much increased.

In feeding potatoes to dairy cows from one-half peck to one peck should be fed to start with. They should be given raw and should be run through a root cutter, to prevent choking the cows. An excessive feed of potatoes to a dairy cow is liable to cause scours, but as much as one-half bushel per cow per day has been fed without bad results. In addition to the nutrients contained, potatoes give succulence to a ration, a factor of importance in feeding dairy cows.

**Increase in
Farm Values;
What it
Means** Farm values have increased 20 per cent during the past year, taking the United States as a whole, according to a recent statement. The European war is credited with causing much of this increase.

Perhaps the estimate is not far from true. We know farm lands have increased in price in many localities.

That is the way much, if not most of the money has been made in America during the past two centuries—by the increase in values. Dollar and a half acres have become hundred dollar acres. Ten dollar city lots have become ten thousand dollar lots. Million dollar railroads have become billion dollar roads—and the owners have prospered just by the prosperity of the community.

The man who owns farm lands, however, obtains less benefit from this "unearned increment" than the owner of city property or corporate industries. The farmer cannot make his income keep up with the increase in values. When 160 acres of land gets to be worth \$150 an acre—there's \$24,000. But does it earn 6, or 7, or 8, or even 10 per cent a year, as a flat building in Chicago would earn—without any effort on the part of the owner?

Not in most cases.

The farmer pays the highest rates of interest when he borrows money, and gets the lowest rate on his investment when he tries to live on his capital. But things are looking better for the farmer. The farmer is making his land work harder and is taking better care of it. Federal and state governments are also beginning to take more interest in making financial conditions easier for the farmer.

Another side of the increase in values is the very serious situation of the tenant farmer, who wants to buy land of his own, and of the young man who is just starting in life. Every increase in

the price of acres makes it just that much harder for the man without capital to become independent.

Who Gets the Money? Another Side of the Problem Here's the other side of the fruit selling game—the jobbers' profits, the retailers' profits—analyzed by an expert.

G. H. Powell, general manager of the California Fruit Growers' Exchange, has conducted some investigations on behalf of the California Fruit Growers' Exchange into the question of where the money goes that people who buy oranges pay for them and finds that the consumer's dollar is divided among the various factors concerned with the oranges up to the time they reach the consumer, as follows:	
Fruit on the tree.....	26.7 cents
Picking and hauling of fruit to packing houses	2.4 cents
Packing house, including package, labor, etc.	7.4 cents
Freight and refrigeration.....	20.5 cents
Grower's selling cost.....	1.5 cents
Jobber's selling cost and profit.....	8.2 cents
Retailer's selling cost and profit.....	33.3 cents

The items showing the proportion of the consumer's dollar in oranges which go to freight and refrigeration, and the jobber's costs and profits are, when the actual facts are presented, not anywhere within gunshot of what the speaker in generalities usually charges these factors with. Also, it will be noted that the grower of the fruit has a value on the trees that is proportionately larger than many either think or try to lead others to believe. These figures, Mr. Powell advises, are based upon an investigation running over one year in thirty of the principal cities of the United States and Canada and upon approximately 5,500 sales. They cover reports received every two weeks on the same grades and sizes of oranges, including the delivered price to the jobber, the jobber's price to the retailer, and the retailer's price to the consumer.

Eliminate the drones from the flock of poultry. The poultry raiser who is in touch with his poultry work can easily discern the unprofitable fowls.

Give the brood sows a daily feed of silage or other succulent feed; the sows will keep in better condition and the pigs will be stronger and more thrifty.

Milk your cows in the same order every day. Cows know the difference and it affects their flow of milk.

The Value of the Farm Adviser The farm advisers are doing a great work. They are instilling better and more productive methods among the tillers of the soil. They are systematizing the business of farming.

This work is beginning to net dollars, and as more farmers adopt scientific methods, the increased values of farm produce will rise into millions.

It is impossible to measure in dollars all the accomplishments of the farm advisers. Perhaps the greatest service of all is the indirect service, and this cannot be expressed in dollars or numbers. For example, it is difficult to place a value on the work with the young folks in their tomato, corn, pig and poultry clubs; the class work in stock and grain judging, and the assistance given in the teaching of agriculture; the holding of "parents' and agricultural days" in the schools, which have tended to bring parents into closer touch with, and stimulate a keener interest in, the work of the school and the teacher.

It is impossible to figure the direct returns from the holding of the movable schools of home economics in which many of the women were given their first lessons in the proper care and preparation of food, care of sick, rearing of children and the many suggestions for lightening of household and home duties. These instances and many more that are similar, must find their justification in the minds of the leaders and sponsors for the movement; they do not directly swell bank accounts or increase yield of corn, but they do build for a bigger, broader, and more satisfactory rural nation.

Do you know that rotation makes use of all the elements of plant food in the soil?

Kindness is the best tonic ever discovered for use both in the family and with the domestic animals; used in generous doses and at frequent intervals gives the best results.

Poor policy to sit down and milk before you have cleaned the stable in the morning. The milk you get will be quite sure to smell of the barn, no matter how careful you may be of it afterward.

Every year some men are in trouble over bob veals. Queer, too. They all know the law. The temptation to get rid of the calves and get the money never ought to make a man a lawbreaker. It will not tempt a strictly honest man.

LOS ANGELES' \$40,000,000 WHITE ELEPHANT

By F. C. FINKLE,

M. Am. Soc. M. E., M. Am. M. W. Assoc., Assoc. M. Am. I. E., E. and Consulting Engineer,
448-449 I. W. Hellman Building, Los Angeles, Cal.

THE city of Los Angeles is the only one, so far as there is a record, which has entered upon the business of constructing an irrigation project. Not only has the city actually constructed such a project at a cost somewhere between \$35,000,000 and \$40,000,000, but it has been built for the purpose of irrigating lands, which were not a part of the city at the time the project was undertaken, and which are not even yet within the city limits.

One of the most disgraceful things connected with the proposition is that the U. S. Reclamation Service, through F. H. Newell, its former director, allowed the Los Angeles speculators to use this branch of the government service to lull the people of Owens Valley to sleep by promising them a reclamation project. Mr. J. B. Lippincott, then of the service, went to the valley, ostensibly for the purpose of inaugurating the project, and turned the whole thing over to the Los Angeles land speculators, hereinafter mentioned, when the necessary preliminary work had been done and rights secured for a reclamation project. For this Mr. Lippincott was rewarded by receiving the appointment as assistant chief engineer by the city of Los Angeles and a derogatory Biblical nickname from the people of Owens Valley.

When it was proposed to build the Los Angeles aqueduct, the public were informed that this was for the purpose of providing a future municipal water supply. Most people accepted this statement at its face value at the time, and the good faith of the city water department in advocating this project was not questioned. However, there were some people who had studied the question of water supply for Los Angeles, or who were informed as to what was going on by reason of being engaged in work which made a study of such problems obligatory. These people, although comparatively few in number, looked into the matter and charged those in control of the Los Angeles water department with bad faith.

The following are the charges made at the time:

First: That the way had been paved for the inauguration of the aqueduct project by causing an artificial water famine in the city of Los Angeles.

Second. That the lands within the city, or those adjacent thereto, over which the future growth of the urban population would extend, were mostly irrigated

and the water used for such irrigation would be ample for domestic purposes.

Third: That the project was inaugurated by Fred Eaton, in his own interest, to acquire large holdings of land in Owens Valley without cost to himself, such land to be paid for by the city of Los Angeles and given to Mr. Eaton.

Fourth: That Mr. Eaton had secured the support of the local press for the project by demonstrating to the proprietors of the leading local newspapers, that they could make millions of dollars profit from the proposed aqueduct, as it would really be an irrigation system, capable of irrigating thousands of acres of land, which could be acquired very cheaply before the details of the scheme became public.

In support of the first charge it was shown that for a year or two preceding the announcement of the aqueduct project, Los Angeles had suffered from a scarcity of water. The lakes in the parks had been allowed to become low or entirely dry, the streets were not adequately sprinkled, the sewers were not flushed, people were forbidden to

sprinkle their lawns, except at stated times, and a general cry as to the scarcity of water was raised by the water works superintendent.

The representations thus made had their effect on the community, which became well nigh panic stricken. Therefore when the aqueduct project was proposed, there was little disposition on the part of anyone to question what was recommended. Many people, who were well informed on the water question, made the charge that the water famine was due to two things, namely, the willful wasting of water in order to create a scarcity; and neglect to install meters on the consumers who were causing unreasonable and reckless waste. The facts would seem to bear out both of these contentions.

*In 1904 the average flow of the Los Angeles river during the summer was 42.82 second feet, or about 28,000,000 gallons daily. The population was 150,000 in round numbers. This was the water famine year, when it was claimed that the supply was grossly insufficient, even for domestic purposes, and char-

*Fourth annual report of the Board of Water Commissioners of the City of Los Angeles, page 26 and page 36.



"Josephine," one of the money makers of the Logan herd at Mulvane, Kansas.

acterized by curtailing the sprinkling of lawns, etc., as hereinabove stated.

*In 1910 the mean flow of the Los Angeles river was 60 second feet, or about 38,760,000 gallons daily, and according to the United States census, the population in 1910 was approximately 320,000 people. There was no claim that water was scarce and insufficient in quantity for all purposes during 1910, and at no time were consumers curtailed in their use, nor did the city fail to maintain the parks, flush the sewers and sprinkle and flush the streets during the summer of 1910.

A glance at the above figures will reveal the startling fact that the Los Angeles river only furnished 38.43 per cent more water in 1910 than 1904, while the population increased about 113½ per cent from 1904 to 1910. This is conclusive proof of the fact that one or both of the charges made against the water department were and are true.

It is not intended to imply that the Los Angeles river surface flow, to which reference has hereinabove been made, is or was the only source of water supply for the city of Los Angeles, before the delivery of a single drop of water from the aqueduct. †On July 1, 1905, all the sources of water supply for the city of Los Angeles were measured, as follows:

Surface flow of Los Angeles river...46.0 Second feet
Sub-surface flow pumped at Buena

Vista pumping station.....	9.0	"	"
Jefferson street plant.....	1.5	"	"
Slauson Ave. pumping plant.....	7.0	"	"
Los Feliz Point pumping plant.....	8.0	"	"

Total 71.5 Second feet

‡This is equal to approximately 46,189,000 gallons daily, while in 1910 the total average consumption in the summer months was only somewhat over 45,000,000 gallons daily. All of these sources of water supply were in existence in 1904 and ever since that time, and have also been further increased by the installation of the Figueroa street pumping plant and other less important developments.

In just what proportion the water famines of 1904 and 1905 were due to lack of proper management on the part of the superintendent of the water works and through willful waste to produce the scarcity of water, or from both of these causes, cannot be known, and everyone familiar with the facts and figures must draw his own conclusions.

That the continued growth of the city, which has been phenomenally rapid, has not produced a scarcity of water, even up to the present time, with no delivery of any consequence from the Los Angeles aqueduct, is due to two things.

A large portion of the lands which have been subdivided were irrigated orchards, alfalfa fields, or gar-

dens where more water was consumed than would be required by an equal area covered with city residences. Thus enough water was released from its former use for irrigation, each time an irrigated tract was subdivided, to take care of the population which would occupy it, and still leave a sufficient surplus to supply the occasional tract which had never been irrigated.

The other fact is, that had the supply of the Los Angeles river watershed been properly developed and conserved, it could be made to supply a population of more than 1,000,000 people.

*This was fully discussed and demonstrated by the Aqueduct Investigation Board in 1912.

It is reasonable to infer that the city officials in charge of the water department were aware of these facts before and at the time the aqueduct project was launched. In fact, there are many statements contained in various reports of the superintendent and water commissioners, which show that all of these facts were well known to them at all times, but were not placed before the public in such a way as to make the people understand them.

The motives of Mr. Eaton in promoting the aqueduct can, of course, only be inferred from the known facts. Mr. Eaton, who had been city engineer and mayor of Los Angeles, had a powerful political influence just before and during the time when the Owens river aqueduct was first proposed. The past relations between him and the superintendent of the water department were and had been such that no one could question Mr. Eaton's overpowering influence. This factor made it easy for Mr. Eaton to control the situation as he saw fit.

The fact that Mr. Eaton emerged from the aqueduct promotion with a fortune in land and cattle, acquired in Owens Valley and paid for by the municipal water department, is a sufficiently strong fact on which to base an opinion. The general opinion by those familiar with the facts is that Mr. Eaton saw an opportunity to acquire valuable properties and gave his time to promoting the aqueduct



It is easy now for this farmer to get his products to market when the prices are best and there is a demand.

for the reason that he desired their acquisition. In fact, it was Mr. Eaton's first plan to have the city build the aqueduct and to permit him to retain one-half the water and carrying capacity. This was not carried out on account of legal objections and Mr. Eaton was satisfied through being presented with the large cattle ranches and cattle thereon within the Owens Valley watershed. Mr. Eaton's political influence has been so great that no attempt to recover this property for the city has been made, although it as demanded by the Aqueduct Investigation Board.†

The fourth charge made against the aqueduct is by far the most important. While Mr. Eaton had large influence as a politician, and could probably have controlled the actions of the water department and influenced leading politicians in its favor, had the project

*Ninth annual report of the Board of Water Commissioners of the City of Los Angeles, page 16.

†Water Commissioners' report for the year ending November 30, 1903, pages 15 and 16 (fourth annual report).

‡Ninth annual report of the Board of Water Commissioners of the City of Los Angeles, page 16.

*Report of Aqueduct Investigation Board of the City of Los Angeles, page 22.

†Report of Aqueduct Investigation Board of the City of Los Angeles, pages 3 and 4.

not been approved by the newspapers, it could not have been consummated. It was, therefore, important to have the support of the local press. How this was obtained was not clear at the time, and only subsequent events have thrown a strong light on the subject.

It has developed that H. G. Otis, the owner of the *Los Angeles Times*, who at that time also controlled the *Herald*, and E. T. Earl, the owner of the *Los Angeles Express*, who since has founded the *Tribune*, became interested in the ownership of large tracts of land in the San Fernando Valley, just prior to or about the time when the aqueduct was proposed. This fact was disclosed by the official records of Los Angeles county. These newspaper owners also subsequently acquired still other and larger tracts of land in the San Fernando Valley, after the large bond issue of \$23,000,000 had been carried, and the aqueduct had become a positive and assured fact.

No one knows just what took place between these newspaper owners on the one hand and Mr. Eaton and the superintendent of the water department and the legal adviser of the city on the other hand. The conclusion is irresistible now that the local newspapers owned by these men, who were also interested in irrigating the San Fernando Valley, gave their influence and industriously urged the aqueduct project, not because they believed that the water was needed for municipal purposes, but because its advent in the San Fernando Valley would raise their land value from an average value of \$50.00 per acre to \$500 per acre.

In this connection let us digress for a moment and recall that the *Los Angeles Examiner*, which had then recently been established, at first opposed the aqueduct project and urged that the matter should be thoroughly investigated before committing the city. The *Examiner* at that time, however, was not in favor and good standing, besides being newly established.

Pressure was brought to bear, which soon changed its attitude, causing it to come out in favor of the aqueduct. Conflicting statements have been made as to the reason for this reversal of policy by the *Examiner*. Its former manager who was in charge at that time, testified before the Aqueduct Investigation Board that pressure was brought to bear from real estate interests, etc., and that Mr. W. R. Hearst himself gave orders to support the aqueduct bonds.* Other rumors have been current that Mr. Hearst also became interested financially in the San Fernando Valley lands, but no facts have ever been forthcoming to show that this rumor had any foundation. In fact, it is the belief of the writer that the *Examiner's* change of policy was brought about in the manner testified to by its former manager at the aqueduct investigation.

There were originally some strong influences against the aqueduct project from many of the financially strong men in the community. Numerous expressions from these men were heard, to the effect that the city should not undertake such a large project without further investigation. There was also much early opposition to the project from the power interests, who were somewhat concerned about the advent of possible aqueduct power.

These matters were all fixed up, however, as the financial men concerned obtained an interest in the San Fernando Valley lands, and these men were also

closely identified with the power companies. There was also a gentlemen's agreement made between the power companies and the interests behind the aqueduct, that the power would be sold to them at wholesale and not distributed to consumers directly by the city. It must have been in consideration of these things that the financial interests of the city and the power companies pooled their issues with the newspaper proprietors and assisted to consummate the aqueduct project.

It is also true that since then charges have frequently been made that all of the parties did not keep faith with the power companies, and some of the politicians and newspaper interests, parties to the former gentlemen's agreement, have supported the municipal distribution of the power directly to the consumers and are still doing so. In the meantime the power companies had withdrawn all opposition to the aqueduct project and aided its consummation. In fact, they were active supporters of the whole scheme until 1912, when certain parties broke faith with them and caused the first power bond election to take place.

Recently an election has been held in the San Fernando Valley to vote upon the annexation of approximately 120,000 acres to the city of Los Angeles.* It is intended that these lands shall all be served with aqueduct water for irrigation purposes.

Every influence which can be brought to bear is being used to cause the consummation of this annexation. Not only are all of the newspaper proprietors and politicians advocating it, but the board of public service commissioners have made water rates for irrigation as low as one cent per hour inch, measured under a four-inch pressure, which is equal to 538 gallons per hour.

The San Fernando Valley having voted in favor of annexation, the city of Los Angeles will be called upon to vote upon the same question at the primary in May. If ratified by the city, the whole San Fernando Valley will become a part of the municipal corporation. It will exclude some of the lands which have abundant water rights and certain towns who do not wish to become part of Los Angeles by reason of their dread of increased taxation. It all amounts to the annexation of a large territory consisting of arid lands, for the purpose of providing these lands with an irrigation system, namely, the Los Angeles aqueduct, built and paid for by the city of Los Angeles.

As to opinions regarding the advisability of thus annexing the San Fernando Valley to the city of Los Angeles, there are two different points from which the question may be viewed.

The first is, that the city of Los Angeles has nearly completed the aqueduct after a fashion, but has no need of the water which it will bring down. The annual expense to the city, on account of the project, may be said to be approximately \$2,000,000, with no revenue in sight to pay these expenses.

It is argued that the city is in the position of the proverbial man holding the "calf's tail," and cannot let go of the aqueduct. It is further argued that the only place where the water can be used is the San Fernando Valley, for which the whole project was planned, designed and constructed.

While all this was not known or admitted in the

*Report of Aqueduct Investigation Board of the City of Los Angeles, pages 95 and 96.

*Engineering News, Vol. 73, No. 7, page 344.
(Continued on page 216)

The Federal Water Users



A Department Devoted to the Interests of the Farmers on the Government Irrigation Projects

EDITED BY GEORGE J. SCHARSCHUG

SOME FACTS FOR COL. ROOSEVELT TO DIGEST

ABOUT the time Secretary of the Interior Lane announced that he had retired Frederick H. Newell as director of the Reclamation Service, Col. Theodore Roosevelt wrote a letter commendatory of Mr. Newell. This was used in connection with a letter by Gifford Pinchot, in what appeared to be the opening gun of a publicity campaign to make Mr. Newell appear a martyr and perhaps so arouse the ignorant public in the East as to force his restoration to office. The editor of the Federal Water Users' department of the IRRIGATION AGE promptly wrote a letter to Colonel Roosevelt pleading with him not to become a party to any movement which would bring harm to the settlers on the federal irrigation projects. In that letter he told some facts about Mr. Newell and much concerning the difficulties with which the settlers are coping. The letter was given to the press and obtained sufficient circulation to halt with a quick turn the Newell martyr publicity campaign. Col. Roosevelt asked for more information. The editor of this department asked several prominent water users to write to him. One of the strongest documents sent to Col. Roosevelt was the subjoined letter by Earl B. Smith, chairman of the executive committee of the National Federation of Water Users' Associations:

Somerton, Yuma County, Ariz., March 20, 1915.
Col. Theodore Roosevelt, Oyster Bay, N. Y.

Dear Mr. Roosevelt: I am in receipt of a letter from Mr. Geo. J. Scharschug (IRRIGATION AGE) in which he says:

"I received a reply to my letter to Col. Roosevelt, concerning F. H. Newell, some time ago.

"As you may recall in my letter to Col. Roosevelt, I mentioned the fact that one water user had a copy of the report of the water users' hearing before Secretary Lane.

"Col. Roosevelt expressed a desire to see this report or portions of it. If you have the time, therefore, I will appreciate it if you will give the Colonel some extracts from the report as it concerns the settlers' feelings towards Mr. Newell's lack of apprecia-

tion of the human side of the federal irrigation problem," etc.

The report is 3,334 pages of typewritten matter covering 17 days of the conference, therefore I deem it undesirable for me to burden you with so great a volume. To send you extracts as suggested would involve great labor, and if attempted, I probably could not do it in a manner to relieve your mind from doubt that my extracting would be free from bias. Nevertheless I feel it is only a justice to you and a duty to those I represent to comply with your wishes in the most practical manner possible. I cannot part with the record as it may be required in evidence, but it is always an open book for examination to any one interested.

The controversy is not political, nor is it of a personal nature against Mr. Newell, but relates to his official policy, his official irresponsibility, his professional incapacity and his habits of deception covering a period of more than ten years. The National Federation of Water Users' Associations was formed to compare notes and ascertain if the experiences of settlers on all the projects were the same, and they were found to be so,

and to devise means of correction. This latter is the delegated duty of the executive committee.

Knowing that Mr. Newell was an appointee of yourself and that you have yet confidence in him, I deem it best to give you data rather than the language of the complaints founded on the data, for you can then judge for yourself as to the merits of the controversy. Therefore I will give you some data regarding my own project on which I live and on which I own and operate an 80-acre ranch, but what I say will substantially tell the story of practically all the projects.

Yuma project: 35,000 acres public and 53,000 private land. Surveys completed early in 1904. Great and lasting opposition to government irrigation as against private proposals and many meetings held to discuss relative merits. Fear of red tape and long delay is great objection. Newell attended at least one of these meetings and explained the law and explained



EARL B. SMITH,
Of Somerton, Ariz., Chairman of the
Executive Committee of the Na-
tional Federation of Water
Users' Associations.

it correctly as to the estimated cost and what we should have to pay, and when and how, etc. He told the meeting that it would be completed within two years, and it was expressly stated that two years did not mean two or three years, but "within *two* years." With those assurances the government's proposition was voted to be accepted.

Then our Water Users' Association wrote an official letter of inquiry as to details and cost, for purpose of having in writing the understanding verbally agreed upon at the meetings, to which Mr. Newell made a prompt reply covering everything very satisfactorily, except as to time of completion, which was never afterwards stated in writing, but his word at the meetings was deemed to be satisfactory. This correspondence was mutually deemed to be a contract or understanding upon which we could rely, and in subscribing our lands to the lien for the payment we thereby bound our lands of record to such lien as a first mortgage. Our confidence in the contract was backed up by reliance on the plain provisions of the Reclamation law; whereby we were required to return to the Reclamation fund the estimated cost, \$3,000,000, or about \$35 per acre, and as we had the estimate made directly to us, and as such estimate had actually been returned to congress as the law provided, we felt perfectly satisfied that we knew what we were doing as a business proposition.

Now let us look upon the subsequent development. Work started in fall of 1904. Five years afterwards (Nov. 1909) only Laguma dam was completed at a cost of \$3,497,686.40, or nearly half a million over the total estimate. (See senate committee's report No. 1281, 1911, page 774.) On same page the work is reported as 70 and $\frac{1}{2}$ per cent completed. After four more years work involving an additional expenditure of about \$3,000,000, the Reclamation Record (I think the August, 1913, issue) reported the project 64 per cent completed, or a net loss of about 6 per cent in completion. Today, March, 1915, the Record shows about 74 per cent completed, and a few weeks ago Director Arthur P. Davis reported to the subcommittee of the house on appropriations, that the revised construction cost as of December, 1914, is \$11,715,000.

December 24, 1912, Mr. Newell made an address in the opera house at Yuma (I was present), in which he stated that "probably no one in the audience would live long enough to see the Yuma project completed," and I guess he was right.

I now call your attention to Mr. Newell's remarks found in the second annual report of the Reclamation Service (a copy of which I examined in the Congressional library in Washington—out of print—I cannot give you the page), in which he stated that the provision of the law regarding the estimated cost was

a very wise provision for the reason that it put every thing on a business basis. (I quote this only from memory.) But it serves to show that the law was construed at that time by Mr. Newell himself that the charges must be according to the estimates reported to Congress. That was about 1904 or 1905.

On Feb. 1, 1909, Mr. Newell promulgated an entirely different doctrine regarding the "estimated cost," in his booklet of "Questions and Answers," wherein on page 38 we find the following:

- "90. Q. How are the charges of the water right determined?
A. These are fixed *as required by the law*, according to the estimated cost of construction of the works.
- "91. Q. When will the cost of the water right be announced?
A. The public notice required by Section 4 of the act will be issued before water is ready for delivery, and *when the work is sufficiently advanced to make an accurate estimate of the cost.*"

This astounding information that the estimated cost means the total amount that is expended, showed us that we were up against a game of "heads I win, tails you lose." This new construction turns the contract from its original mutual conception into something entirely different, and so great was the effect of this new construction that loans were refused and called and that our titles had an absolutely unlimited mortgage on them according to the amount that the engi-

neering trust in the government employ could induce the Secretary or Congress to appropriate for them to expend, and all without consultation with us or our consent, nor were we asked to consent and we were politely told that the amount they desired to spend was none of our business, and we were denied access to the books and were treated with utter contempt. Banking credit has ever since been practically withdrawn from us and development of the lands practically ceased as a matter of financial necessity. At the super table with Secretary of the Interior Fisher, at Yuma, our project engineer stated that the Service had now given many of the lands access to irrigating water for which they had been clamoring for years and now the owners did not seem to want it and would not put their lands in cultivation, and only last week we had a letter from our Senator, Mark A. Smith, Chairman of Senate Committee on Irrigation, stating that the Department was complaining very bitterly that we were not putting our lands under cultivation to utilize the water, and alleged that we were holding our lands for speculative purposes. Under the circumstances of an unknown and unlimited mortgage I don't



A typical irrigation pumping plant at Hereford, Texas. This plant pumps 1,600 gallons of water per minute. It consists of a Bessemer crude oil engine and a Layne turbine centrifugal pump. The cost of irrigating in this district is from 30 to 50 cents per acre for each application of water.

know that I desire to deny the charge. I would like to sell out myself but cannot do so, for the reason that suckers are not around trying to purchase such uncertainties. I think there are as many American hard-working citizens who have been attracted by the glitter of government irrigation that have invested their all and lost it all during these years of waiting on certainty when each year the uncertainty became greater and greater that have become tramps, as there are now living on the project.

In the report of the Water Users' Conference of May 8, 1913, Senator Walsh of Montana used a good portion of the day in addressing himself to the Secretary on the interpretation of the law regarding the "estimated cost" which accords with our views entirely. He stated that under Mr. Newell's construction that any man who cultivated his lands did so at his peril. Nor during the entire conference did any man even attempt to answer Senator Walsh. Under the existing circumstances agricultural prosperity on a government project is next to an impossibility, especially in the sparsely settled communities of the far West, with very limited markets and very limited methods of transportation. On a ranch a short distance from mine, there are three years of cutting of alfalfa that lies rotting in the stack and cannot be sold for the cost of production and the owner cannot finance the purchase of stock to eat it because he is denied, on account of the government lien, access to the usual money markets of the world.

Again, until completion, users of water have to rent their water without having any definite water right. I inclose a copy of the rental contract for your inspection and call your attention to clause 6 where the "United States reserves the right to terminate this contract at any time upon giving thirty days' notice." We are expected to clear our land from the mesquite timber, level the land and put into crops relying on a thirty days' tenure of water. Is it reasonable to ask a man to make such an expenditure relying on such a tenure of water? Of course we well know the reasons for that clause, which are, that when the day of accounting comes we are expected to give a more specific mortgage called a "Water Right Application," in which we must agree to pay the total cost, and if our lands are in cultivation and we demur, the water rental contract will be terminated by notice and water shut off until we come through. Did you ever see a more effective club against a helpless individual like the average man who is endeavoring to establish a home for himself and his family? Is this the "square deal"? Would such a thing be tolerated in Russia or darkest Africa, and is not the great faith we have in our own government our greatest weakness?

Now as to the Extension Act. To the man up the tree it is most charitable, but in effect, it is a Trojan horse filled with armed men to compel us to acquiesce in the new construction of "estimated cost"! Again, the proposed re-valuation boards, on one of which we are entitled to have one representative to two of the government's representatives, and is therefore by no means a board of arbitration, and if we appoint a man on such board we will naturally be bound by the findings. That is nothing but another Trojan horse. This project, on due reflection has declined both propositions so far.

I will invite your attention to Congressman Bor-

land's remarks in the Congressional Record of February 17, 1915, page 4030. Mr. Borland is chairman of the House Committee on Appropriations.

"Mr. Borland: Mr. Chairman, I move to strike out the last word. I want to say a word in regard to the question of the increased cost, because that is one of the features of the new Reclamation Extension law.

"It was claimed originally as to most of these projects that an advance estimate had been given to the settlers as to how much the project was going to cost per acre, and that they had capitalized the water users' associations upon that basis, and that was what they were bound for. A controversy of considerable size existed between the settlers and the Department on that very question. The Department solved that problem in this way: The settlers in many cases wanted additional time on their payments, or they wanted an enlargement of their original projects, and when they came to the department to ask either an extension of time or relief from a default, or an extension, or new work, or any other favor, the Department said to them, 'Gentlemen, either you must agree to the increased cost over and above what you claim was the limit fixed by the Department when the work was begun, or we will not do what you ask. In that way they compelled the settlers to agree to the real cost instead of the original estimate, which in all cases was too low and in some cases was only 50 per cent of the real cost."

The foregoing are the views of the actual settlers who, endeavoring to produce from the soil, or who would desire to do so if they were not shut out by the above circumstances. But there are those who will not listen to these views that are right here close at hand, and who are bankers and merchants and so-called Commercial Clubs, who will tell you a different story. The more money put into the project the better they are pleased, for its expenditure makes good business in the mercantile line. Every increased appropriation for the project is hailed with delight in our local press who are supported by the advertising merchants, and the people of the towns are always favorable to further appropriations, though well knowing but caring less, that it must all be dug up again by the producer—the man the law was intended to help. We farmers, and committees, and men who argue like Senator Walsh does, are dubbed kickers, agitators, socialists, etc., etc.—so great is their greed for greater and greater government expenditures. The views of different men depend on whose ox is being gored. We insist that no one has any right in this controversy except the settlers on the lands and the government, and if the question is only to be discussed in town and city banquets with officials of the Reclamation Service, and to which no producer is ever invited, then such discussion is among people who are not vitally interested and are attending to other people's business besides their own.

It is impossible in this communication to touch on all that should be said as to what developed at the Washington conference in even the Yuma project. I will endeavor to have sent to you the pleadings in the case of the Bell Fourche Water Users' Association against the officials of the Service, and where the association got a temporary injunction in the state court, affirmed in the U. S. District court, and again confirmed in the U. S. Court of Appeals. Those pleadings tell the human side of these questions.

We have studied the question for years; we have

consulted the highest engineering talent in this country and obtained the best legal advice obtainable, and have concluded that everything is extravagant—that Mr. Newell is remarkably incompetent as engineer, director and business man; that he has gone ahead regardless of law and his own contracts. He even denied that he wrote the letter to the Yuma County Water Users' Association giving the details of the estimate and that he knows nothing about it.

Under Newell's interpretations the law is nonsense. Suppose they go on for ten more years and run the cost up to twenty or thirty millions, can the land stand it, and are not the objects of the law defeated by its administrators?

But this is enough for this communication. I am willing to aid you in any investigation with documentary evidence that you may call for, for you should know the facts more than any other man outside the present government. With highest regard, I remain,

Very truly yours,

EARL B. SMITH,

Chairman of the Executive Committee of the National Federation of Water Users' Associations.

ADDENDA.

Congressman Hayden in Congress February 12, 1915: (p. 4023).

"Mr. Chairman, of course I do not ask for a cent to be spent on the Yuma project that is not necessary, because it must all ultimately come out of the pockets of the farmers there."

* * *

Secretary Lane has now been in office for over two years since all these matters have been brought to his attention in a 17-day conference, and it is time that he came to some conclusion as to what is the matter. Of course he inherited Newellism when he became the Secretary of the Interior. Congressman Borland's remarks quoted in this letter let the cat out of the bag when he explained on the floor of the House how the Secretary is holding up the settlers to agree to a different bargain when they ask for extensions of time on payments due that they could not possibly pay under the circumstances brought around not by their acts, but by the policy of the Reclamation Service. A wobbling policy still prevails.

* * *

Of all the nonsense appearing in the official organ of the Reclamation Service when dealing with so grave a proposition as is involved in this discussion, and upon which depends the success or failure of thousands of settlers, the following article taken from the May issue (1914), page 168, I think this is the worst that has ever appeared, and shows the weakness of the position maintained by the Department. I quote the article in full as follows:

VARIETIES OF ESTIMATES.

"In connection with the question more or less frequently raised regarding the "estimated" cost of a project, it is interesting to note the following classification of estimates suggested by Allen Hazen, Consulting Civil Engineer of New York City:

1. Preliminary estimates, being estimates made in advance of the preparation of detailed plans and specifications for the purpose of discussing a project for deciding as to its

adoption, and for making the necessary financial arrangements for carrying it out.

2. Detailed estimates, being estimates based upon detailed plans for the execution of the work, and usually made shortly before bids are asked for the particular work covered, or in advance of undertaking to carry it out by day labor.
3. Final estimates, being made to the contractor at contract prices for the actual work done. The term 'final estimates' may also properly be applied to a statement of the cost of a completed work based upon actual expenditures made in carrying it out.

"It has been suggested that the term 'estimates' as used in the Reclamation Act, obviously refers to the final estimates as defined above, while the so-called estimates of the engineers and others, made in the early stages of consideration of a project, were just as obviously merely preliminary estimates as above noted."

The above constitutes the *only* discussion ever appearing in the Reclamation Record on this important subject, and if our destinies are to depend on the mere passing remarks or *obiter dictum* of Mr. Allen Hazen, then he had better be immediately employed as the government's engineer, legal counselor, director, etc., and let him complete the job undertaken by Congress on June 17, 1902.

* * *

In my humble opinion this uncertainty has gone on long enough. That the lands are not going into cultivation after this enormous expenditure is sufficient reason that somebody ought to do something to ascertain, officially, the real cause.

* * *

A few words about real values. Congress has just passed appropriation of \$725,000 to continue the work on the Yuma project from June 30, 1915, to July 1, 1916, or approximately \$2,000 per day including Sundays and holidays. This daily expenditure is sufficient to purchase, at present values, an ordinary farm unit each day of the year, and during the year 365 units will have their present entire value expended simply to continue the work for the twelfth year of operations. While the towns-people want the appropriations, the settlers do not want them, for the reason that each appropriation simply adds to the already heavy burden,—that is, according to the Department's interpretation of the law. These 365 units constitute a very large portion of the entire project. The settlers do not thank our Congressman Hayden for helping to secure this appropriation, but would thank him if he could hold up every appropriation until the law of estimated cost is finally settled and settled right in accordance with terms agreed upon, by every possible precaution, at the time the project was started.

* * *

Dear Colonel, the reclamation law is a child of yours. Are the views of the men you intended to assist in establishing homes in the far west of any material interest to you?

Yours truly,

EARL B. SMITH,
Chairman.

THE PROOF OF THE "SERVICE" PUDDING.

The Carlsbad (N. M.) Project Investigation Brings Startling Reclamation Service Revelations

OFFICIALS of the Reclamation Service, serving as members of the Board for Revaluation and Review of costs on the Federal Irrigation projects, openly favor star chamber hearings by these boards.

The Reclamation Service is inclined, if it can get away with it, to rest its case on a very general statement of project costs, styled "Statement giving by features the amount of expenditures, subdivided into elements of costs."

Overhead charges on the projects, when finally dug out by the representatives of the settlers, are much greater than has been charged frequently by the settlers and by the *IRRIGATION AGE*.

These facts were developed very fully at the hearing on the Carlsbad, N. M., project hearing. They also have cropped out in practically every other hearing which has been held or is now in progress. On some of the projects, Reclamation Service influence has succeeded in making the hearings practically star chamber affairs.

Open hearings were held on the Carlsbad project, but only after Prof. T. U. Taylor, of Austin, Texas, the third member of the board, had joined with Scott Etter, of Carlsbad, N. M., representing the water users, in insisting upon an open hearing. D. W. Murphy, representative of the Reclamation Service, was quite insistent that the only work before the board was an examination of the project accounts and that any witnesses, who might be heard, should be heard in secret.

"We don't do things that way in Texas," is the reported reply of Prof. Taylor, who is dean of engineering at the University of Texas.

The establishment of the open hearing precedent should prove of great value to those projects on which the revaluations and costs reviews are not yet completed.

From the settler's standpoint, the Carlsbad hearing was probably the most complete and thorough yet held. Fulton H. Sears, lawyer, a settler on the Truckee-Carson project in Nevada, member of the Executive Committee of the National Federation of Water Users' Associations, and one of the closest students in the United States of Reclamation Service affairs, was retained as counsel for the Carlsbad association. Mr. Sears is an able attorney and he probed to the very bottom of the project affairs. His results were startling.



The Carlsbad Board of Review, Reading From the Left—D. W. Murphy, Drainage Engineer of the Reclamation Service; Prof. T. U. Taylor of Austin, Texas; Scott Etter of Carlsbad, N. M.

The association also engaged T. J. Guilfoil, a public accountant of Albuquerque, N. M., who is also secretary of the Democratic State Central Committee of New Mexico. Mr. Guilfoil made as thorough an audit of the project books as was possible from the rather un-

systematic records kept by the Reclamation Service officials, and his discoveries were of much value to Mr. Sears in establishing his case for the water users.

The Reclamation Service statement showed the cost of the project up to Dec. 31, 1914, to be \$933,840.96. The water right cost as now fixed by the Reclamation Service is \$55 per acre, or a total estimated cost of \$1,100,000. The original estimates, on which many of the farmers accepted government contracts was \$31 per acre or a total cost of \$620,000 for the project.

"I maintain that all above the original estimated cost of \$31 per acre is waste," said Mr. Sears after he had completed his case before the Review Board. "The difference of \$480,000 represents money spent for inefficiency."

The hearing developed that the books of the project are in a chaotic condition, vouchers for thousands of dollars are missing and freight bills for vast amounts are also gone. Innumerable examples of engineering mismanagement were uncovered. No field notes or other engineering data from which to compute quantities and costs

were found and so far as the Reclamation Service engineers, now on the project know, none were available.

Although the overhead charges were generally very carefully concealed in the other cost features, one estimate placed these charges at 40 per cent of the total cost of the project.

The books of the project balanced, no actual evidence of graft was uncovered but wastage stared the board in the face whenever they started down a new path.

From the very beginning of the hearing, the Reclamation Service officials assumed the attitude of not disclosing any facts, except such as could be drawn from hostile witnesses.

The case developed by Mr. Sears is exceedingly interesting not only to water users but also to all who have followed the workings of the Reclamation Service. Through Mr. Guilfoil, the water users' accountant, Mr. Sears showed that the books and records of the project for the first two years, during which the Reclamation Service handled it, are not a current set of books, but instead are a set of records written up



Fulton H. Sears of Fallon, Nev., Who Acted as Attorney for the Carlsbad Water Users.

from eighteen months to three years after the expenditures actually had been made.

Mr. Guilfoil also told of locating charges for cement and freight against the Carlsbad project, when in fact the supplies were forwarded to the Hondo project. As W. M. Reed, who in the earlier years of the Carlsbad project was its project engineer, also served at the same time in a like capacity on the Hondo project, the witness indicated the possibility that large quantities of other supplies, besides those discovered, may have been used on the Hondo project, while being charged to the Carlsbad project. Because of loss of vouchers and freight bills, none of the original bills of lading with the exception of about 300 being furnished, it was impossible to make any intelligent verification of the actual amount of supplies used on the Carlsbad project as against the amount for which the project is charged.

Extravagance and inefficiency in the matter of purchases were uncovered. For instance, it was found that much cement was purchased from a mill at Portland, Colo., a much longer freight haul than on the cement purchased at the same time from mills in Oklahoma and Kansas.

Staple commodities, such as dynamite, nails and tools were bought for a long period of time in the local market at retail prices, while at other times these supplies were purchased from jobbers in the wholesale market at prices much lower than the local retailers could offer.

Local blacksmiths were hired to sharpen picks and grind tools, when one project blacksmith on a daily wage could have taken care of all this work.

The project was charged at the rate of ten cents for each sack in which cement was delivered to it. This money was to be paid back upon return of the sacks. It was found that thousands of these sacks had never been returned. Failure to return the sacks in most instances increased the prime cost of the cement as much as 50 per cent per barrel.

Little attention seems to have been paid to making savings on freight rates. Material was reshipped from Carlsbad to Avalon, Lakewood and other construction points on local rate, when if proper attention and anticipation had been given to the needs at the various points, these supplies might have been handled on the much lower through rates.

Bill of Lading No. 8121 showed a shipment of four Sarden wheels by express, the charges, \$80.05, being 75 per cent in excess of the cost of the equipment itself.



T. J. Guilfoil of Albuquerque, N. M., Accountant for the Carlsbad Water Users.



Abel Ady, Water Users' Member of the Board of Review on the Klamath (Ore) Project.

Five cement mixers were purchased during the construction period on the project. Two now remain on hand. The other three were transferred to other projects at second hand prices. For instance, one mixer that cost with freight charges about \$1,200 was sent to the Strawberry Valley project in Utah at a price of \$500. It was also shown by witnesses that had proper engineering anticipation been exercised two cement mixers would have been all that was necessary to complete the job. It was shown definitely that the purchase of the fifth mixer was not an expedient expenditure.

Of course the settlers are expected to pay the bills.

And then the tragedy of it all. The Carlsbad hearing had been completed. A woman rushed into town breathless, weeping. She cried out to the astounded townspeople that the Lake McMillan dam had broken; that the engineers had given up hope of saving it, and that once the McMillan dam let go, it would carry out the Avalon dam, and let loose a flood upon Carlsbad and the project that was almost certain to wipe out the homes of the townspeople and the farmers.

It was impossible to obtain any further communication with the crew at the McMillan dam. Finally a foreman from the dam reached Carlsbad. He declared the hole in the dam was such it could not be plugged up and the big earthwork must give way at any minute.

The bells of warning were rung. The militia was called out. The frightened women and children of the town and surrounding country and many of the men were hurried to the hills, leaving behind all their possessions, their homes, their life works.

Meanwhile at McMillan dam five men were battling against tremendous odds. Finally they located the hole in the dam. Working madly, they dumped in 600 bags of silt and stopped the break. They had saved Carlsbad and the project.

This dam was built just of earth without any concrete core. If as the result of this break, it is found necessary, as it likely will be in order to safeguard the lives and property of the farmers and townspeople, to rebuild the dam, the present dam is a total loss—just so much more waste—thousands upon thousands of dollars.

And the settlers are expected to pay for this dam at Reclamation Service rates.

Attorney P. W. Dent, representing the Reclamation Service, entered an appearance at the hearing, after he saw what a strong case was being developed

by the settlers, and before he left Carlsbad, he asked permission to return at a later date, reopen the hearing and produce government witnesses to refute the evidence offered by the water users.

If he is good enough to do this, the water users will get an opportunity to add to their present remarkable record, the story of the Lake McMillan folly—a costly dam of just dirt, without a core of any kind—a frail wall, expected to hold back millions of tons of water.

The story of the heroism of the men who saved the McMillan dam is told in simple language by Prof. Taylor, Secretary Lane's member of the Carlsbad revaluation project, in a letter to the *IRRIGATION AGE*. He says:

"I venture in this direct way to call your attention to signal, brave, prompt, patriotic, and dangerous service performed on April 18, 1915 (Sunday), by Mr. E. C. Koppen, a surveyor or engineer now in the employ of the U. S. Geological Survey, or the U. S. Reclamation Service. The circumstances are these:

"The water at and above Carlsbad was very high and the Pecos River was nearly full and Lakes McMillan and Avalon were even full and every waste way running full blast and wide open. Mr. Koppen, about 2 p. m., Sunday, was taking a stroll with his wife and happened to walk along the old river bank below McMillan dam. At this time he saw water running from the sides and down the stream face of the dam and that the total discharge by his estimate was about four cubic feet per second.

"Without hesitation he dashed at full speed back to the east end of the dam, routed out his field party of assistants on the lake survey, secured sacks, spades, and ran to the point of danger. He promptly went to work, located the point of ingress of the water which was about at the level of the water in the lake, filled sacks with dirt, dumped them in the holes, while two of his men worked in the dangerous section in the mud, slush, up to the hips, and finally after he had filled and dropped in something over FIVE HUNDRED SACKS of dirt, he succeeded in checking the flow by about 7 to 8 p. m.

"Only five men were engaged in the work and they were men on the surveying party. A runner came to Carlsbad and put out the report that it would be impossible to save the dam, and that it was practically OUT. The heroic and prompt work of Koppen and his men had the flow and leak stopped by the time the reported failure had spread in Carlsbad. I was in Carlsbad at the time and on Monday, April 19, 1915, I went to Lake McMillan and looked over the situation. I can say without hesitation that had it not been for Koppen and his men the McMillan dam would have washed out, and without doubt, the flood would have taken the Avalon dam, and great loss of life and the destruction of the Carlsbad project would have been the result.

"Koppen and his men saved a million dollar project and many lives. Too much can not be said in praise of this modest hero and his men."

Abel Ady, member of the Review Board on the Klawath (Ore.) project, has the following to say concerning the work on his project:

"The April number of the *IRRIGATION AGE* presents the Federal Review Boards as "Revaluation Boards."

"These boards have been provided for the purpose

of reviewing the actual expenditures upon Federal Irrigation Projects, with a view of determining and fixing the proper amounts of project expenditures to be collected from the settlers.

"To divert this work into a mere revaluation of the structures would be a farce so far as the expenditures are concerned. The present economic conditions may give the structures a far greater valuation than would have been justified by the economic conditions when the structures were made or obtained, or vice versa.

"Also a revaluation would not reveal the wisdom or lack of wisdom in making the expenditures or in apportioning them among the various units of a project.

"What the settlers really desire is a review of the actual expenditure, a determination of the intent of contracts, agreements and understanding between the Service and settlers, the law under which the expenditures were made; and a determination of the amounts of these expenditures that should be collected from the settlers. Also the elimination of such charges as may be shown to have been inequitably or unjustly debited.

"To this end the settlers of the Klamath Project are bending every energy. Every contract, agreement, assurance and inducement affecting any of the expenditures or the apportionment of the same, will be carefully scrutinized.

"Our settlers will agree to pay all that is determined by a fair board to be just, regardless whether or not that amount is greater or less than the present value of the works, and regardless of whether or not that amount is equal to or less than the entire project expenditures.

"We will not attempt to repudiate the payment of a dollar honestly or intentionally spent in our behalf, and will give the lender of the funds the benefit of all doubts."

AN AUSTRALIAN BUYER

Editor of *IRRIGATION AGE*: The writer has just arrived in the States, together with one of our engineers, and among other things, we are investigating closely methods, machinery and new developments in the field covered by your journal.

I shall be glad to have at hand a sample copy or two of your publication, together with a memo of subscription rates to Australia, and shall be pleased if you will be good enough to announce in your next issue our presence in the U. S. A. and our interest in the machinery, etc., as particularly applied to this trade or business.

It so happens that I am making a short visit to a relative of mine at 3219 North Capitol avenue, Indianapolis, where I shall be glad of your return advice and sample copies. In a week or two I will join our engineer, Mr. H. P. McColl, who has now reached Chicago, at the Hotel LaSalle there, following which we will work through all the industrial centers to the East and then across to England.

We are,

Very truly yours,

W.M. MCLEAN & Co.,
of Melbourne, Australia.

O. L. REMINGTON.

General Manager.

TEACHING CITY CHILDREN TO IRRIGATE LAND

By MORRIS W. RATHBUN

WHILE many of the larger cities of the country are experimenting with agricultural courses in the public schools, in response to the "back to the farm" cry, in only a few instances is the work assuming form sufficiently practical to be of economic value. The importance of instructing children—especially city children—in tilling the soil is becoming more apparent all the time. If the present cost of food stuffs is to be maintained it may be expedient to use all of the available ground in and about the cities. Knowledge in addition to labor is necessary in making soil revenue yielding, especially in those sections of the country where the rainfall is confined to certain seasons of the year.

The agricultural department of the Los Angeles city schools was among the first to realize that the school garden movement could be extended to the home gardens and that these in turn could be made an economic factor liable to assume greater importance as it was more fully developed.

Although the school gardening was well systematized in 1912 it was not until last fall that any decided impetus was given to the work, this being brought about through the activities of a general committee organized for the purpose of beautifying the city and county and entertaining conventions during California expositions, year. In the appropriation made by the county of funds for this work, provision was made for seventeen thousand five hundred dollars in prizes for the children and schools for the best efforts at beautification. Of this amount more than twelve thousand was for distribution as prizes among the individual young gardeners for work done at their homes.

The awards will not be made until next fall, but results of the general school and home beautification has progressed far enough for some definite results to be apparent.

There are ninety-five schools in which garden work is taught, the classes numbering nearly twelve thousand pupils of the elementary grades. Sixty teachers and four expert agricultural supervisors are engaged in the work and co-operating with them are ninety-nine parent-teacher associations, practically all in the city. Nearly ten thousand of the pupils have entered their home gardens in the prize contest in which the individual rewards range from five to thirty-five dollars.

In addition to the school gardens proper the children have taken part in creating twenty-six school lawns, which work, as those familiar with semi-arid countries are aware, requires care and skill, and parking has been done in forty-eight school grounds. Seventy-six vacant city lots are being utilized by school children for garden plots, the owners being glad to have the ground devoted to this purpose without charge.

The practical side of the work is emphasized by the use of thirty lath houses, forty-three cold frames and seven hot beds, most of which were constructed by the little gardeners and in some instances paid for by them from the proceeds of their work.

While the idea of the General Committee primarily was to improve the appearance of the city through home and school flower beds, the movement has progressed much further than that. What was sought in this line was accomplished while thousands of dollars worth of garden truck from home gardens is being consumed by families to whom the cost of living ever presents a serious problem.

Not the least and probably the most permanent benefit is in the training received by the future citizens. Of necessity the time devoted to actual instruction is limited, the average being about an hour each week, but the cultivation in the home gardens requires considerable time and energy which, for the most part is



Girls caring for one of the flower gardens which adorn the front yards of Los Angeles schools. This photograph was made in February, 1915.



This school garden, located in the industrial district of Los Angeles, furnished vegetables for the Christmas dinners of the young gardeners and other children. The photo was taken in December, 1914.

cheerfully given.

The general movement was begun last fall, when the Friday following Thanksgiving was proclaimed a holiday by the mayor for the purpose of allowing the school children to do their fall planting. It was estimated that some ninety thousand school pupils in the city and county took part in planting. Climatic conditions are such in southern California that there is no "closed season" for growing things, the winter months comprising what is known as the rainy season. The annual normal precipitation is 15.72 inches, which is distributed over six to seven months, approximately equal to the same period of time in the Mississippi Valley states.

A large amount of seed was furnished free to the children expressing their intention of entering their home gardens in the prize contest. Enough packets were distributed to plant an area of three million square feet, or approximately five square feet to every man, woman and child in the city.

Through the co-operation of seed houses and nurserymen a comprehensive pamphlet was issued under the title "Home Garden Manual." Copies were given away to all who applied for them, whether child or adult. The dealers also agreed to furnish seeds at reduced prices for home planting. The child taking advantage of this had to show an identification card signed by its teacher.

The winter gardens in southern California present much the same problem to the little folk as in other sections of the country where the rainfall is depended upon to supply all the moisture required. But with the coming of the dry season, which begins usually in May and extends into October or November, it is necessary to use irrigation. The children are taught the conservation of moisture and the difference between wetting the plants with a sprinkler and really giving the roots the water needed.

The trench method of irrigation is generally used. Ridge and furrow planting in companion rows is encouraged, so as to most readily permit of this form of watering and easy cultivation. In two of the schools experiments are being made with the Skinner system of automatic sprinkling, though no decision has been reached.

In connection with the various forms of irrigation taught attention is paid to dry farming methods. The manner of preparing the ground for this form of agriculture is explained.

While sprinkling is not encouraged, in some instances it is necessary to use this form of supplying moisture to the gardens. On these occasions the youngsters are impressed with the importance of thorough soaking. The boys are put in charge of the irri-

gating and held responsible for results. They are allowed to leave classes to change the sprinklers as needed, they having the option of when to move them. Water has been piped to the garden plots in most of the schools.

The enthusiasm of the children is kept well up through exceptional individual successes. Keen rivalry exists to grow the earliest vegetables or the largest. When one little gardener shows proof of a properly and well-cared for home plot others quickly investigate the methods used. One part of the school work is to interchange ideas. It is effective because the child who has done well is pleased to tell of it, and the children learn from each other without the restraint that always must exist to a degree between teacher and pupil.

Many instances have developed where the child with its home garden actually has added to the family income, beside supplying the table with fresh products. One little girl of nine helped her family materially through selling her garden truck. A boy of ten has an acre planted in the suburbs. He employs other boys to help him. The business instinct has been developed in numerous instances to the point where boys form partnerships in gardening that are highly profitable. A girl of eight was first to raise ripe vegetables after the

fall planting. She proudly took a basket of onions, beets and other products to her teacher, who in turn sent them to the Chamber of Commerce, which maintains a large permanent exhibit of agricultural products. This was in February.

The enthusiasm of the children was communicated to parents who previously had taken no interest in vocational training in the schools, especially in the garden work. Their interest aroused, the adults not only aided the children but themselves took active part in cultivating the ground about their homes.

It is believed that the impetus given to school and home gardening by the beautifying campaign will be maintained. The main purpose of the school work is to give the boys and girls intelligent and sympathetic interest in those phases of the labor which contribute to the great problem of food, clothing and shelter, which must necessarily be the fundamental occupation of mankind. Gardening places the child in a most wholesome environment and furnishes the best sort of physical exercise and relaxation from book study. It gives both the child and the teacher fine opportunity for self expression.

The ethical value of the garden work is considered one of its chief claims to place in the curriculum. The children unconsciously learn orderliness, the value of property and labor and that they must pay in some form for what they consume.



A school garden in the residence district, as it appeared late this spring.

IRRIGATION WATER MEASURING DEVICES

*By California Agents of Irrigation Investigations, Office of Experiment Stations, U. S. Department of Agriculture

THIS is the second of a series of articles prepared from a bulletin issued by the College of Agriculture of the University of California, at Berkeley. The articles are illustrated with photographs and drawings of the various structures and devices used in compiling the data.—THE EDITOR.

When irrigation water is distributed in underground pipes measurement is usually accomplished at the hydrant through which the water is brought to the surface. Three of the measuring hydrants used in southern California have been installed at the Davis (Calif.) field laboratory.

The Azusa hydrant (Figs. 3 and 4) is chiefly used in the vicinity of Azusa, Calif., and provides for measurement through one or more orifices on the center of which a pressure head of 4 inches is maintained by means of a sheet-iron spill crest set at right angles to the orifice plate. The hydrant is in the form of a concrete box placed over the supply pipe line. The openings in the orifice plate are 4 inches high and $2\frac{1}{2}$, $3\frac{3}{4}$, $6\frac{1}{4}$, and $12\frac{1}{2}$ inches wide, giving areas of 10, 15, 25 and 50 square inches, respectively. When the water surface on the upper side of these openings is held 4 inches above their centers they will discharge respec-

tively, 10, 15, 25 and 50 inches. By using different combinations of these openings, several different amounts up to 100 inches can be measured. The water enters through the pipe shown in the drawing (Fig. 3). The orifices for the desired amounts to be turned out are opened and the others closed with slides. By adjusting the gate below the spillway the water can be brought to the crest of the spillway, the area of the orifices in square inches being then equal to the number of inches turned out. If the water rises above the openings a large part of the increase will be carried back to the supply line over the spillway, but any increase in depth on the openings will also increase the amount turned out.

The Azusa box as shown has walls 6 inches thick, all sides being vertical and flat. The forms required in making are therefore simple. The box contains 78.3 cubic feet of concrete. This can be made of 1 part cement to 4 parts coarse sand. As the walls are 6

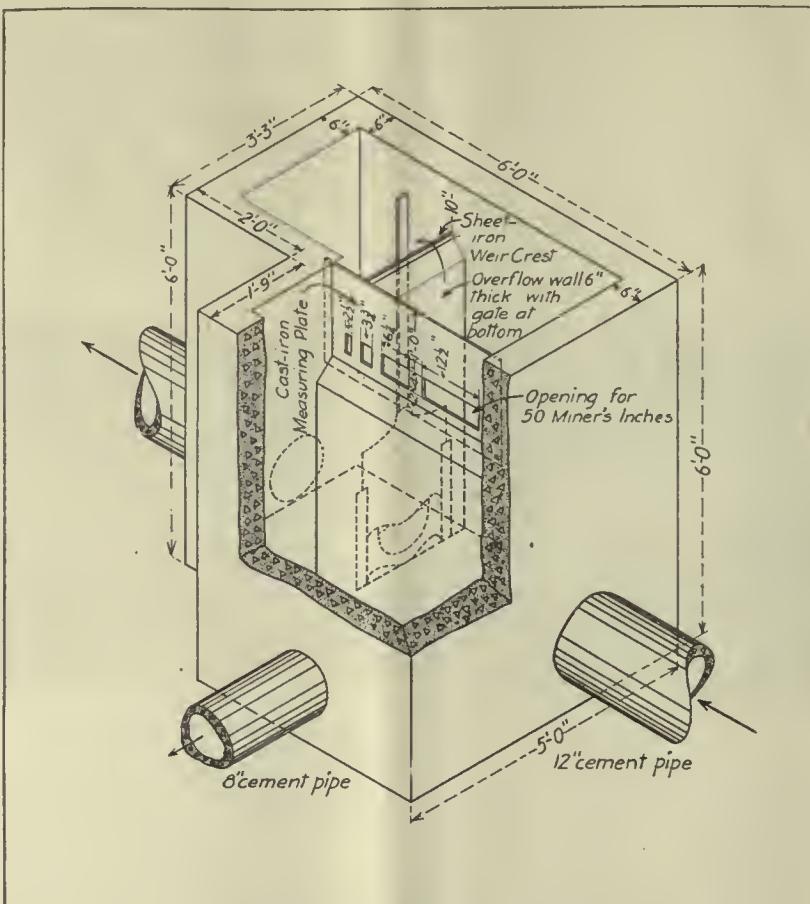


Fig. 3—Drawing of Azusa hydrant.

inches thick it is better to use some gravel when it can be obtained. A good mixture when using gravel is 1 part cement, 3 parts sand, and 4 parts gravel. The gravel should not be larger than $1\frac{1}{2}$ inches. The concrete for this box including forms will cost from \$18

*The installation of the measuring devices described in this series of articles has been carried out chiefly by S. H. Beckett and R. D. Robertson, irrigation engineers, assisted by Roy Wray. The tests of the devices have been made under the immediate direction of S. T. Harding, irrigation engineer, in charge of irrigation investigations in Montana, temporarily on duty in California, who has also prepared the reports of the tests. The weir tables have been prepared by Wells A. Hotchkiss. The drawings and diagrams have been prepared by Stephen C. Whipple, scientific assistant. F. L. Bixby, irrigation engineer, in charge of irrigation investigations in New Mexico, temporarily on duty in California, assisted in designing the general plan of installation. The full study has been

planned and, in general, supervised, and the data has been arranged for publication by Frank Adams, irrigation manager.

The installation of the Davis field laboratory and the testing of the devices have been jointly paid for from funds contributed by the state engineering department of California, the office of experiment stations of the United States department of agriculture, and the California agricultural experiment station. Co-operation with the state engineering department of California has been effected through agreement between that department and the office of experiment stations, the irrigation investigations at Davis having formerly been carried on by those two agencies without financial aid from the California agricultural experiment station.

to \$20 under a large contract and about \$30 if made singly. The plate with the openings and slides can be bought already made for \$12 from foundries in the vicinity of the places the hydrant is used. The gate can be any of the usual types of slide gate.

The average of all tests made of this hydrant showed the amounts in inches being carried through the openings to be 1 per cent more than their area in square inches. This difference includes all errors in the measurements so that these openings are seen to be very accurate. The tests showed all openings or combinations of openings to be equally accurate. The box will therefore measure as accurately as is required. The openings are not as closely adjustable to the amounts turned out, however, as they are in the case of the box of the Riverside Water Co.

The gage hydrant (Figs. 5 and 6) has been developed, and, so far as is known, is only used by the Gage Canal Company of Riverside, Calif. The main box is of mortar 2 inches thick and is made in the material yard and seasoned before setting. The concrete is made of 1 part cement and 3 parts coarse sand, mixed quite dry and thoroughly tamped. The bottom is cast separately and the top cemented to it in the field. The dimensions of the box are shown in the drawing. The weir crest consists of $\frac{1}{8}$ -inch by $1\frac{1}{2}$ -inch iron cemented to the sides, giving a final opening of 10 inches wide and $10\frac{1}{2}$ inches high. One man makes 2 boxes in a day. In making one box 2- $\frac{2}{7}$ sacks of cement are used. The company charges \$10 per box, with weir, not installed. The outlet chamber into which the water goes after passing over the weir is omitted from the drawing. In the hydrant installed at Davis a half section of 18-inch pipe



Fig. 4—Photograph of Azusa hydrant from above.

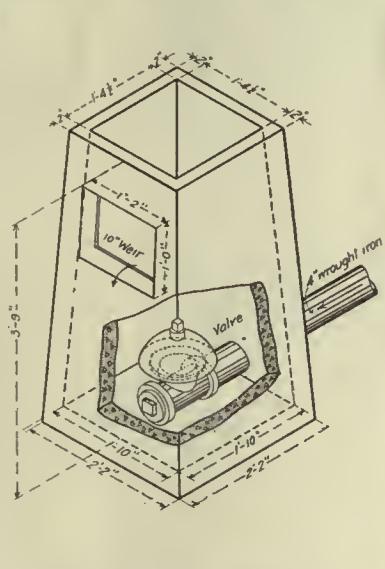


Fig. 5—Drawing of Gage hydrant.

is used for this purpose, as shown in the photograph. When the hydrant is not in use the valve shown in the drawing at the end of the pipe is kept closed. When in use the valve is opened to the desired extent and the water rises from the valve and flows over the weir. The mount flowing is determined by measuring the depth of the water in the box above the crest of the weir and either figuring the discharge or taking it from a table. The depth of water on the crest is usually obtained by measurement from a bracket set level with the crest at the back side of the box. After the water passes the weir it can be caught in various ways and carried to its point of use. Generally this is done by letting it fall to a pipe below and carrying it through pipe distributing systems or directly into a distributing flume.

In the tests with this hydrant it was found that the



Fig. 6—Photograph of Gage hydrant.

amount of water discharged for any given depth was greater with this box than it would be with a standard 10-inch weir. This is due to the nearness of the sides of the box to the sides of the weir and to the velocity conditions in the box. The amount of this difference increases as the head increases, being as much as 35 per cent at the higher heads. In practice the principal source of error in using this box will be the difficulty in meas-

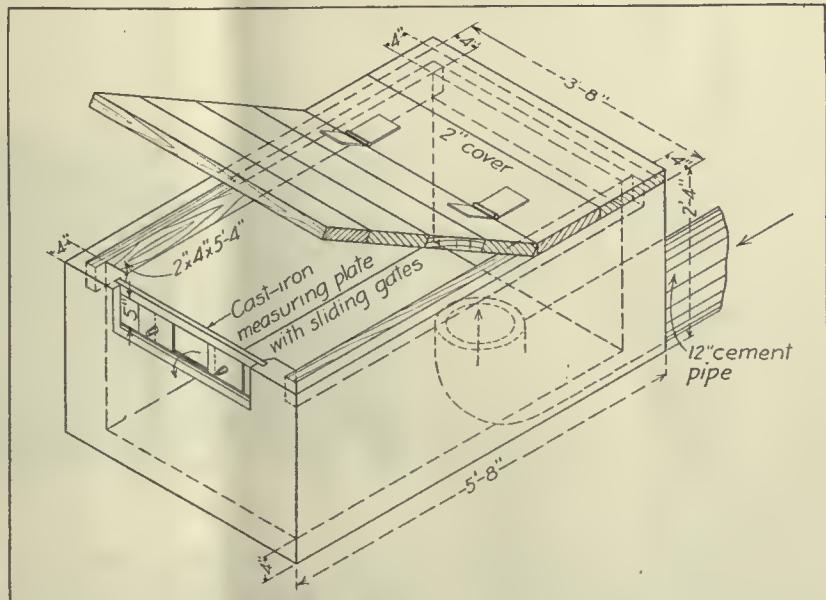


Fig. 7—Drawing of Riverside measuring box.

uring the depth over the weir closely. In the tests this was done with special gages enclosed in stilling cans, but even then it was difficult to get the depths

correctly. Measurements in open water with a rule would vary much more.

The Riverside box is shown in figures 7 and 8. It consists of a shallow box set over the end of the delivery pipe line. The water enters through the bottom of the box and is measured out through an adjustable cast-iron measuring plate in the end. The opening in this plate is 5 inches high and by moving the iron slide gates it can be varied in width up to 14 inches. With this gate, however, there is no provision for holding a constant head or pressure above the opening. The top of the plate is 4 inches above the center of the opening. Thus if the slides are set so as to hold the water surface at the top of this plate the discharge in inches will equal the area of the opening in square inches. The area of the opening is the width in inches multiplied by 5. Marks one inch apart are made on the plate to assist in measuring the width. The method of carrying the measured water away is not shown on the drawing but is shown in the photograph. The water is usually dropped into another pipe system to be distributed for use. Care should be taken so to place the outlet chamber that water passing through the gate will always have a free fall.

The Riverside box is made of concrete 4 inches thick and contains 18.4 cubic feet of concrete. The concrete can be made of 1 part cement, 3 parts sand, and 4 parts of gravel not larger than $1\frac{1}{2}$ inches in diameter. This will require 3 sacks of cement for the box. The box can be made with a cover as shown in the drawing. The plates containing the orifice can be purchased already made. The forms for making the concrete walls are simple as there are no curves and all sides are vertical. The cost of the plate is \$2.25, the concrete will cost from \$3.50 to \$5.00 for material, forms, and labor, and the cover will cost about \$1.50 more. These boxes are made and installed by the company for \$10.00.

In the tests of this device the average difference

between the number of inches actually received and the area in square inches of the opening was about 2 per cent. Some of these tests gave more and some less than the measured amounts. For all tests the area in square inches of the opening averaged 1 per cent greater than the inches actually received. The tests show that where care is used to adjust the width of the opening to the amount running this box will measure water very closely.

While the Riverside box is of the type used on underground pipe systems, the measuring plate used in it can be set in open ditches if desired. The box is sufficiently large so that the water passes through it without much agitation and can be brought to the top of the opening plate quite closely. There will generally be some leakage around the slides but these can be wedged tight if necessary. The box shown will measure amounts up to 75 inches.

The Foote inch box is shown in figures 9 and 10. It consists of a box having two principal parts, the larger part being merely a section of flume set in the main channel of the supply lateral and the smaller a spill and measuring chamber. On one side of this smaller portion there is a discharge opening in which a slide moves horizontally.

The other side of this side box or flume is a spillway. Gates are arranged as shown at the upper end so that water can be turned into this side box as desired. This is done by putting in as many flash boards across the supply lateral as are needed to crowd the water into the side box. The slide on the miner's inch opening is then set so that the water in this side box stands level with the crest of the spillway. The crest of this spillway is placed 4 inches above the center of the opening is 4 inches high. Thus when the water

stands level with the spillway the width of the opening of the slide multiplied by four gives the number of inches flowing.

This box does not require much fall in the supply lateral. The crest of the spillway should be set so

(Continued on page 223)



Fig. 8—Photograph of Riverside measuring box.

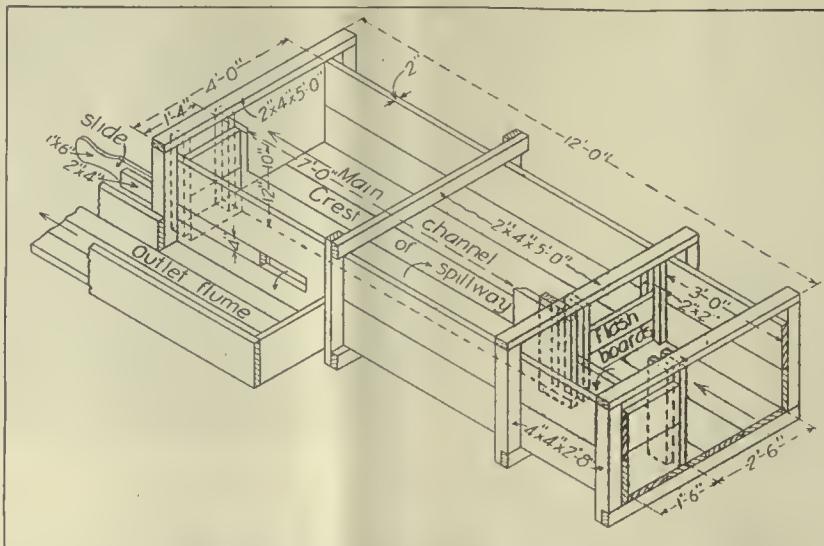


Fig. 9—Drawing of Foote inch box.



Fig. 10—Photograph of Foote inch box.

SHOOTING CEMENT LININGS INTO DITCHES

By CARL WEBER, C. E.
President Cement Gun Construction Co., Chicago
(Continued From Our April Issue.)

THE operation of the Cement-Gun is comparatively simple. The materials, cement and sand, are mixed dry until a uniform color of the material is obtained. This mixing is usually done by hand on a portable mixing platform. Turning the dry materials 2 to 3 times is, as a rule, sufficient. The material should be mixed as needed. No old material in which the cement may have partially set, or wet sand should be used.

The dry mixture is then put into the upper material hopper (see Fig. 2, page 186, April issue), the upper cone valve is closed and compressed air admitted into tank (B) by opening the air valve. Then the lower cone valve opens and the material drops into the compression chamber (C) and fills the pockets on the feedwheel (D) and the chamber above the same. After the lower cone valve is closed and the compressed air is discharged from the upper tank the machine is ready for another load.

The air from the compressor line enters the piping system of the gun at (A), all details of which are easily understood from the drawing.

The feedwheel (D) is slowly rotated by the air motor (H) and as it revolves small measured charges of the dry material are carried into the entrance of the material hose and by the same through the mixing nozzle where the necessary water is added for the hydration of the materials. A cross section of the rubber lined mixing nozzle is shown under Fig. 1, on page 185 (April issue), and the working of the same is easily understood. The water supply is carried through a separate one-half-inch hose line and its flow is regulated by the handwheel valve at the nozzle end. The water pressure must be at least from 15 to 25 pounds higher than the air pressure used to obtain best results.

The gun is also equipped with the necessary shut-off and by-pass valves, pressure gauge and is mounted on two wheels which allow its moving from place to place like a cart. The weight of a gun is about 1,100 pounds and the height of the charge opening is about 54 inches above the ground.

For the lining of irrigation ditches it is often very advantageous to place the gun in the ditch and provide gravity chute for filling.

The material hose is from 1 inch to 1½ inches inside diameter and may be of any length up to 300 feet or even more. Of course, it is good economy to keep the hose line as short as possible, and rather move the



Fig. 3—Shooting the cement into a wall. Note the two lines of hose.

gun than to use excessive length of hose. The hose is supplied in standard length of 50 feet with external couplings. The hose consists of a pure soft rubber tube with canvas backing. The same is subject to strong abrasion as the sharp sand is blown through it. The best soft rubber tubing will be found the cheapest in operation. It may be estimated that a good hose will last from two to three months of hard service. In emergency cases for straight sections steel pipes may be used in the hose line, where they will last for a short time, while in curved sections a steel pipe may last only from two to three hours.

In Fig. 3 a nozzle is shown in operation on the repair work for concrete retaining walls for the Pennsylvania Railroad lines. It will be clearly seen how the hydrated mixture leaves the nozzle and the two lines for the dry material and the water are plainly shown.

It is characteristic of the Cement-Gun, and of greatest importance for the quality of the work, that the material is delivered "dry" through the machine into the nozzle, and that the necessary water for hydration is added at the moment of deposit. The hydration of the material really takes place in the air between the nozzle and the place of deposit and any loss of the binding power of the cement in transit is absolutely avoided. The initial set of the cement takes place on the structure and not in the mortar box.

Another very important factor of the Cement-Gun process is that only the proper amount of water for perfect hydration can be added, because all superfluous water is expelled automatically by the force of impact of the material at its place of deposit.

If we consider that the air in the Cement-Gun does not act as a plunger in forcing the material through the delivery hose but carries the materials by suspension and skin friction, we can easily understand that only a dry material can be successfully conveyed by air pressure and that only a machine shooting dry material can be self-cleaning and free from clogging and excessive wear.

An air compressor delivering about 40 cubic feet of compressed air at 45 pounds pressure, which is equal to about 150 pounds free air per minute, is sufficient for the ordinary working capacity of the gun of say 1½ cubic yards of dry material per hour. A larger volume of air at higher pressure will greatly increase the capacity up to a maximum of about 3 cubic yards per hour.

(Continued on page 217)

A \$40,000,000 WHITE ELEPHANT

(Continued from page 202)

beginning, nor ever admitted up to this time in so many words, the acts of everybody at this time make the matter perfectly clear. The very way in which the aqueduct was built amounts to a practical demonstration that it was not intended as a municipal water supply. No discrimination as to the kind of water obtained was exercised, no attention given to reliability of service, through the type of construction adopted and the workmanship and material employed, and no provision was made for any material part of the water to be used for domestic purposes.

Not only was very flimsy and defective work done on many portions of the aqueduct, as shown by numerous visible defects and failures to date, but a tunnel was even bored crossing the San Andreas Fault at some considerable depth below the surface, so that a disturbance along the fault may, at any time, close up the aqueduct and make its repair a very long and difficult undertaking.

The other view expressed against the annexation is held by those who realize fully that the city of Los Angeles has been completely swindled by the aqueduct project. They argue that it is useless to throw good money after bad, and to attempt the realization of any profit from this source.

But the most weighty argument advanced is the future ill effect which the annexation of the San Fernando Valley will have on the city of Los Angeles. The lands to be annexed are so located and of such a character that they can never, in fact, become a part of the city. They are separated from the city by a high mountain range called the Santa Monica mountains. They are not in any way contiguous to any portion of the country which will ever be built up as part of the city of Los Angeles. The only connection by a reasonable grade with the city is through the narrows of the Los Angeles river. It is, therefore, clear that this tract can never in reality become a part of the city in any physical sense.

On the other hand this annexation is sure to lead to endless complications and difficulties which must inevitably arise by embracing, under the municipal plan,

the distant tract of land mentioned for the purpose of irrigating it and making it more valuable. In fact, it would look to anyone, whether living in Los Angeles or elsewhere, that it will make Los Angeles city more or less of a joke. Were it really contiguous to the city and so situated that it might, in time at least, be inhabited by an urban population, such a statement would, of course, not be true.

Again it is argued that the use of the aqueduct water on these lands can never make the project profitable. Most of the San Fernando Valley has to contend with a very poor climate, being extremely hot in the summer and very cold and windy in the winter. Very small portions of it are adapted to the growth of citrus fruits or other valuable horticultural crops, on account of the cold and unfavorable climate. Most of the lands are only adapted to deciduous fruits, sugar beets, alfalfa and general farming.

The very fact that it is proposed to sell the water for one cent per hour inch, equal to 538 gallons, demonstrates that this valley will not support profitably any agriculture under a high cost of water. In this connection it must be remembered that water for irrigation in southern California, in localities similarly situated to the San Fernando Valley, costs from two to four cents per hour inch, even when delivered and distributed by mutual water companies without profit.

Were it not for taking up an unreasonable amount of space, it could readily be shown by unanswerable figures that there is no profit possible to the city of Los Angeles from selling water at one cent for 538 gallons, particularly when the water is made available by means of mediums as costly as the Los Angeles aqueduct.

It is not the purpose of the writer to say what would be best for the people to do, whether to annex the San Fernando Valley or not to annex it. The purpose of this contribution is merely to give the facts and legitimate conclusions therefrom, which unfortunately show that the city of Los Angeles is in something of a predicament, and will not have the smoothest sailing whichever horn of the dilemma it chooses. Also to show that this annexation proposition is a complete confession of the charge that the aqueduct never was anything but an irrigation scheme to enhance real estate values.

CLOVER SEED IS NEW

IDAHO MONEY-MAKER

AHUNDRED dollars an acre from clover seed! Sounds pretty good, doesn't it? A good many of the farmers in the Twin Falls country are getting it. The average returns from clover are considerably above \$50 an acre, which also sounds pretty well, because any farmer can have that much. If it had been generally known, when the Twin Falls region was first opened for settlement, that the country was so well adapted to seed growing the farmers there would be millions of dollars ahead now. But they are expressing no regrets and are making excellent use of the new knowledge. Clover makes fine hay and the seed is of such superior quality that the markets cannot get enough of it. The market is world-wide.

Clover is not the only profitable crop in the Twin Falls county, however. They are raising big, fine potatoes, sugar beets for the factory at Burley, seed peas for a dozen of the big seed houses in the East; also onion seed, carrot and parsnip seed. The seed

business is more than likely to grow until it embraces both vegetable and flower seeds of many kinds.

Grain crops in this region compare with the largest yields of the world. The average wheat crop of more than 100 farmers was above 50 bushels to the acre, while some made records above 80 bushels per acre. Oats frequently go more than 100 and as high as 130 bushels per acre. Barley and rye are proportionately productive.

Another farm industry that is growing rapidly is dairying. Stock can be fed here with great economy. With 75,000 acres in alfalfa, yielding five to eight tons per acre each season, it is apparent that dairying and livestock growing are important factors in the development of the new country. Hundreds of thousands of sheep are brought in from the mountains in the fall and are fed on the surplus alfalfa hay during the winter.

Apples and other fruits are receiving attention in

every community. A total of more than 20,000 acres has been planted to fruit, principally apples. These orchards are fast coming into bearing and large warehouses are being erected in various towns for handling the crops.

It is now nine years since the beginning of irrigation in the Twin Falls region. Land that originally cost \$25 to \$40 an acre, with water right, has advanced in value to an average of \$100 an acre. Two hundred dollars an acre is predicted for all the farms under the several irrigation systems. Twenty acres situated one mile north of Twin Falls, with ordinary improvements sold for \$600 an acre in March last. Young orchards are selling at \$600 an acre. Land in alfalfa or clover sells at \$150 to \$160 an acre. Unimproved land may be had as low as \$50 an acre including the water right. At this price one must expect more or less waste land.

Three thousand acres 14 miles southwest of Twin Falls have been sold in the last few months to Nebraska people. Fifteen families, numbering over 70 people, arrived the second week in March to begin life under the new conditions of an irrigated country. A new settlement seven miles from Filer has been started under the name of Clover. It has a townsite of 40 acres. All the farms begin production with clover as the first crop. The 3,000 acres constitute a strip about a mile wide and seven miles long above the high-line canal of the Twin Falls south side project. A pumping station lifts the water from the high-line canal 40 feet to a new canal which serves the entire strip. This project was financed by Messrs. Smith & Green of Morrison, Ill., and the lands were sold by Harley J. Hooker of St. Louis. Mr. Hooker's sales have amounted to upwards of \$500,000 in the few months he has been at work on this enterprise.

SHOOTING CEMENT LININGS

Continued from page 215)

The working capacity of the Cement-Gun depends upon many different factors. The experience of the crew, the kind of work to be done, and the method and thickness of the coating must be taken into consideration. The distance of delivery and the height of elevation, however, are of minor importance. As stated before, the capacity of the Cement-Gun is up to 3 cubic yards per hour, but if a thin coating is applied it is, of course, impossible to utilize more than a fraction of the gun's capacity under actual working conditions.

The crew for the operation of a Cement-Gun usually consists of one foreman and six to seven men and best results can, of course, only be obtained when the operators are experienced. The foreman must be a good cement worker and a general all-around mechanic. He must be able to make such small forms, scaffolds, working platforms, etc., as may be required and must have an intimate knowledge of the operation of his gun, compressor motor, etc., so that breakdowns and delays are avoided. There also should be an experienced gun operator and at least two able nozzle men on each job. The success of the work greatly depends upon the skill of the nozzle man to apply an even and uniform coating with proper hydration. Gun-tender, mixers, wheelers, etc., may be ordinary laborers; however, intelligent men should be selected for all work.

Every day from one to a dozen emigrant cars are going into the Twin Falls country, carrying the household goods, live stock and farm equipment of families attracted by the favorable conditions to be found in this part of southern Idaho. In one day the latter part of March, some 35 families from Oklahoma arrived unannounced, unloaded their goods and put up their tents, preparatory to living under canvas until they could look about and establish themselves on farms.

It is characteristic of the settlers in the Twin Falls region that they are no sooner established than they begin writing to friends urging them to join them while the land is yet purchasable at reasonable figures. There has never been a boom in Twin Falls land. The area was so large in the beginning that there was enough for all comers. There still is enough and while the supply lasts there can be no artificial boosting of prices.

The city of Twin Falls celebrates its 10th anniversary with a population of upwards of 8,000. You feel that you are in a city of 25,000 or 30,000, so well built, well paved and well lighted is the business district. Kimberly, Hansen, Niles, Buhl, Hollister, Jerome and Wendell are other attractive places, all growing and all doing a thriving business.

One needs only to stand beside the tracks of the trans-continental railroads and note the cars of emigrant goods to realize that there is still a westward movement of population. It may slow down, but it never stops. The spring of 1915 saw it revived to its full intensity. Homesteaders are still taking up government land at the rate of a million acres a month. The picking is not as good as it used to be but the American pioneer has a stout heart and the desert as now understood does not appall him.

3 VARIETIES OF IRRIGATION

A unique irrigation proposition of some magnitude is being inaugurated in the Fremont Valley, Cal., by the Fremont Valley Land and Water Company.

This beautiful valley of southern California lying only 75 miles from Los Angeles, and consisting of about 50,000 acres has so been favored by nature that a large part of its area is being developed by pumping plants, which may be fed by a nearby oil field and refinery at a minimum cost.

Another part of the valley lies in proximity to a gravity system, which when completed by the company will amply provide water for its broad acreage.

Still farther towards the south end of the valley is a large acreage where the water lift is greater, and may be placed under development by the company through the agency of electric power, which is convenient.

The water development is being carried on under the direction of P. E. Fuller, consulting reclamation engineer, and other directors of the company are William Hicks, H. V. Wall and W. R. Little, all of 1001 Central building, Los Angeles, Cal.

Discing sod land before plowing will give a much finer seed bed for planting.

SETS DATES FOR CONGRESS

J. B. Case, president of the International Irrigation Congress, announces that the dates for the Congress have been fixed for September 13 to 20, at Sacramento, Fresno and San Francisco, Calif. The first two days of the session will be held at Sacramento, the third and fourth in the valley nearby and at Fresno, and the closing sessions at the exposition grounds. Special trains will carry the delegates from place to place.

ARE COMMON CARRIERS

The Nebraska State Railway Commission has jurisdiction over irrigation companies as common carriers, according to the decision handed down by the State Supreme court in the case of the McCook Irrigation and Water Power Company against Pauline Burtless and others. The case was an appeal by the defendants from an order by the commission, permitting the company to raise the maintenance rates from \$1 per year per acre to \$2 per year per acre. The water users had contended that it was unconstitutional for the commission to interfere with a previous private contract with the company at the lower rate. They also pleaded mismanagement on the part of the company and that the lower rate was reasonable. They lost on both grounds.

WATER FLOW IN IRRIGATION CHANNELS

Under the title "The Flow of Water in Irrigation Channels" (Bulletin 194), the United States Department of Agriculture has published the results of extended tests by its irrigation engineers to determine the retardation factor in Kutter's formula under the various conditions found in practice.

Inasmuch as Kutter's formula was derived from tests for the most part under other than irrigation conditions, before some of the now more commonly used materials of construction were generally available, the application of the formula to new conditions should give engineers new and important data.

The bulletin is a technical paper designed only for the use of engineers. It is believed that its 68 pages and tables and diagrams will be of value to engineers interested in designing and measuring irrigation, drainage, and power channels, and to courts and attorneys at law interested in cases involving the carrying capacities of open channels.

A SMALL AND EFFICIENT ENGINE

THE John Lauson Manufacturing Company of New Holstein, Wis., announces the addition of a $1\frac{1}{2}$ h. p. engine to the line, which will be known as the "Frost King Junior." The engine is especially designed for pumping, running cream separators, churns, grindstones, washing machines and other work requiring light power. In designing the Frost King Junior special attention was given by the designer to make each piece adaptable to jig work to facilitate quick production in large quantities.

The general specifications of this engine are as follows:

Ignition make and break, with Sumter built-in gear-driven magneto. No batteries for starting or running. Igniter fits cylinder on copper asbestos packing, and igniter equipped with standard National Gas Engine Association electrode, which can be purchased in any hardware store.

Cylinder head and base cast separate, with cylinder and piston ground to size, insuring perfect compression and long life.

Governor is of the two-ball type, very accurate and substantial, equipped with speed changing device.

Gasoline carburetor or mixer is of suction feed type, having a venturi nozzle.

Crank shaft is extra heavy, of drop-forged steel, ground to size, and connecting rod is also of drop-forged steel.

Main bearings are cut at an angle of forty-five degrees, giving additional strength, and are lined with the highest grade babbitt metal, adjustable to wear.

Flywheels are perfectly balanced, insuring a smooth-running engine.

The approximate shipping weight is 300 pounds.

Horsepower, $1\frac{1}{2}$. Speed, 475 revolutions per minute.

RECLAMATION SERVICE CONTRACTS

Under authority of the Secretary of the Interior, contracts for Portland cement for the Reclamation Service have been awarded as follows:

To Colorado Portland Cement Company, Denver, Colorado, 1,500 barrels at \$1.00 per barrel, for Grand and Uncompahgre projects, Colorado.

International Portland Cement Company of Spokane, Washington, 10,000 barrels at \$1.18 per barrel, for Okanogan and Yakima Storage projects, Washington; Umatilla project, Oregon.

Lehigh Portland Cement Company of Allentown, Pa., 6,000 barrels at \$1.00 per barrel, for Flathead project, Montana, and Sunnyside project, Washington.

Pacific Portland Cement Company of San Francisco, 1,300 barrels at \$1.40 per barrel, for Klamath and Orland projects, California.

Three Forks Portland Cement Company, Ogden, Utah, 11,000 barrels at \$1.20 per barrel, for projects in Montana.

Union Portland Cement Company, Ogden, Utah, 24,000 barrels at \$1.10 per barrel, for Boise and Minidoka projects, Idaho, and Strawberry Valley project, Utah.

The Secretary of the Interior has awarded a contract to the Pacific Tank and Pipe Company of Portland, Oregon, for furnishing for the Sunnyside irrigation district, Sunnyside Unit, Yakima project, Washington, 5,520 linear feet of 20-inch machine banded wood pipe, the contract price being \$2,633.04, f. o. b. contractor's shipping point.

BRIEF NOTES FROM IRRIGATION PROJECTS

Kansas

Members of the Kansas state board of irrigation have announced that they would sink a deep water well at Goodland, Sherman county, where the state will locate an irrigation demonstration station. It will probably be necessary to go more than 100 feet for water and the irrigation plant will cost \$3,000 to \$3,500. The new Goodland well is the fifth to be sunk by the state since the creation of the state commission. Irrigation plants have been established near Dighton, Leoti, Tribune and in Wallace county. It is probable that the Goodland well will be the last work of the present commission, which steps out of office on July 1 to give way to a state commissioner appointed by the governor.

An irrigation survey of Norton, Decatur, Thomas and Sherman counties, Kansas, is being made by H. B. Walker, state irrigation engineer in the agricultural college. Mr. Walker is visiting two farms each day, learning the irrigation conditions and furnishing definite irrigation projects.

The Syracuse Pump & Manufacturing Company, Syracuse, Kan., has been incorporated with a capital stock of \$30,000 by E. E. Helfrich, Samuel Yaggy and H. Helfrich, to manufac-

ture irrigation pumps. It has erected a demonstration plant and begun operations. Samuel Yaggy is in charge.

California

The Sacramento Valley Land & Water Company, with a capital stock of \$6,000,000, has filed its articles of incorporation at Fairfield, Solano county. The purpose of the corporation is to develop and carry out a vast irrigation system in Solano and Yolo counties.

The Southern Lassen Irrigation Association of Calneva, Cal., has been organized for the reclamation of a vast tract that will eventually comprise 300,000 acres of land, most of which is in a valley bordered on the east by the Nevada state line. Permanent organization of the association has been effected this week and Leonard Dozier chosen as president, with John Mauk, secretary.

Despite a letter of protest filed by Attorney W. C. Le Hane, threatening court procedure to secure invalidation and cancellation of the action, the board of directors of the Modesto irrigation district of California, has let the contract for the construction of the Raider and Slater fills on the main canal near La Grande to the

Tibbits-Pacific Company of San Francisco for \$71,155, the lowest of the six bids. Attorney Le Hane, supported by representatives of the Water Users' Association, appeared at the morning session and made formal protest to letting the contract for construction of these fills, with a capacity of 2,000 second feet instead of 1,200 second feet, as planned before the voting of the \$610,000 bond issue several months ago.

E. T. Earl has purchased for his ranch at Palmdale, Calif., a new 15-inch centrifugal turbine pump to be installed at a depth of 150 feet, and also a 15-inch pump of the same type to be installed at a depth of 50 feet.

The Santa Ana Valley Irrigation Company of California has just contracted for a 400-foot well, 26 inches in diameter, pump to have a capacity of 3,000 gallons of water per minute. The contract was let to the Layne & Bowler Corporation of Los Angeles.

The general land office has approved all plants of irrigation companies in the Imperial valley of California with the exception of the North Alamo and the Mount Signal Water Companies, approval of these companies having been deferred, and Impe-

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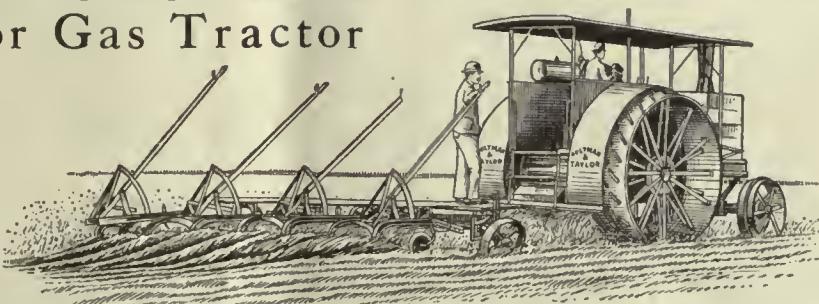
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(Built in 2 sizes—30-60; 25-50)

and then you can farm better, cheaper, and with more satisfaction. You can get your seed bed ready when the ground is in prime condition. You can sow when conditions are just right, and you can gather your crops when they should be gathered. All this, and lots more can be done quicker, cheaper and better than you can do it with horses. You'll be astonished at what can be accomplished with this great tractor. No other tractor can give you such wonderful results—such entire satisfaction, for the simple reason that the Aultman-Taylor Gas Tractor is particularly adapted to the power needs of the farm—built for this particular work at no spurd pains or expense. It's the tractor that makes good everywhere at all kinds of work. The Aultman-Taylor burns either gasoline or kerosene under all loads. Go see this great tractor work. There's

hauling, etc. In fact, it will save you money at every power job, large or small, on the farm, and the beauty of it all that it is, costs you nothing when not working.

Right now is the time to get rid of the greater part of four horses. Don't let them eat their heads off. Dispose of these expensive animals now. The proceeds of the sale of feed which you would otherwise have fed to these animals will make a good substantial payment on an



one in your neighborhood. We want you to see this tractor in operation. Seeing is believing. Its performance will convince you that it's the best tractor ever built, or if you cannot locate one in your immediate vicinity, write for catalog and other literature at once, and get all the facts about the Aultman-Taylor Gas Tractor.

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MANSFIELD, OHIO

BRANCHES:—Minneapolis, Minn.; Great Falls, Mont.; Portland, Ore.; Lincoln, Neb.; Kansas City, Mo.; Wichita, Kansas; Decatur, Ill.; Indianapolis, Ind.

rial North Side Water Company, on which adverse action was taken. This action will have the effect of immediately releasing desert land claims to a number of settlers in the Imperial valley, who have brought final proof up to the point of establishing satisfactory evidence of irrigation, and practically clears the title to their land.

John P. Ryan has announced preliminary plans for irrigating 25,000 acres in the foothills west of Willows, Calif., with water from Stony Creek. Ryan states plenty of water is available and there is good fruit and alfalfa land in the tract in question.

Iowa

Charles Callahan and John Marlin have installed an irrigation plant for truck gardening near Red Oaks, Ia. The equipment includes an eight-horsepower engine and three-inch centrifugal pump at the river, and a flume 1,515 feet long to the point where the water is allowed to flow on the garden. The flume is over 13 feet high at the pump, so the water has to be raised about 23 or 24 feet from the river before it gets to the waterway. When the water empties out of the flume at the garden it is directed to any desired place by means of ditches.

Muscatine, Ia., officials have asked the extension department of the Iowa state university to aid them in irrigation experiments in the Cedar river country near Muscatine. The peculiar nature of the soil is such that crops planted there are in danger of drought and it is believed that irrigation would convert land of low productivity into veritable garden spots. Soil tests are to be made shortly and it is believed that experiments will establish the advantages of irrigation to the extent that the plan will be adopted by the farmers of that locality. That watermelons and other truck crops could be grown on the sandy soil with profit if the ground was properly watered has long been realized.

Washington

The Western Farm Land Company of Chicago, of which George C. Borchart is secretary, has notified the Spokane chamber of commerce that it is preparing to develop a tract of 26,000 acres in the vicinity of Kennewick, Wash., on the Columbia by putting in irrigating wells.

The F. C. Crowe Irrigation Company, Spokane, Wash., has increased its capital stock from \$250,000 to \$1,000,000, the increase to be used in installing machinery for the manufacture of irrigation machinery.

Oregon

The farmers in that portion of Rogue River valley, Oregon, just west of Grants Pass have organized a cooperative irrigation corporation. Owners of approximately 1,000 acres of land have signed up, and nearly two miles of irrigation ditches have been built. The water is to be pumped

from the Rogue river by a centrifugal pump driven by an electric motor. It will be forced first to a knoll, and then piped across the valley to a high-line ditch, and from the ditch diverted on the land. The cost of installing the plant will be \$5 an acre. A 100-horsepower electric motor and a 12-inch centrifugal pump have been purchased and will be installed prior to June 1.

Nebraska

Efforts are under way to obtain state and federal aid for the installation of an experimental well at Ingleside, Neb. There is a federal appropriation of \$50,000 for experimental irrigation in western Nebraska, and so an effort will be made to obtain a part of this fund for the Ingleside project.

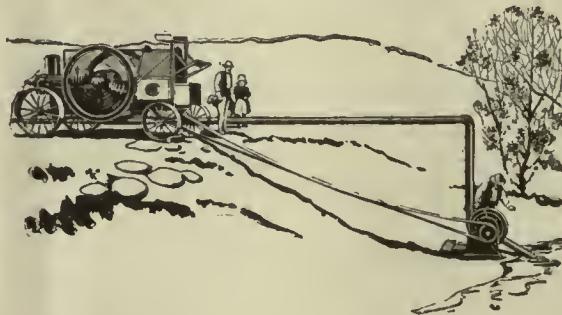
The irrigation and drainage division of the department of agriculture will make preparations for an investigation of the feasibility of elevating the water to the land from the sheet which is known to underlie the Lodge Pole valley of Nebraska, but a few feet below the surface.

Texas

The Texas Land & Development Company at Plainview, Texas, will put down 100 irrigation wells on as many farms in the shallow water belt this season.

The Texas board of water engineers has granted permits to several persons and corporations to appropriate water for irrigation purposes. Those granted permits are: William Biereschwale, Kimble county, to appropriate 70 acre-feet of water per year from the Llano river to irrigate 35 acres; Mrs. Ida F. Westervelt, Kimble county, 600 acre-feet of water per year from the Llano river to irrigate 300 acres; Austin & Northwestern Railway Company, to appropriate 100,000 gallons per day from the Colorado river for power purposes; to the same company to appropriate 100,000 gallons of water per day from the San Gabriel river for power purposes; Dr. E. W. Brown, Orange county, to appropriate 2,577 acre-feet of water per year from the Sabine river for the irrigation of 1,718 acres of land.

International Harvester Engines for Irrigating



WHEN you put in an irrigating plant of your own, the most important thing to get is an engine that will run your plant at any time you want water. Make the safest selection and buy an I H C oil and gas engine—Mogul or Titan.

An I H C outfit delivers the most power on the smallest fuel consumption. It uses the fuel that is cheapest or most convenient for you to buy. In case of accident you can get repairs in a few hours.

The same engine may be used for running a saw, cream separator, feed grinder, hay press, or any other machine to which power may be applied.

I H C engines are made in sizes from 1 to 50-horse power and in styles suitable for every form of irrigating outfit or for general farm work.

The I H C local dealer near you should be able to show you I H C engines. If he cannot, write us, and we will tell you who handles them.

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Montana

At the annual meeting of the Winnett Irrigation Company at Lewistown, Mont., recently, it was decided to go ahead and complete the project, so that the system will be available for irrigating next season. This will require an outlay of \$25,000. J. H. Akins was reelected president, with G. J. Wiedeman treasurer and E. H. Holmboe, secretary.

Wyoming

Early completion of the Lake De Smet project which will put at least 50,000 acres more land under irrigation in the Sheridan district of Wyoming has been assured by Verner Z. Reed, a Denver Capitalist, who is interested in the project and is also the

How to Make Farming Pay

Agriculture

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owner of several thousand acres of land south of Sheridan.

Nevada

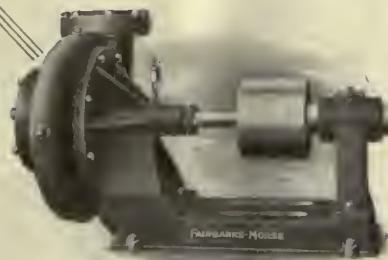
D. W. Cole, engineer in charge of the Truekee-Carson project and a corps of engineers are completing the preliminary investigation of the feasibility of putting in a dam at Mudd lake and Long valley dam sites in Nevada.

Dean J. G. Scrugham of the state university of Nevada, has arranged for the installation of a pumping plant at the state industrial home at Elko, Nev. The water will be used to irrigate the lands to put under cultivation, and as the surface water has been practically all taken up in this county, the experiments are being watched with much interest. Dean Scrugham declares that Nevada possesses nearly 18,000,000 acres of arable land, with a surface water supply capable of irrigating about 1,000,000 acres under the present system of distributing and handling.

South Dakota

Options have recently been obtained by T. S. Overpeck, of the firm of Cade & Overpeck Land & Abstract Company, acting as agent for the Redwater Irrigation Association on several hundred acres of land in the vicinity of Chicken creek, fifteen miles southwest of Belle Fourche, S. D. The plan of the association is to establish a large reservoir with a capacity of 8,400 acre-feet, on a flat in that part of the country, and to this reservoir the surplus water from Spearfish creek will be conveyed through a canal during the winter months, when the water from this stream is not used by the irrigators along the Spearfish valley. This water will be held in the reservoir until the irrigating season is on, when it will be turned into Chicken creek, passing down this stream to the Redwater and thus be conveyed to the ditches of the association and other ranchers who take water from Redwater.

You Insure Your House—You Insure Your Life



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Crops?**

The reliability of Fairbanks-Morse oil engines and centrifugal pumps in irrigation service makes them the safest of "crop insurance"—their efficiency makes them the most economical.

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Only \$2 DOWN and One Year To Pay

For any Size—Direct from Factory

You can now get one of these splendid money-making, labor-saving machines on a plan whereby it will earn its own cost and more before you pay. You won't feel the cost at all.

\$24 BUYS THE NEW BUTTERFLY

No. 2 Junior—a light running, easy cleaning, close skimming, durable, lifetime guaranteed separator. Skims 95 quarts per hour. We also make four other sizes up to our big 600 lb. capacity machine shown here—all sold at similar low prices and on our liberal terms of only \$2 down and a year to pay.

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You can have 30 days' FREE trial and see for yourself how easily one of these splendid machines will earn its own cost and more before you pay. Try it along side of any separator you wish. Keep it if pleased. If not you can return it at our expense and we will refund your \$2 deposit and pay the freight charges both ways. You won't be out one penny. You take no risk. Postal bring Free Catalog Folder and direct from factory offer. Buy from the manufacturers and save half. Write TODAY.

Albaugh-Dover Co., 2253 Marshall Blvd., Chicago, Ill.

No. 5
Over 20,000
now in use

Articles of incorporation have been filed for the Bennett County Irrigation & Water Company, at La Creek, S. D., with a capital of \$10,000. Incorporators: P. E. Skalinder, O. H. Gifford, George Ruff, R. H. Johnson, Mary Ruff.

Idaho

The water system and plant of the Hagerman Valley Water Users' Association, Gooding, Idaho, will be improved and additional machinery installed.

If the Black canyon irrigation district, located in the southwestern part of Idaho, can dispose of 15,000 horse-power electric energy to cities and towns in the section, the project to reclaim 150,000 acres of choice land can and will be financed. C. L. Tallmadge of New York has been meeting with the settlers on the project and has guaranteed to take over the enterprise and bring the capital into the state on the conditions named. The settlers have begun soliciting subscriptions for the power.

Utah

With a view to extending irrigation in the upper Sevier valley of Utah, a project is assuming shape in John's valley on the east fork of the Sevier, according to John H. Clark, civil engineer, of Panguitch, by which the old Tropic reservoir will be enlarged several times. The present dam, which is about five feet in height, is to be raised from 35 to 45 feet and will be 1,140 feet long. The new reservoir will be two miles long and three-quarters of a mile wide, with spill-

ways and gates set in tunnels in the native rock.

H. S. Kleinschmidt has completed surveys for an irrigation project that will furnish water to about 1,500 acres of land in Washington county, Utah. He reports that several other irrigation projects have been planned in the county and says that the southern part of Utah is showing great activity and progress in land improvement.

Colorado

Extensive improvements are being made on the Swink irrigation system in Otero county, Colo. A contract has been let to Mishou & Millard of Pueblo and men are now at work enlarging the capacity of reservoirs No. 2 and No. 5, which are just across the Pueblo county line, along the Apishapa creek. The contract calls for the excavation of 120,000 cubic yards of earth and placing it on the two dams. The contract price is \$16,000.

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"One-Half the Alfalfa Seed
Sown is Wasted Every Year"

This statement has been made by many recognized Alfalfa experts—men who know what they are talking about.

They say that they secured better stands of Alfalfa with 10 pounds of seed, drilled with the Superior Special Alfalfa and Grass Seed Drill than with 20 pounds of seed sown broadcast.



THE SUPERIOR 20 X 4 SPECIAL ALFALFA AND GRASS SEED DRILL

There are 20 discs on this machine set 4 inches apart. The construction is such that all the seed is sown at an even depth, and an equal amount of seed in every furrow.

None of the seed is wasted, when drilled in the ground with a Superior Alfalfa and Grass Seed Drill

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RENEWS OLD PASTURES AND MEADOWS

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**INCREASES YIELDS OF WINTER WHEAT BY
CULTIVATION and SOWS CLOVER AT SAME TIME**

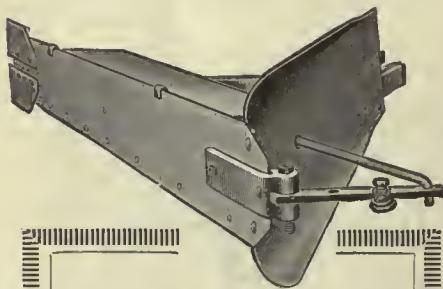
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No Wheels or Levers

Nothing to break or get out of fix. No. 4 machine shown above is all steel and weighs 300 lbs. Cuts a V-shaped ditch any depth up to 4 feet.

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Write for particulars of this one-man, one-team implement TODAY.

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Box 722, OWENSBORO, KY.

WATER MEASURING DEVICES

(Continued from page 214)

that the water in the main channel will be at least 3 to 4 inches below it. The water in the ditch above can then be checked up with the flashboards until the water in the side box comes level with its crest. The ditch into which the measured water is turned must be lower than the main channel by over one foot. The water in the outlet flume should not rise within about 3 inches of the bottom of the slide opening. If the water in the outlet flume does rise above the bottom of the slide opening, the conditions for measurement are changed and the discharge is smaller than with free fall.

In the tests of this device the amount of water supposed to have been passed, as measured by taking the area of the slide openings, averaged 4 per cent greater than was actually run. The error did not vary with the amount of the discharge. From these tests it appears that the slide can be set within an average 4 per cent of correct if care is used.

This box will measure water up to 150 inches satisfactorily under conditions to which it is adapted, although it is not in general an economical box to use. It requires as much fall from the supply lateral as a weir, besides some fall in the lateral itself. It also takes as much lumber as is required for a check and turnout in the supply later and a weir below. The weir will give more satisfactory measurements and has no slides to leak if too loose or to stick if too tight. The inch box was used a good deal in the earlier days

when water was measured mainly for mining but is built but little now for irrigation use. It has one advantage over a weir in that the amount being measured can be determined directly from the area of the slide opening, no tables or figuring being needed. With a weir, tables must be used giving the discharge for weirs of different lengths at different depths.

The next article in this series will be devoted to a discussion of Weirs.

Mr. J. W.
Lough, Scott,
Kan., writes:

"My 60 H.P.
Charter Type
"R" Oil Eng-
ine burns
about 100
gallons of oil
every 15 hrs.,
costing 2½
per gallon
laid down in
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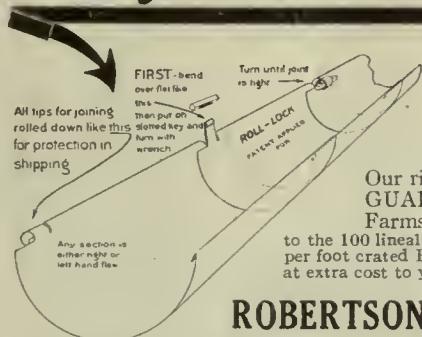
This flow of water is pumped by Mr. Lough's
60 H.P. Charter Oil Engine

Submit your irrigation problem and we will help figure it out for you.

Operates on Distillate, Kerosene and Gasoline, fuels that are obtainable at all times.

CHARTER GAS ENGINE CO.
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Every Farmer Needs This Galvanized Flume



With water-tight joints. Every Farmer who sees this Flume in operation will want it. We ship 10 foot lengths; you spend scarcely 10 seconds making water-tight, "ROLL-LOCK" joint.

NO SOLDER REQUIRED

Our rigid "ROLL-LOCK" flume in practice permits handling of 30-foot sections and we GUARANTEE our roll-lock to remain water-tight. For Apple Orchards and Small Truck Farms we recommend a flume 10 in. across top, (18 in. girth) 24 gauge, when pitched 3 in. to the 100 linear feet will discharge 220 gallons water per minute. 10", 24 gauge flume with cross bars. Price 8½¢ per foot crated F. O. B. Chicago. Weight per 100 linear feet 190 lbs. Portable steel adjustable supports furnished at extra cost to you. Will quote price on flume up to 36" in 16 gauge and lighter. *District Agents Wanted*

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"The Perfect Outdoor Bed"
For Porch, Lawn or Camp

The Enterprise Tent-Cot will protect you from all the discomforts and dangers of sleeping out. You sleep 17 inches and windows are fitted with both storm and mosquito curtains that can be raised and lowered at will of the occupant. For anyone afflicted with lung trouble there is nothing equals the Tent-Cot. It also has a splendid appearance and can be set up on your porch, lawn or roof and taken down when not in use. Can be set up in a space 30x78 inches and only requires about 30 seconds to operate. It is ideal for hunters, fishers and campers as it eliminates all the annoyance of "making camp." With a Tent-Cot you carry your camp with you under your arm and sleep safe and sound any place.

SPECIFICATIONS—Length of cot open, 6 ft. 6 in.; width of cot, one person, 28 in.; width of cot, two persons, 44 in.; height of bed from ground, 17 in.; height of tent over cot, 32 in.; size of cot folded, for 1 person, 28x36; size of cot folded, for 2 persons, 44x36; weight, 1 person, 29 lbs.; weight, 2 persons, 44 lbs.; frame is of hard maple, painted green; covering is of heavy waterproof canvas in colors, tan or olive green.

PRICE—Tent-Cot 28 in. wide, open 1 side, \$9.50; Tent-Cot 44 in. wide, open 2 sides, \$11.50.

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In the form of Corrugated Arches as well as in that of full circle pipe

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The illustration is that of a 10-gauge Armco Iron Corrugated Arch, with 10-foot base and 5-foot rise installed under the Ramona Mesa Grande Road in San Diego County, California. The arch is 30 feet long and its top is 17 feet above the stream bed.

The smooth road surface, so much appreciated by the drivers of modern vehicles, is maintained over the construction. This installation, being of the purest and most even of irons, constitutes a lasting improvement.

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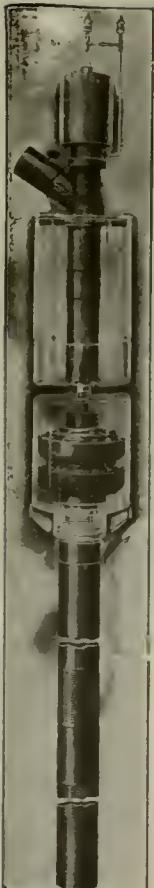
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An Arkansas Installation. Layne Patent Screen and Patent Enclosed Line Shaft Centrifugal Pump.

With the three thousand successful working plants using our system of irrigation, which inoculates and energizes the dormant forces, there is now being produced in previously non-productive districts throughout the United States and in portions of Europe and Asia over eleven million dollars worth of FOOD PRODUCTS ANNUALLY. That our system is not an experiment is forcibly demonstrated by the fact that much of this production is from localities which were arid and barren previous to the introduction of our system.

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The World's Largest Water Development Company

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LINING IRRIGATION DITCHES with Concrete by CEMENT-CUN Process.



Cement Gun linings for Irrigation ditches are vastly superior and more economical than any other form of lining.

The picture shows a section of a large irrigation ditch in Hawaii as it looks after completion.

For details of this work look at this space in the next issue.

For further information, estimates, etc., write to

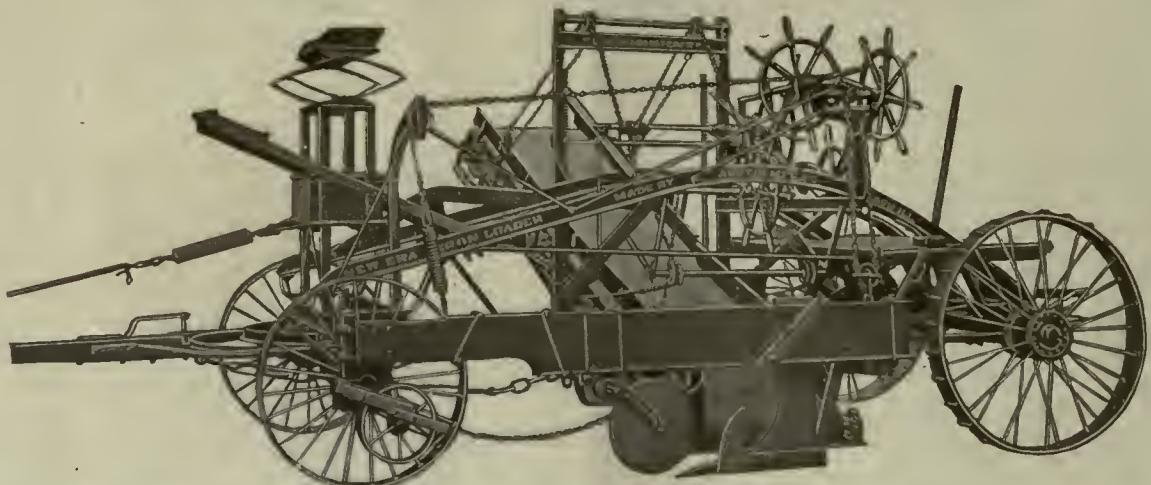
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THE FROST KING JUNIOR

Just what you have been looking for.

A High Grade Engine with a medium price.

Especially designed for pumping, running cream separator, churn, grindstone, washing machine, and a hundred other small jobs about the place.

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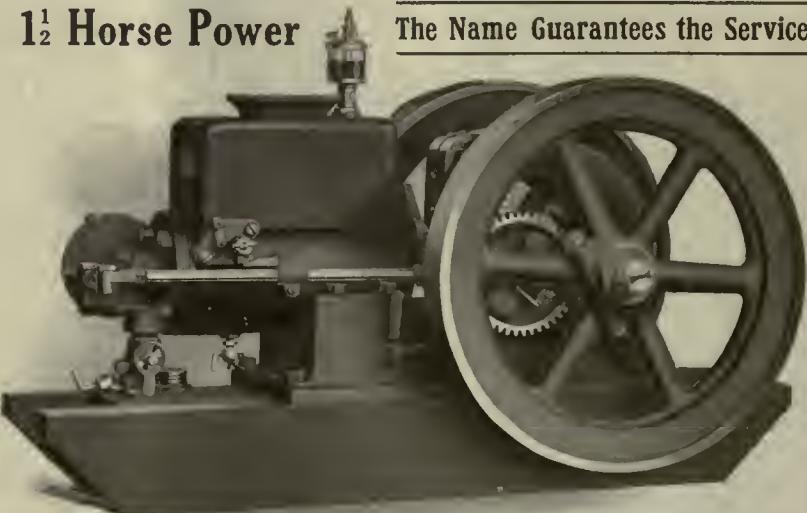
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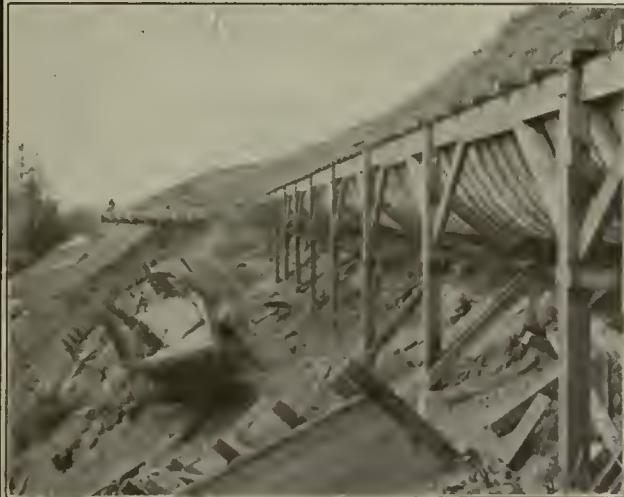


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When you get tired of fixing up the old wooden chute



Tear it out and install an

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and then be free to give your time and thought to other matters. This construction is Simple, Practical and Efficient. Long service is assured by the unequalled rust-resistance of Armco (American Ingot) Iron.



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When the PUMP cannot be direct connected to the turbine shaft, the power is usually transmitted by gears, shafting, etc. On account of the HIGH SPEED of the SAMSON, for a given power, lighter and consequently CHEAPER transmission machinery can be used.

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DESIGNED especially for IRRIGATION and pumping large quantities of water from deep wells.

Made in four sizes. Range of stroke, 5 to 24 inches. Size of cylinder can be varied to meet requirements of depth and diameter of well.

The frame is attached to the base of the pump so that it can be hinged back out of the way when the pump rods and valves are being removed.

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Every Man Interested in Irrigation Should Have This Book



Contains interesting information on Irrigation systems. Illustrates and describes the different types of pumps used for Irrigation and includes some typical installations to show how the various types are installed.

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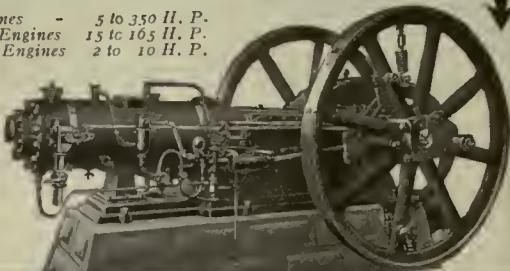
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BESSEMER Fuel Oil Engines are going into the factories of the big cities and small towns to reduce the power cost, the upkeep cost, the smoke nuisance, the risk of fire and explosion

Is going into the arid deserts to make those deserts into productive areas by means of irrigation, they are being hauled up lofty mountains to crush the ore containing precious metals. In all instances Bessemer Oil Engines are accomplishing the work better and more economical than it has ever before been accomplished. Bessemer Oil Engines are simple and economical, operate continuously on oils that are low in price and easy to secure. Close regulation makes them suited to the most exacting service. The price is most fair to you and quick deliveries can be made. Write us your requirements and ask for a catalogue.

THE BESSEMER GAS ENGINE CO.
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Gas Engines - 5 to 350 H. P.
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BESSEMER ENGINES RUNNING TODAY IN FIFTEEN THOUSAND POWER PLANTS

Why This Manure Spreader Fits an IRRIGATED FARM

IRRIGATED farms can get just as much more out of a load of manure as they do out of an acre of ground, when making comparison with the dry farm. BARNYARD manure and a Litchfield Spreader will increase the crop on any farm from 20 to 100%.

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The Litchfield manure spreader is specially adapted to irrigated territory because it is low down, and easily loaded, yet it will handle itself through the roughest kind of ground, in and out of ditches, and successfully operate wherever a team can go. Other Low Down spreaders will not do this, some of them are too low, some of them are not adapted to this kind of rough usage, and none of them are capable of standing up to the service and producing the results that the Litchfield machine is constantly doing in all parts of the world.

The readers of the "Irrigation Age" should become posted on this modern, yet oldest machine on the market. We are closer in touch with you than perhaps you realize. We have distributing points at Los Angeles, San Francisco, Portland,

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Thirtieth Year

THE IRRIGATION AGE

VOL. XXX

CHICAGO, JUNE, 1915.

No. 8

THE IRRIGATION AGE

With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARID AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

D. H. ANDERSON
PUBLISHER,

Published Monthly at 30 No. Dearborn Street,
CHICAGO

Entered as second-class matter October 3, 1897, at the Postoffice
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D. H. ANDERSON, Editor

ANNOUNCEMENT.

The "Primer of Hydraulics" is now ready; Price \$2.00.
If ordered in connection with subscription \$2.50.

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To United States Subscribers, Postage Paid,	\$1.00
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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Associations has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Interesting to Advertisers

It may interest advertisers to know that The Irrigation Age is the only publication in the world having an actual paid in advance circulation among individual irrigators and large irrigation corporations. It is read regularly by all interested in this subject and has readers in all parts of the world. The Irrigation Age is 30 years old and is the pioneer publication of its class in the world.

Our Flag Stands for Humanity

These quiet ships, lying in the river, have no suggestion of bluster about them—no intimation of aggression. They are commanded by men thoughtful of the duty of citizens as well as the duty of officers—men acquainted with the traditions of the great service to which they belong—men who know by touch with the people of the United States what sort of purposes they ought to entertain and what sort of discretion they ought to exercise in order to use those engines of force as engines to promote the interests of humanity.

For the interesting and inspiring thing about America is that she asks nothing for herself except what she has a right to ask for humanity itself.

We want no nation's property, we wish to question no nation's honor, we wish to stand selfishly in the way of no nation; we want nothing that we cannot get by our own legitimate enterprise and by the inspiration of our own example, and, standing for these things, it is not pretension on our part to say that we are privileged to stand for what every nation would stand for, and speaking for those things which all humanity must desire.

When I think of the flag which those ships carry, the only touch of color about them, the only thing that moves as if it had a settled spirit in it, in their solid structure, it seems to me that I see alternate strips of parchment upon which are written the right of liberty and justice and strips of blood spilled to vindicate those rights and then, in the corner, a prediction of the blue serene into which every nation may swim which stands for these great things.

And so with every man in arms who serves the nation, he stands and waits to do the things which the nation desires.

America sometimes seems, perhaps, to forget her program; or, rather, I will say, that sometimes those who represent her seem to forget her program. But the people never forget it. It is as startling as it is touching to see how whenever you touch a principle you touch the hearts of the people of the United States. They listen to your debates of policy, they determine which party they will prefer to power; they choose and prefer as ordinary men; but their real affection, their real force, their real, irresistible momentum is for the ideals which men embody.

Excerpts from President Wilson's address at the review of the North Atlantic fleet.

THE IRRIGATION AGE.

**New
Shake-up of
Reclamation
Service**

Denver, Colo. This will be the central office of the service.

The Reclamation Commission is cut to three members. I. D. O'Donnell will be retained as Supervisor of Irrigation, but will not serve on the Commission. Neither will Frederick H. Newell, who was recently deposed as director but retained as a consulting engineer. A. P. Davis is retained as director, but is divested of the title and duties of chief engineer.

All supervising engineers and some other high-priced help are to be dispensed with. The Reclamation Commission will continue to operate from Washington, but much of the office force will be sent to Denver. There will be other pruning and consolidations to further cut down the overhead charges.

It looks as if Secretary Lane is really trying to make a business organization out of the Reclamation Service.

Keep up the good work, Mr. Lane.

**Patriotism
Should
Begin
At Home**

Neighborhood patriotism is one of the best elements that can be injected into any farming community. Realizing this, the Department of Agriculture has worked out a plan, which it is prepared to supply to any farmer.

The scheme calls for ten committees, five of which are to deal with business needs, and five with social needs. Every member of the organization is to serve on some one of these committees. In addition, there is to be a central or executive committee composed of the President of the organization, its Secretary, its Treasurer, and the Chairmen of the ten other committees. This central body is to direct the general policy of the organization, raise all funds and control their expenditures. The committees that are to deal with the business interests of the community are as follows:

1. Committee on Farm Production.
2. Committee on Marketing.
3. Committee on Securing Farm Supplies.
4. Committee on Farm Finance and Accounting.
5. Committee on Communication and Transportation.

Similarly, the five committees that attend to the community's social interests will deal with:

1. Education.
2. Sanitation.
3. Recreation.
4. Beautification.
5. Household economics.

The work of most of these committees is indicated sufficiently clearly by their titles; for example, the committee on production can do much good by improving the breeds of livestock in a community through cooperative purchases of pure-bred males. It can encourage the formation of corn, poultry, pig, cattle, canning and gardening clubs, which have already demonstrated their value in the sections where they have been established; and it can carry on useful studies of the type of agriculture best fitted to local conditions.

In the same way, the committee on marketing can secure the standardization of the community's products and thus obtain better prices than are possible when nondescript goods are dumped upon the market. The committee can also search out the best markets, make contracts on a large scale which will be more favorable than any individual can secure for himself, and in many other ways economize in the selling of the community's goods. Even if cooperative marketing is not actually resorted to, the information which the committee collects can hardly fail to be of great assistance to the individual shippers.

With the committee on farm finance and accounting, the first duty is to ascertain what farm enterprises can safely be financed. This is only possible when accurate accounts are kept and carefully analyzed. After this has been done, the next step is to secure the most favorable terms for financing proper and sound enterprises. This is frequently not difficult if the committee has thoroughly mastered the subject and is able to put it clearly before local bankers. Where the local bankers are unwilling to finance genuinely productive enterprises at a reasonable rate of interest, the committee must consider other ways of securing capital. One of the simplest plans for accomplishing this is a credit union or cooperative credit association. The essential features of this plan are that a group of farmers organize themselves to receive deposits and make loans. By keeping the expenses down to a minimum, it has been possible in some cases for such associations to pay interest on deposits that is within one per cent of the interest it charges on loans.

Cooperation on the part of rural communities can do as much to alter these conditions as it can

to increase the average cash income. The committees that have these matters in charge should, therefore, be regarded as quite as important as those which deal with business questions, and they should receive the same support from the entire community which they are endeavoring to benefit. The result will be a community spirit which, in its way, is capable of producing as valuable results as the national spirit. In fact, patriotism, like charity, begins at home—that is, in the neighborhood.

**Protect
Your Home
Meat
Supply**

This is an age of prevention. Meat inspection is one of the greatest of all disease preventives. It is one which a great many farmers now ignore, so far as the supply of meats in their own home is concerned.

They are not only losing many dollars, but are spreading disease by ignoring the possibilities of good which meat inspection affords.

Recently there was received at the Department of Veterinary Medicine, Colorado Agricultural College, some meat samples from hogs which a farmer killed for home use. Upon examination of these samples, was found an immense number of tapeworm cysts (so-called miasles) which, if taken into the body, would cause tapeworms.

Another instance: Farmer killed seven hogs, keeping three for home use, using heads of same for head-cheese. The other four hogs were presented for inspection at the college, where upon examination, tuberculosis was found in all four heads. Upon knowing this, the head-cheese at home was immediately discarded.

These instances show the average condition of danger in rural life, from some of the farmers not taking available and proper precautions in having meat inspected.

When animals of any kind, including poultry, are killed on the farm for home consumption, if possible it would be well always to submit the carcass at the time of slaughter for inspection to a graduate veterinarian, in order that if there be any disease among live stock as tuberculosis, tapeworm cysts, etc., the farmer's family, also his live stock, could be protected in time so as to prevent the spread of disease, also from further pecuniary loss.

Want me to join a gold mining company?
Nope!, A good live potato association suits me better. Good potatoes are as good as gold.

The grunting of contented hogs in a pasture is better than the jingling of money in the pocket. The hogs keep growing, the money keeps going.

**Your Wood
Lot; Money,
Fuel,
Fertilizer**

Every farmer needs fuel; every farm needs fertilizer; and every farm woodlot needs improvement. Why not kill all three 'birds' with one stone? By judiciously planned thinnings the condition of the woodlot can be greatly improved; the material removed in the thinnings can be burned as firewood, and the wood ashes left are so rich in potash as to make a valuable fertilizer.

The woodlot is, perhaps, the only farm crop to which the farmer has not considered it necessary to devote any care. His grains are sowed on carefully prepared soil; his vegetables are cultivated, and his fruit trees are pruned and sprayed; his forest trees alone are left to look out for themselves. This is the more remarkable when it is taken into consideration that any labor expended on the woodlot not only improves the final crop, but ordinarily pays for itself as well. No detailed technical knowledge is required for the work, all that is necessary is the exercise of common sense.

It is obvious that the trees in any woodlot are not all of equal value. Some are taller, straighter, thriftier, and of species which yield more valuable wood than others. It is also obvious that there is a constant struggle going on between the trees for light and growing space. The object of thinning is simply to give the best trees the advantage in this struggle by removing the poorer ones which interfere with their development.

First of all, defective trees should be removed. This includes trees attacked by insects or fungi (conks), trees with fire-scarred butts, with tops broken off by wind or lightning, and in general all trees which are unthrifty from any cause. Next come the trees of poor form such as very crooked or very branchy ones, which are interfering with the growth of better formed neighbors. And finally are the trees of less valuable species, such as dogwood, ironwood, and hornbeam. These not only take up space that might better be occupied by such species as oak, hickory and ash, but also, as a rule, produce seed more abundantly and so reproduce themselves at the expense of more desirable trees.

While the wood removed in these thinnings is frequently of no value for other purposes, it can practically always be used to advantage for fuel. In this way the work can be made to pay for itself, particularly when the future use of the wood ashes for fertilizer is borne in mind. The essential point to remember in making such thinnings is that the woodlot is a tree society, in which the best trees should be given every chance to attain the greatest possible development by the removal and utilization of the unfit.

HOW YOU CAN BUILD YOUR OWN PIT SILO

By C. LARSEN

Dairy Husbandman of the South Dakota State College of Agriculture
and Mechanics Arts, Brookings, S. D.

THE pit or underground silo is useful in the semi-arid sections and on high locations. Where the ground is low, where irrigation is practiced and where the rainfall is great, seepage water will interfere with its usefulness.

The pit silo can be built with common home labor. The cost is very low. When once properly built a pit silo is long lived, it never rots, it never blows down, and the silage never freezes in it during the winter.

The pit silo can be filled with an ordinary feed cutter costing only about \$60. A 6 H. P. engine is large enough for running the cutter. Several neighbors may own such a cutting outfit and co-operate in filling their silos.

First determine the size of silo to build. This in turn depends on the number of cattle and the length of time they are to be fed. The following table gives some information on this point:

No. of Cows	Length of time	Tons of silage required	Approximate size of pit silo to build
For 6	9 months	32 tons	10 ft. x 23 ft. deep
For 8	9 months	43 tons	12 ft. x 22 ft. deep
For 10	9 months	54 tons	12 ft. x 26 ft. deep
For 12	9 months	65 tons	14 ft. x 24 ft. deep
For 14	9 months	76 tons	14 ft. x 26 ft. deep
For 16	9 months	86 tons	14 ft. x 29 ft. deep
For 18	9 months	97 tons	16 ft. x 26 ft. deep
For 20	9 months	108 tons	16 ft. x 28 ft. deep
For 22	9 months	118 tons	18 ft. x 25 ft. deep
For 25	9 months	135 tons	18 ft. x 28 ft. deep

First locate the silo on a suitable place. It should be handy for feeding. If convenient, locate on the south side of the barn or shed. Do not dig the pit too close to the barn. It should be at least 6 feet away.

Then locate and drive a peg in the center. With another stake having one end fastened to the center peg, mark out the circumference of the silo as illustrated.

Proceed to dig out a trench forming the circumference of the silo. Make this trench from $1\frac{1}{2}$ ft. to 3 ft. in depth. The concrete should rest on solid ground, and be about 14 inches wide at the bottom. At the top it need not be over 6 or 8 inches wide. This curbing should be straight on the side next to the silo, and slant in from the bottom on the outside.

The circumference of the curbing of a 12 ft. diameter silo will be about 38 ft. If the trench is 2 ft. in depth and averages 9 inches $\frac{3}{4}$ of a three-fourths of a

foot in thickness, then it will hold about 57 cu. ft. of concrete. For this concrete, about 2.1 yards or two good sized loads of clean gravel and about 11 sacks of cement, are needed.

The cement and gravel should be thoroughly mixed before any water is added.

Use clean gravel and make the concrete in the proportion of 5 of gravel to 1 of cement. Add enough water, and mix until the concrete has a suitable consistency, so it will pour. Do not add strong alkali water. It will weaken the concrete. It is better to have the concrete a little too wet than to have it too dry. If the ground or sides of the trench is very dry, then wet the dirt before the concrete is put in.

Fill the trench with this concrete. Extend the concrete curbing about 6 inches above the surface of the ground, so dirt can be graded around the silo and enable the surface water to drain away.

Put a few square headed bolts into the concrete to which the sill for the roof can be fastened. If properly put in, this concrete curbing may be used as a foundation for a silo to extend above ground, should additional silo room be needed.

This concrete should be reinforced with a few strands of barb-wire, about six rounds, each about six inches apart. This is not necessary, but it will strengthen the curbing.

When the concrete curbing has "set," then proceed to dig out the dirt. Dig down 6 ft. and plaster the side. Apply two coats, each about $\frac{1}{2}$ inch in thickness. If the plastering is done each 6 ft., then no scaffolding is necessary. With a long-handled shovel, a man can throw the dirt out to a depth of 12 ft. When this depth has been reached, it is necessary to have a plank platform on one side of the silo, about 10 feet from the surface of the ground, or to have a windlass or some other simple hoisting device for raising the dirt out of the pit.

A rough dirt wall will require more concrete than will a smooth one. For this reason, the man

who digs the pit should make an effort to have the wall straight and as smooth as is consistent with rapid work. An experienced digger, and in the average subsoil, will have no difficulty in digging such a wall without any other guide than the eye. Should it be found necessary, a straight pole may be placed perpendicularly in

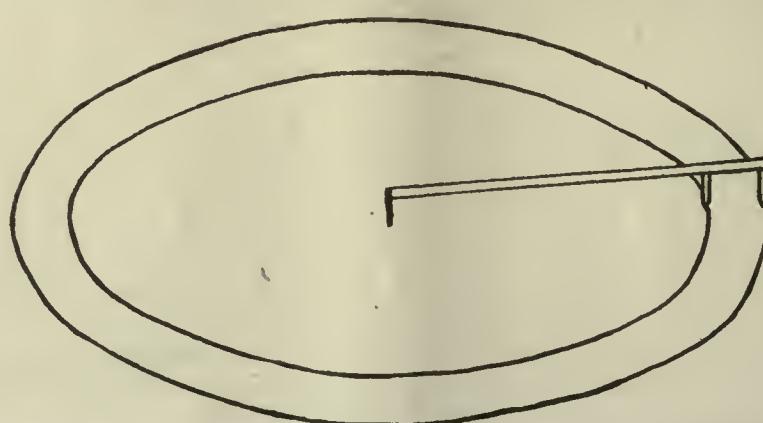


Fig. 1.—Marking the Circumference of a Pit Silo Before Digging Trench for Concrete Curbing.

the center of the pit. By means of a horizontal arm, having a hoe or spade fastened at one end, and the other end fastened to the center pole, in such a way as to swing around, the pit can be dug straight, and the sides can be made smooth. This method is to be especially recommended when a silo of large diameter is dug.

The mortar used for plastering should be made of 2 parts of clean sand and one part of cement, with enough soft water to make it of suitable consistency to adhere to the dirt wall.

If the silo is 26 ft. in depth and 12 ft. in diameter, then there will be about 1,000 square feet to plaster. If two coats of cement plaster are applied each about $\frac{1}{2}$ inch in thickness, then about 84 cubic feet of mortar are required. About 3 yards of clean sand and about 40 sacks of cement will be needed. If the wall is dry, wet it before the cement mortar is applied.

The total amounts of gravel, sand and cement needed for a silo 26 ft. in depth and 12 ft. in diameter are about as follows:

For curbing, 2.1 yards clean gravel (2 loads) and 11 sacks of cement.

For plastering, 3 yards clean sand (3 loads) and 40 sacks of cement.

This coat of plaster on the dirt wall may be put on considerably thinner. Each applied coat could be made as thin as $\frac{1}{4}$ inch in thickness. This would lessen the cost of the silo considerably, but it would also lessen the strength and durability.

If the subsoil is shaly, and crumbles when exposed to the weather, it may be difficult to make the plaster adhere by the ordinary method of plastering. In such a case the mortar may be thrown on, and then smoothed. In extreme cases fine-meshed woven wire, or the regular steel lath, may be fastened to the dirt by means of wire hooks driven into the side. Then no difficulty will be encountered in making the cement mortar adhere. This, however, will add to the cost of the silo.

The bottom of the silo may be covered with a two-inch layer of concrete. This, however, is not necessary. The silage may rest directly on the ground. A small amount of bottom silage may mold and spoil. From a practical standpoint, this amount of spoiled silage is so small, that it need not be considered.

If the labor necessary for digging the silo has to be hired, and a heavy coat of cement plaster is used, then a pit silo is about as expensive as an ordinary silo.

The pit silo should be covered in some way to prevent any one from falling into the pit, to prevent rain, snow and other foreign matter from entering, to protect the silage from freezing, and to protect the silage wall from being exposed to the elements. This latter is likely to cause caving.

The cheapest and simplest way of covering a pit silo, probably is to place a post on the side of the silo farthest from the barn. The post should be at least 8 feet above the ground. Nail a 2x6 plank (having straight grain) to the side even with the top of the post. The other end is fastened to the side of the shed or barn. This 2x6 placed edgeways above the center of the silo furnishes a good support for the top of the rafters, and also for fastening a device for hoisting the silage out of the silo. The lower end of the rafters can be fastened to the sill on top of the concrete curbing. This frame work may be covered with a composition roofing or with sheet galvanized iron, or with boards and shingles.

The rafters may also be placed so that all of the upper ends are fastened, and meet at a point directly above the center of the silo. The lower ends are nailed to the plate bolted on the top of the foundation. The roof in this case is similar to the roofs put on ordinary silos. More labor is perhaps required for building a roof of this kind.

Getting the silage out of a pit silo is not difficult. There are several ways by which this can be accomplished. The first 12 feet of silage can be thrown out with a pitchfork. If

the silo is small and only a few cows are being fed, then the silage can easily be carried out in a box or in sacks. If a considerable number of cows are fed silage, then some hoisting device should be installed.

A hoisting apparatus put in one of the state experimental silos works very well, and it is cheaply installed by home labor. It consists of a block and tackle with rope fastened to the top part of the covering directly above the center of the silo. The end of the hoisting rope is fastened to a home-made windlass on the side of the covering for the silo. A box of suitable size (2 ft. x 4 ft. x 3 ft.) having rope han-



Fig. 2.—Hoisting Dirt, While Digging a Pit Silo.

dles, is fastened to the hook of the tackle. This box, empty or full, is lowered and raised at will. Two planks are laid across the center of the silo just far enough apart to permit the box to go between when raising or lowering.

The box filled with silage is hoisted above the planks several feet. Then a truck is run directly under it. The box is lowered onto the truck, on which it can be wheeled to any place in the barn.

Another method consists simply of raising and lowering, by hand, the box by means of block and tackle, without the use of truck. This method is used in another one of the state experimental pit silos.

Still another method consists of fastening an ordinary hay track and hay lift to the 2x6 in the top part of the covering. The lift should be directly over the center of the silo. The track may be extended so as to carry the silage to any part of the barn. This method is more expensive, and is not necessary.

If it is impossible to secure about \$40 with which to purchase the necessary material for the above described silo, do not on this account refrain from digging a pit silo. Dig the hole in the ground anyhow, and fill it with some green feed. In many sections of South Dakota the subsoil is hard and in some instances shaly. Such ground will stand for years without caving. If the wall is not plas-

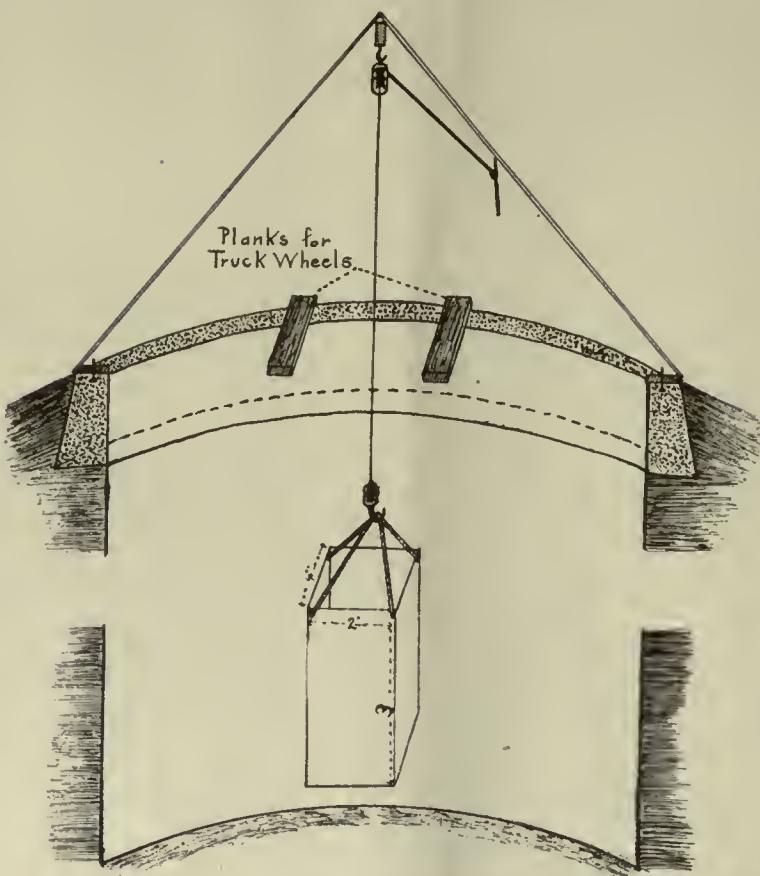


Fig. 3.—Hoisting Apparatus to Take Silage Out of Silo.

tered, a small amount of silage on the outside next to the dirt will mold, but compared to the amount of good feed obtained, this is of little consequence. If time permits, dig it now. If not now, then plan to remove the first few feet of dirt in the fall before frost, then dig at it a little all winter during spare time. The following spring the silo will be completed and ready to fill, either with spring, summer or fall crops.

There is but slight danger from poisonous gases in pit silos. The greatest danger is during filling. At this time the green silage ferments and forms carbonic acid gas. This gas is heavier than air, and therefore tends

to settle near the bottom of the pit. If the silo is left for any length of time, partially filled, the owner should take the precaution of lowering a lighted candle before entering, or to stir up the air by means of a limb of a tree, or with any other contrivance that will cause the air in the pit to move and mix. While the silo is full or nearly so, and after the silage has been in the silo about a month, there is very slight danger from poisonous gases in a pit silo.

In the four state experimental silos dug in different parts of the state no trouble has been encountered from this source.

1. Green feed of some kind such as kaffir corn, milo maize or ordinary corn can always be raised. These crops make

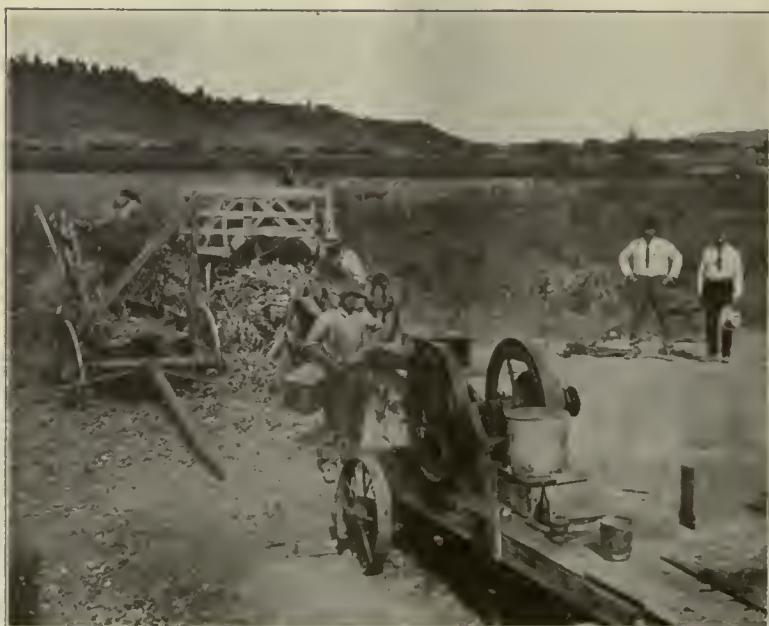


Fig. 4.—Filling One of the Experimental Silos in Western South Dakota. All the Cuts Used With This Article Are By Courtesy of the South Dakota Agricultural College.

the very best silage. Matured grain crops cannot always be relied on, while crops suitable for the silo can. If all crops should fail, then Russian thistles or other green weeds may be put into the silo. They will produce splendid feed.

2. Only little more than one-half of the nutrients of corn is in the ear. Why not obtain good use of the other half in the stalk by putting it into the silo?

3. Silage can be fed during the winter, during the summer or during the whole year. It can be kept over from a large crop season to a short crop season. With one or more silos it is not necessary to sell cows because of feed shortage.

4. Silage is healthful for cows and for young stock. Cows, freshening in the fall, and fed on silage and alfalfa hay, make a combination of farming for profit, and for sure and safe results, that is difficult to beat under South Dakota conditions.

5. The silo puts rough feeds into a form which cows and other live stock can handle most economically. South Dakota is distantly removed from central markets. To avoid expense of marketing our bulky field crops, the roughage must be concentrated into animal products.

When the corn begins to dry up, then cut with a corn binder. At this stage the lower part of the stalk and leaves and inner part of the husk have started to wilt, and about one-half of the kernels have dented. This is the best stage at which to cut corn for silage. It may, however, be cut at almost any stage, and splendid feed results.

In case of prolonged drouth, hail, early frost, or late spring, it may be necessary to cut the corn crop, and put it into the silo earlier. The most and the best silage, however, results from normally matured corn as described above.

Dry corn fodder may be converted into a splendid feed by cutting and putting it into the silo. Corn fodder in this condition should have water added, as it is packed into the silo. Care should be taken to have all of it wetted uniformly so that no dry pockets remain. If not uniformly moist, then there will be pockets of moldy and spoiled silage. Additional packing is also necessary. The dry cut corn fodder is lighter, and does not pack so well in the silo as does green corn fodder.

Do not tie the bundles of corn too large. The corn binder should be adjusted to tie small bundles. These handle easier, and they pass through the silage cutter without much separation.

These corn bundles may be hauled in a hay rack having the sides and ends removed. A truck wagon is handy. It obviates lifting the bundles too high.

If the cornfield is close to the silo, the following filling crew works economically:

- 4 teams and men for hauling corn fodder.
- 2 men in the field pitching bundles.
- 1 man to help unload at the silage cutter.
- 1 man distributing and packing silage in silo.
- 1 man to look after gasoline engine and feed cutter.

Such a crew can cut about 80 tons of silage in one day.

One or two days after the silo has been filled, the contents will have settled. If possible the filling machinery should be left in place a couple of days so that the silo can be refilled.

During the first week after filling, the owner should make it a point to go into the silo every day and thoroughly tramp the silage down. Otherwise the silage below will settle and leave the top part open or porous. This admits air into the surface silage, and causes it to spoil. It is a good plan to wet the surface silage a little every day when the tramping is being done. This will help to pack the top silage and exclude air.

In addition, cover the surface of the silage with a layer of building paper. This, if properly put on, helps to exclude air.

Another surface covering used is cut straw. Run a load of straw through the silage cutter the last thing. Distribute this straw on the top of the silage, wet it and tramp it down.

Never feed any large amount of spoiled silage. When the silo is opened the spoiled silage should be hauled to some place where the cattle cannot obtain access to it. Moldy and spoiled silage is likely to poison the cows.

Silage may be fed to all kinds of live stock, but it is pre-eminently a feed for dairy cows. In order to obtain the best possible results from a dairy cow, a succulent feed of some kind must be fed.

There are several kinds of succulent feeds suitable for cows. Green grass or pasture is probably the best. Soiling crops, such as green alfalfa, green oats and field peas, and green corn, etc., make good succulent feeds for dairy cows. These latter crops cannot be fed during the winter. They are especially suitable for supplementing shortage of pasture during late summer and fall. Considerable labor also is required in feeding these crops extensively. Roots of the various kinds are good succulent feeds for dairy cows, but are expensive to raise. Besides, very few farmers in South Dakota are prepared to keep roots and protect them from frost during winter.

Silage is cheap and healthful when properly fed, handy to feed any time during the year, and crops for silage can be grown anywhere in South Dakota.

An average cow weighing about 1,000 pounds will eat from 30 to 40 pounds per day. Silage alone should not be fed to dairy cows. Corn silage is a fat and heat producing food. It does not contain enough of the milk and muscle producing elements. Corn silage, alone, is not a balanced ration. Some hay, preferably alfalfa, should be fed in connection with it. In addition to the 30 pounds of silage an average cow will eat about 15 pounds of hay daily.

All of the common feeds may be classified into two groups:

First: The feeds rich in fat and heat producing substances (fats and carbohydrates).

Second: The feeds rich in milk and muscle producing substances (protein).

The chief common feeds rich in fat and carbohydrates are:

Concentrates: Corn, barley, rye, wheat, speltz, millet;

Roughages: Corn silage, corn fodder, prairie hay, timothy hay, and millet, cane, milo-maize, kaffir corn.

The chief common feeds rich in protein are:

(Continued on page 251)

The Federal Water Users



A Department Devoted to the Interests of the Farmers on the Government Irrigation Projects

EDITED BY GEORGE J. SCHARSCHUG

WOULD CUT PROJECT COST SIXTY PER CENT

GOD pity the water users on the Carlsbad project." These are the closing words of a statement by Prof. T. U. Taylor of Austin, Texas, Secretary of the Interior Lane's member of the Board of Review and Revaluation on the Carlsbad (N. M.) project. The statement was forwarded to Secretary Lane with the decision of the Carlsbad board, the first one of the project revaluation decisions to be announced.

The Carlsbad decision is a remarkable document.

It is a stinging indictment of the Reclamation Service.

It recommends that the construction charges be cut from \$55 per acre to \$34 per acre.

It further recommends that, if as the Reclamation law now provides, title to the dams and main works shall remain in the United States government, then the construction cost shall be \$20.71 per acre instead of \$55 per acre.

The tremendous difference in the charges of the Reclamation Service and what the majority of the board finds to be the proper cost is due, according to the decision, to incompetency, waste, extravagance and excessive overhead charges.

The findings, which are addressed to Secretary Lane, with the history of the project eliminated, follows:

Caption to Findings

Your board finds that under the law it is not just to charge as a proper cost the reservoirs and works necessary for their protection. If this is true it is just to add to this the waste and extravagance in the other portion of the project where no benefit was derived to the settlers, as an additional improper charge.

Should this be determined by the secretary not to be true this board finds that the waste and extravagance

in the headworks, reservoirs and works for their protection, together with the waste in construction and maintenance in other features of the project where no benefit was derived, should be added together and charged to profit and loss, or some other account which may be available as an unjust and improper charge and not to be returned by the water users of the Carlsbad project.

Therefore, we have separated our findings under separate headings producing different results as we see them, so that if the first is rejected, it will still leave the other to be the judgment and findings of this board of review.

Finding No. 1

The findings of fact based upon the findings and personal investigations of this board, charging of items of cost under the instructions of the secretary of the interior to this board, with special reference to waste, mismanagement, and excessive charges in expenditures giving items of cost which this board now finds are not proper charges against the Carlsbad project.

In reviewing the special items of cost, the members of this board have been surprised and somewhat chagrined and disappointed in arriving at a statement of "Quantities" and "Unit Costs." This information was necessary to ascertain the proper construction cost to be collected under the terms of the Reclamation Act, and in many cases has not been accessible. Your board has been furnished with not less than six estimates of cost furnished by the United States Reclamation Service and all appear to give quantities and unit costs and no two of these statements agree. Special attention is called to exhibits 2, 18, 29, 42, 50 and 51, which statements will certify these findings to you. We have examined and considered every item of quantity, unit cost and



Elwood Mead, who is on his way from Australia to serve as a member of Secretary of the Interior Lane's supreme court of review of costs and revaluation of the federal irrigation projects.

total cost as given on these exhibits, and each case of doubt has given the benefit to the "Service." Under Section 3 of your instructions we find the following relative to items of cost on the Carlsbad project:

1. AVALON DAM. We find that the books of the Reclamation Service show the excavation of class 1 material amounts to 94,239 cubic yards at 38.3 cents per cubic yard as shown in exhibit 29. In exhibit 42 this is shown as 84,710 cubic yards at a cost of 42.6 cents per cubic yard. Exhibits 18, 42 and 50 show, 50,183 cubic yards of excavation class 3. We find that this is an earthen dam with concrete core and that the use of 50,183 cubic yards of class 3 material is a grave engineering error and was unnecessary, unpardonable, and inexcusable. We find that 50,183 yards of No. 3 material was placed in this dam at a cost of 98.6 cents per cubic yard and that 56 cents per yard of this cost is an improper charge and that the total sum of \$28,100 should be eliminated and charged to profit and loss.

2. PUDDLING. Reference is made to exhibit 18 for 208 cubic yards of puddling at \$5.00 per cubic yard, amounting to \$1,041.50. While this is a small item, good puddling should be placed for \$1.00 per cubic yard. We find that the sum of \$4.00 per cubic yard is an improper charge and should be charged to profit and loss, amounting to \$832. This wrongful charge is due to absolute inefficiency.

3. OLD SPILLWAY. Reference is made to exhibit No. 29, which shows 320 cubic yards of concrete at \$18.02 per cubic yard costing \$5,767.53. This should have been placed for \$9.00 per cubic yard as a reasonable cost *at the most*. We find in this item of construction of the Avalon dam that the sum of \$9.02 per cubic yard is an improper charge and should be charged to profit and loss, and certainly not to the water user now or later.

4. SPILLGATES. The Reclamation Service installed thirty-nine double gates, which were installed over the protest of the water users. These gates were supposed to act somewhat automatically. On July 24,

1911, a flood came and the gates failed to act. The rain began falling at 6 o'clock p. m. on Sunday, July 23, 1911, but the Reclamation Service watchman stayed in his house until 3 o'clock a. m. the next morning, at which time the water was running over the top of the gates and it was impossible to open them so that they would remain open.

A glance at exhibit 25 will show the failure of these gates to work. The failure of these gates to work caused the water in the reservoir to destroy Spillway No. 2 and the Reclamation Service later installed the circular concrete cylinder weir at Spillway No. 2.

The failure of these so-called automatic gates and the failure of the watchman to act in time of emergency caused the destruction of Spillway No. 2 and it can not be charged to an act of Providence, but it must be charged to inefficient gates designed by the Service (protested against many times by the water users), and to a negligent watchman of the Service.

The present project manager testified before this board (see record, page 840) that the present circular spillway and circular steel gates cost about \$100,000. This board finds that \$91,000 of this charge is an improper charge and should be charged to profit and loss. The elaborate and costly design of the steel gates with their appurtenances are found to be unnecessary for the present project. Sensible gates installed in the old Spillway No. 1 would be sufficient.

5. McMILLAN DAM. Exhibit No. 29 shows 319.18 cubic yards of concrete costing \$20 per cubic yard, making a total of \$6,383.65. This board finds that this work should have been done for a total sum of \$3,383.65, and that the sum of \$3,000 is an improper charge and should be charged to profit and loss.

6. MAIN CANAL. Reference is made to exhibits 18 and 29, showing 575,000 cubic yards of excavation, class 1, at 12.4 cents per cubic yard of excavation, amounting to \$71,558.65, but the project manager later filed exhibit 42, giving the amount at 273,000 cubic yards. Exhibit 42 was filed about three weeks after



The Bessemer Gas Engine Company exhibit at the Panama-Pacific Exposition located in block 34, palace of machinery. Exhibit consists of a 165-H. P. Bessemer oil engine direct connected to 100-K. W. Jantz & Leist generator; a 25-H. P. open case Bessemer oil engine; a 20-H. P. Bessemer oil engine direct geared to high duty pump and an 80-H. P. Bessemer oil engine connected by rope drive to a centrifugal pump pumping over 4,000 gallons of water every minute, the water falling from a height of 35 feet into the 12,000-gallon Redwood tank in the middle background and forming a water cascade of no mean proportions. When you go to San Francisco do not miss the Bessemer exhibit.

the engineer employed by the water users had discovered the inaccuracy of this statement. Your board finds that new unit costs shown in exhibit 42 at 26 cents per cubic yard was obtained by simply dividing the new quantity into the old expenditure. (Many other items of unit costs, where reference is made to the six exhibits filed by the service simply show a juggling of quantities and unit costs.) Your board finds that the original costs per unit on this work was sufficient and reasonable and that the sum of \$32,000 in this item is an improper charge and should be charged to profit and loss. Your board furnished finds that over half of this west embankment on main canal was unnecessary for the acreage under the present project.

7. MAIN CANAL. Reference to said exhibits show 44,311 cubic yards of excavation, class 3, at a cost of \$2.03 per cubic yard. This was not difficult work and was easily accessible, and should have been done for \$1.00 per cubic yard. Your board finds that the sum of \$4,563.93 is an improper charge and should be charged to profit and loss.

8. DARK CANYON SYPHON. Reference to exhibit 29 filed by the Service shows excavation and back-filling of 19,083 cubic yards and unit cost of 57 cents per cubic yard, making a total cost of \$10,887.76. The project manager has testified that the excavation was 14 feet deep, 12 wide at the bottom, with slopes of 1½ to 1. Exhibit 37 shows this feature. The length of the excavation is 400 feet. Your board finds that the first excavation could have been done for 40 cents per cubic yard by any efficient and experienced contractor and that back-filling should have been done for 15 cents per cubic yard, as it was loose. Your board finds that the yardage actually excavated was less than 8,000 cubic yards, according to the dimensions furnished by the project manager. Your board finds further that a reasonable cost and a proper charge for removing this yardage should be 55 cents for excavating and back-filling both, making a total cost of \$4,400. Your board finds that further the sum of \$7,487.76 is an improper charge and should be charged to profit and loss.

9. This board finds that by segregating the engineering and overhead charges as best we can from other charges into which such engineering and other charges have been merged by the Service that a total of \$132,904 have been spent by the Service for engineering and overhead charges. According to the statements of local officials of the Carlsbad project, the total cost of the project is \$933,840.96. The old Pecos Irrigation Company cost \$150,000 and the engineering and overhead charges amounted to \$132,904, making a total for these two items of \$282,904. Subtracting this from the total cost of \$933,840.96 leaves \$650,840.96, as construction cost. Your board finds that this is over twenty per cent (20) of the money that was actually spent on construction.

Your board finds that this is very excessive (see record, page 241, and exhibit 34, page 787) and that ten per cent (10) would have been a liberal allowance for such services. If you consider the fact that the old P. I. Company had the canals and many laterals already located, ten per cent is a rather high allowance. Your board finds that \$68,000 of this engineering charge is an improper charge and should be charged to profit and loss.

10. The board finds in the case of maintenance

and operation that charges have been handled by the Reclamation Service by transferring items from operation and maintenance, etc., that it is difficult to segregate operation and maintenance from construction charges vice versa. The result of this is that your board can only submit the record for review.

This board finds that \$1.00 per acre for 3 acre feet on this project is ample to operate and maintain the system with its present acreage of 24,796, provided competent and experienced managers or administrators are employed and economy and efficiency obtain.

11. Your board finds that 2,240 bags of cement were transferred from this project to the Hondo project and that the cost of these including freight, amounted to \$1,391.62 (see exhibit 34, page 751, also record, page 193). At present your board has not arrived at a satisfactory explanation and advise that it be looked into.

12. Your board finds that during construction, 20,865 cement bags were not returned in serviceable condition. This cost the project \$2,986. Giving the project the benefit of all doubt, your board finds that \$1,043, half of this amount, should be charged to profit and loss. This was due to negligence, in our judgment (see exhibit 34, page 756, record, page 201).

Recapitulation of Finding No. 1

Total cost of project, as shown by project books, exhibit 50.....	\$933,840.96
<i>Improper costs eliminated—</i>	
Excavation, Avalon Dam.....	\$ 28,100.00
Puddling	832.00
Old Spillway	2,886.40
Spillgates	91,000.00
McMillan Dam	3,000.00
Main Canal	32,000.00
Main Canal	4,563.93
Dark Canyon Syphon.....	7,487.76
Engineering and overhead.....	68,000.00
Cement to Hondo.....	1,391.62
Cement Bags	2,086.00

Total amount eliminated and charged to profit and loss.....\$241,347.71

We find the proper building charge should be

.....\$692,493.25

This finding is based upon area of 20,273 acres, excluding the new unit and after charging off items above mentioned, which were eliminated by this board for reasons heretofore set forth, that produces a net cost per acre which is found proper by this board amounting to \$34.

Evidence and exhibits show that a new unit has been added amounting to 4,523, known as unit No. 2, and the farmers and settlers agreed to and understood that this unit should be brought into the project at \$5.00 per acre in excess of the proper cost of the first unit. We, therefore, find that this unit of 4,523 acres should pay \$39 as a proper cost per acre and that the accruals therefrom should be credited to the entire project for the purpose of completing laterals, cement lining and drainage provided for in report signed by D. W. Murphy, Scott Etter, W. B. Wilson and L. E. Foster, which is marked as an exhibit.

This board finds that the total area of this project as now constituted is 24,796 acres and while the orig-

inal estimate was for 40,000 acres, we have not been furnished with data sufficient to make a finding for this acreage, although surveys and estimates have been requested from the Service, which are in their hands, but have been refused by the director, A. P. Davis.

Finding No. 2

The following is a report of the finding of this board under the law making application of fact in connection with the law and as your board sees it in pursuance to your instructions:

1. THE LAW. Section 4 of the Reclamation Act of June 17, 1902, states: "The said charges shall be expended with the view of return to the Reclamation Fund of the *Estimated Cost* of construction of the Project." The estimated cost as shown by exhibit 13 and signed by G. Y. Wisner, Consulting Engineer; W. H. Sanders, Consulting Engineer, and W. M. Reed, District Manager, was \$620,000, based upon an area of 20,000 acres. However, the same report which fixed this estimate of the first unit area stated the final area of this project should be 40,000 acres. Water was first placed upon the 20,000 acres and since that date the area of 4,796 has been added as a second unit as per public notice dated March 2, 1915. We find that the construction charge under the law should be the estimated cost upon the present area of 24,796 acres at \$31 per acre, or a total construction charge of \$768,676 in any event.

The water users who are expected to repay this fund, reposed good faith in the Board of Reclamation Engineers and through them expected to get a square deal from the United States government.

They accepted their report of estimated cost, and signed their contract upon this project in good faith, mortgaged their lands to pay back the estimated cost to the United States government and your board finds that in all fair dealings the United States government should respect its own contract, which was obtained through these representations to the farmer.

2. Section 6 of the Reclamation Act provided that the title of and the management and operation of the reservoirs and headworks necessary for their protection and operation shall remain in the government until otherwise provided for by Congress. In all common sense the farmer water user cannot be expected in law and equity or square dealing to pay for anything before at least receiving a promise of title or possession and in this Congress has not even promised to deliver title or possession to the reservoirs and headworks and works necessary for their protection and operation. According to the statement of the Reclamation Service through its Carlsbad office the cost of the Avalon and McMillan Dams, together with works necessary for their protection and operation, is \$401,990. Your board finds under the law and the representations made to the farmers, in view of the fact that the government retains title and possession under the law, that the sum of \$401,990 is an improper charge against the Carlsbad project, being the total cost of these headworks and that this sum should not be collected from the water users.

The United States government should not exact more than is nominated in the bond and it certainly should not demand more than its pound of flesh, to which it is justly and legally entitled.

Recapitulation of Finding No. 2

Total cost of project as shown by project books, exhibit 50.	\$933,840.96
Improper costs eliminated on account of title not being delivered to water users	401,990.00
Main Canal	32,000.00
Main Canal	4,563.93
Dark Canyon Syphon	7,467.76
Engineering and overhead	68,000.00

Total amount eliminated because of title and amounts charged off to profit and loss outside of the headworks and works necessary for their protection.	\$514,041.69
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We find the total proper building cost under this method to be	\$419,799.27
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We find the proper building cost per acre under this finding to be	\$ 20.71
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This finding is based upon the area of 20,273 acres excluding the new unit and the balance of our remarks in finding No. 1 applies to this.

(Signed) T. U. TAYLOR,
(Signed) SCOTT ETTER.

I dissent.

(Signed) D. W. MURPHY.
Minority report will be submitted.

Comments by T. U. Taylor, member Board of Review, Carlsbad Project:

Let the record of findings show: That T. U. Taylor, third member of the Board of Cost Review on the Carlsbad Project, asserts his right under Section 8 of the instructions from Secretary of the Interior to make individual comment relative to the character and amount of the charges on this project in his additional statement, which is in addition to the itemized findings of the board.

1. It is true that the Reclamation Act limited the hours of labor to be performed upon the construction of the projects to eight hours per day, but the facilities of the Reclamation Service for obtaining much cheaper supplies, such as cement and other materials, and its low freight rates would largely tend to balance this handicap of eight hour labor.

2. It is believed, and it is my best judgment, that had the Reclamation Service adopted the usual classification of material, such as obtained generally in the west, it could have let contracts that would have saved at least $33\frac{1}{3}$ per cent of the Carlsbad project as a whole. The definition of class 3 material was stipulated as such material as could be plowed by a six mule or horse team, each mule or horse weighing 1,400 pounds. This within itself was sufficient to announce to this section of the country: "No hope of a contract ye who enter here."

Recently I collected from several Texas cities statements on this question, and I here submit the results, and in order to head off demands for "exhibits," I shoulder the responsibility for the correctness of the same:

(Continued on page 249)

MINIDOKA PROJECT SAYS STICK TO CONTRACTS

WATER Users on the Minidoka project kicked off the lid of Reclamation Service affairs when the revaluation board met in Rupert, Idaho. The settlers held a meeting at which the following resolution was adopted:

"That we protest against the payment of one cent more than we agreed to pay when we filed on this land, and that we take the matter up with the Commission of Review."

A committee, consisting of F. R. Randolph, W. J. Smith and P. O'Rourke, was named to make a presentation of the settlers' case before the Board of Review. This committee formulated the following statement, which was presented to the Commission:

Gentlemen: We, the committee selected by a number of our fellow settlers, present to you for your consideration the following facts: After the opening of the Project for settlement, we filed on the land in accordance with the provisions of the Reclamation Act, an act passed by Congress June 17, 1902. According to the said Reclamation Act, the charge to the settlers was to be based on the estimated cost, including the building of the dam, all canals, laterals and sub-laterals, said canals and laterals to be maintained by the government for ten years or until such time as the payments required by the act were made for the major portion of the land irrigated. Then the management and operation of said irrigation works were to pass to the settlers, to be maintained at their expense.

In 1904 Mr. Hitchcock, who was then Secretary of the Interior, published a notice in the local papers, and also in pamphlet form, in which he stated that the cost to the settlers for the construction and maintenance of all canals and laterals would be \$26.00 per acre, to be paid in ten annual installments.

After the contractors were supposed to have finished the canals, the Reclamation Service commenced work on the laterals and sub-laterals in the Autumn of 1906, and continued for a short time, when we were informed that the bottom had fallen out of the receptacle which contained the Reclamation fund, and that the work of building laterals should cease; that the Secretary of the Interior had made a ruling to that effect; and we have had



Watermelons raised with irrigation on the Tagtmeyer farm at Goodland, Kans.

rulings from Ballinger and Fisher with every change of the moon during their respective term in office. Some of their rulings have completely usurped the power of the law-making body of the nation.

A ruling by one of these precious worthies charging all those settlers \$30.00 per acre who filed between 1909 and 1911 is illegal, because Congress did not give him authority to either increase or decrease the price of any water right on this or any other project, until the passing of the act of February, 1911.

Such illegal acts on the part of a Secretary of the Interior should be treated with contempt by all men who believe in a democratic form of government and are opposed to despotism. It is certainly a nice state of affairs when a subordinate official can issue a royal edict which completely supersedes the law passed in the interest of the people by their elected representatives. In one of these rulings we were told that we would have to build the laterals to our farms if we want to get water, although the Reclamation Service should build and maintain all canals and laterals, according to their contract with us.

One of the reasons they have given for the breaking of their contract with us was that labor and material cost more than they estimated. Suppose that labor and material did cost more than they estimated, what did we have to do with that? Must we pay for the mistakes of the gentleman of the Reclamation Service?

Some of the contractors became bankrupt because their estimates were too low. Did the Reclamation Service make good the loss sustained by the contractors because of too low an estimate? No, they told them they were very unfortunate.

But the gentlemen of the Reclamation Service were not quite so unfortunate. They were able to make good the loss caused by their own stupidity by making us pay an ever-increasing maintenance charge, although the Reclamation law does not pro-

vide for any such charge; but law or no law, the Reclamation gentlemen very adroitly laid the foundation for a maintenance charge in 1906. In the winter of 1905-6, a man named Ross, who was Project Engineer at the time, addressed meetings at Acequia, Rupert and Heyburn and told the settlers of the benefits that would accrue to the project if they would consent to have a maintenance charge as well as a building charge; that instead of paying \$26.00, or \$2.60 per acre for ten years, how much nicer it would be to have a building charge of \$22.00, or \$2.20 per acre each year for ten years, together with a maintenance fee of 40 cents for a year or two, because, as the banks of the canals became thoroughly settled, the whole works could be maintained for fifteen or twenty cents an acre; and what was still better, he looked forward to the day when the proceeds from the electricity generated at the dam would more than pay for the maintenance of the project.

And at the time that Ross was singing his siren song, for the purpose of sirenizing the settlers, and finally getting them into the trap that he and his superiors were preparing for them, he knew that the Reclamation fund was depleted to the amount of \$100,000.00 in connection with this project, and, furthermore, that the officials above him were consulting the ablest lawyers in Washington to know if they could increase the charge; but not being able to increase the charge with any appearance of legality, they were still determined to "get" the settlers.

Accordingly, in 1907, they prepared what they called water-right applications, which were in reality cunningly prepared documents for the purpose of making the settlers pay an "operation and maintenance charge." They then issued "public notices," saying that water could not be delivered to any settler who refused to sign a water-right application, because, as they said at the time, the state law demanded it.

After using force and fraud in getting us to sign these documents, they told us later on with the brazen effrontery of bushwhackers, that the applications for water which we signed were contracts, and that we agreed to pay whatever it would cost to maintain and operate the project. They then commenced in a lavish manner to charge everything to maintenance, including drain ditches, which they were then digging, or going to dig in the future, any old time up to the sounding of Gabriel's trumpet. They have forced some of the settlers to sign documents freeing them from the terms of their original contract. According to their agreement with us they were to put the water on the most available place on each farm unit. This they refused to do. They have said to settlers on high land: "You must sign these documents giving us the right to charge whatever it will cost to put water on your high land or you will have to pay the building charge of \$22.00 an acre, operation and maintenance for your high land whether you ever get water for it or not."

This is the kind of organized lawlessness that we have been accustomed to during Ballinger's and Fisher's respective administrations of Reclama-

mation affairs. We have been face to face with a worse condition than that which caused the revolution in this country in 1776. It is not only taxation without representation that we have been struggling against, but misrepresentation as well.

We feel a little embarrassed because we cannot take as roseate a view of things—things Reclamation—as a good many other people, especially the gentlemen of the Reclamation Service. A stranger who would read the Reclamation Record would be led to believe that he was missing the bliss of heaven if he failed to get in on the ground floor, or even up stairs, on a Reclamation project. There are people who believed that this Reclamation bunco game was intended in the first place to be a blessing poured down on the heads of the dear people, but if such was the intention we are sorry to say that it has wandered far from the mark; that it has failed to hit the bull's eye, for instead of a blessing, it is a curse today, because of the maladministration of Reclamation officials.

Unfortunately, we were credulous enough to believe that the agents of the American government would keep their contract with us when we filed on this land, and not violate it as they have so basely and so treacherously done, but what else could be expected when a Secretary of the Interior will openly flout the law.

In the Autumn of 1911, Mr. Fisher came here on a special train, with all the insolence of a Russian autocrat, and the manner of a Bowery Thug, and entered into a discussion concerning the "drainage," and told us with all the bravado of a drunken prize fighter that he did not have any laws to enable him to collect "drainage," but that he was going to collect it until we found a law to stop him. If Mr. Fisher did not have a law to collect "drainage," neither has Mr. Lane the statutory power nor the moral right to do so.

We hold that as this land belongs to the nation, it is the duty of the nation to drain it. In other words, that the cost of drainage should come out of the Reclamation fund and not out of the settlers' pockets.

Why did the Reclamation Service, by means of circulars and pamphlets, inveigle people to this project, enter into a solemn contract with them, keep it for two years and then break it? Why did they deceive the people and then betray them? Why didn't they tell us that this land would be forty or fifty dollars an acre; and if they had done so, many of us would not be here today, because we could get improved land at that price, and not be forced to undergo the hardships of pioneer life.

It is an absolute fact that men and women have deprived themselves of the necessities of life, and that children have suffered for want of food because of the exaction of the Reclamation Service on this project.

Why did they wait for almost three years before they made any attempt to increase the price of water, although they knew in 1906 that there was a deficit of \$100,000.00 connected in some way with this project?

These are questions that demand answers. Do the men who were at the head of the Reclamation

Service at that time possess sufficient courage to answer them? Do they possess sufficient courage to tell the truth and shame the devil? Do they possess sufficient courage to let the cat out of the bag and take the bull by the horns, by making an honest effort to right the wrong committed in 1907, when people were forced to sell their cows, their sows, or mares to make a payment before it was due?

It was that act of injustice in 1907 that paved the way for another injustice, when settlers were forced to sign the so-called \$30.00 contract, that contract that would be hooted out of court in any civilized country on earth; even a nation of Hot-tentots would denounce it as an outrage and a misdemeanor against humanity.

Another cause of complaint against the Reclamation Service is the thousands of dollars squandered in useless experiments, especially the money wasted in connection with the experimental farm by a man named McPherson, a professor, bless your souls. But there was one thing that was very commendable in the "professor." When he saw the mistakes that he made, he still possessed sufficient manhood to get out one night before the rising of the moon, make a dash for the tall timber, and never showed his face here since. If some of the other parasites—the consulting engineers and chiefs of foolology and bugology who have been feeding out of the public crib, at the expense of the people, and who never do anything more strenuous than making a bold attempt to look wise and draw their pay, would follow the example of the "professor," it would be a blessing to the settlers on the projects of the West.

Reclamation gentlemen seem to think that they have a license to do whatever they please on this project because of a decision handed down by the Supreme Court (in the case of Swigart and Baker), when that tribunal came to the conclusion that it was the intention of the Congress, which framed the Reclamation law, to compel settlers on Reclamation projects to return to the Reclamation fund the hundreds of thousands of dollars wasted through the stupidity and carelessness of the Reclamation officials. If that was the intention of the men who drafted the Reclamation bill, they would not have inserted in it the word "estimated." The men who drafted the Reclamation law were farsighted, and good judges of human nature. They knew that wherever there is carrion, there you will find the vultures also, and in order to protect the people, and to keep officials within proper bounds, they wisely inserted in the law the words "estimated cost."

We wish to call the attention of the commission to the fact that our case is entirely different from the Swigart vs. Baker case before mentioned. It seems that Baker filed in 1909, and consequently came under Mr. Ballinger's rulings. The majority of the settlers on this project filed in 1904-5.

In conclusion, we wish to call your attention to Section 6 of the Reclamation law, which says:

"That the Secretary of the Interior is hereby authorized and directed to use the Reclamation fund for the operation and maintenance of all reservoirs and irrigation works constructed under

the provisions of that act; provided, that when the payments required by their act are made for the major portion of the lands irrigated from the waters of any of the works herein provided for, then the management and operation of such irrigation works shall pass to the owners of the lands irrigated thereby to be maintained at their expense, under such forms of organization and under such rules and regulations as may be acceptable to the Secretary of the Interior; provided, that the title to and management and operation of the reservoirs and the works necessary for their protection and operation shall remain in the government until otherwise provided by congress."

We wish to call your attention also to a passage from one of their pamphlets published in 1907, where it stated: "The cost to the settlers of land located in the area, under the terms of the Reclamation act is \$22.00 an acre, which is to be paid in ten annual installments, together with a maintenance fee of 40 cents per acre each year." It does not say 40 cents the first year, 40 cents the second year, 60 cents the third year, 75 cents the fourth, and \$1.75 the fifth and sixth years.

We charge the Reclamation Service with incompetency and extravagance. Evidence of incompetency can be found along the canals and laterals. They have put in concrete taps, and other structures, at great expense, that were entirely useless, and later on they blasted some of them out with powder; even laterals that it cost thousands of dollars to build have been rejected as worthless. Several loads of gravel were hauled a distance of four or five miles for the purpose of making concrete taps—all taps were to be made of concrete—and it never was used. We understand that 500 iron gates were purchased for the concrete taps and they have not been used on the project. They have put in measuring devices that cost thousands of dollars and they, too, have been thrown aside as useless.

Is it right to make the settlers pay for all this useless work, all this sinful extravagance?

We protest in the most emphatic manner against paying for it, or paying one cent more than \$26.00 an acre.

FORM \$10,000,000 DISTRICT

A \$10,000,000 irrigation district will be organized this month by the Horse Heaven Land Owners' Association of Washington.

The Horse Heaven district comprises more than 300,000 acres of the finest kind of irrigation land, with fertile soil and natural drainage facilities.

This action on the part of the land owners was brought about by the introduction into Congress of a bill providing for the guarantee by the United States of interest on irrigation bonds to run for forty years, and by the fact that the last legislature of this state enacted a law providing for the formation of irrigation districts and the cooperation with the United States, where the interest is guaranteed by the United States.

It was stated that L. M. Rice & Co., Seattle engineers, had surveyed the project and placed the estimated cost of construction at about \$10,000,000, which the land owners believed to be not excessive.

ARE THESE LANE'S VIEWS ON REVALUATION?

THE following dispatch from Washington, which has been appearing in Federal irrigation project newspapers, bears every evidence that it is inspired by high officials in the Reclamation Service. Does it represent Secretary of the Interior Franklin K. Lane's views?

Washington.—A revaluation of all government irrigation projects is now being made, under order of Secretary Lane, with a view to determining whether settlers are paying too much or too little for water for their lands, and for the maintenance of the projects. Based on this revaluation, and new estimates of the cost of projects, the charges assessed settlers are to be revised, and until the work is completed it will not be known how the various projects will be affected.

While, in some instances, this revaluation may result in a reduction of water and maintenance charges, the indications are that on many projects the charges will be increased. And for this reason: the Reclamation fund, under the Reclamation Act, is a permanent, revolving fund, and the law contemplated that every dollar expended should be returned to the fund by the settlers on the land. There is no direct appropriation out of the treasury to pay for the Washington or other offices of the Reclamation Service, and all overhead expense must be prorated, to be paid ultimately by the settlers.

This means that the settler must not only pay his pro rata share of the cost of building the project upon which he is located, but he must contribute something toward the cost of administering the Service generally,

and toward defraying all general expenses. But it has been discovered that there is another expense that must be taken care of, that has not been reckoned on up to this time. From the date of the organization of the Reclamation Service to June 30, 1914, there has been expended nearly \$900,000 on surveys and preliminary examinations of projects that have not been adopted or constructed, and many of them never will be undertaken by the government.

Inasmuch as the government probably will not undertake the construction of any new projects for several years to come, and in view of the further fact that some thirty-five or forty projects have been examined and more or less surveyed, only to be abandoned, the officials in charge have come to the conclusion that there must be an accounting; in fact, they construe the Reclamation law to demand an accounting which will assess all costs against the settlers. This means, in all probability, that the settlers must not only pay back to the government the cost of projects which are being or have been built, but must be taxed with the further burden of paying for the cost of surveys of projects never adopted or constructed.

Before these additional costs are assessed against the settlers, however, the question probably will be presented to Congress in order that it may have an opportunity of saying how the moneys spent on surveys of abandoned projects shall be reimbursed. If Congress decides to make a direct appropriation from the treasury to cover these costs the settlers will be relieved of paying for surveys from which they get no benefit.

CALLS HIGH WATER CHARGES CONFISCATION

FULFILLMENT of the settlers' original contract with the government, providing for a charge of \$25 per acre, without any extras or alterations, was demanded by water users on the Uncompahgre project in Colorado during the Review Board's hearings at Montrose.

Among the witnesses examined were F. D. Catlin, J. F. Kyle, W. E. Obert, L. E. Ross, George Conklin, C. M. Ryan and Ira Monell. Each one of these men participated in the gathering of the subscriptions to the project and all were emphatic in their declaration that the land was subscribed on the understanding that the cost would not exceed \$25 per acre. The witnesses quoted the government officials, including Mr. Newell, Bien, Davis, McConnell, Fellows, as their authorities for representing to the land owners that the cost would not exceed that amount. In fact, the articles of incorporation of the Water Users' Association specifically represented that the cost would not exceed \$25 per acre with the possibility of the cost even being as low as \$17 per acre.

Mr. Catlin argued that a charge of from \$50 to \$75 an acre would practically mean the confiscation of 75,000 acres of land. He found no fault with the work of the construction of the project and believed that in the main the money had been judiciously spent. For that reason he could see no relief in the hope of finding here or there an item of a few thousand dollars

which might be deducted from the project even if the total ran up to as much as \$200,000. The only relief he could see would be for the government to cut off a big slice of the cost so as to bring it somewhere near the original estimate upon which the land subscriptions were secured.

George W. Bruce, president of the Uncompahgre Water Users' Association, suggested as a possible solution of the Reclamation problem that the government retain the Reclamation projects and sell the water to the water users on the basis of about two per cent interest on the investment in the projects. On this basis it is figured out that the water would cost the Uncompahgre farmer \$2 an acre per year, half of which would represent interest to the government and half of which would represent maintenance and operation. This would be perpetual, however, with no provisions of the water users ever becoming owners of the project.

PUMP REFERENCE BOOK

Royal C. Wise, 9 South Clinton street, Chicago, has just issued his reference bulletin, containing commercial information on pumping machinery. The matter relates especially to electrically driven direct connected centrifugal pumps, sump pumps, gasoline engine outfits, and deep well supplies.

AUSTRALIA SORRY TO LOSE ELWOOD MEAD

*A*USTRALIA papers pay glowing tribute to Elwood Mead, who has resigned as chairman of the State Rivers and Water Supply Commission of Victoria to return to the United States to act as chairman of the final board of review on the revaluations of the Federal projects. The Bendigo Advertiser says:

In alluding to Mr. Mead's resignation, the Premier (Sir Alex. Peacock) expressed regret that Victoria was to lose the services of an expert irrigationist of such a marked character as Mr. Mead had proved himself to be. Mr. Mead combined a remarkable ability in irrigation matters with a personality that had made him popular with everyone with whom he had come in contact.

Mr. Hutchinson also expressed sincere regret. He said that Mr. Mead had been identified so closely with irrigation development in Victoria that his departure would be a severe blow to such work. Some compensation would be afforded by the fact that Mr. Mead's methods and organization would remain. These could not fail to be of use in future work.

Mr. Mead's salary was £2,000 (\$10,000) a year.

The same newspaper says editorially:

When Mr. Mead has gone, the people of this state will see, as the distance of time lengthens, his greatness as an irrigation expert in increasing proportions. Even now he has become regarded as almost indispensable to the success of the irrigation venture of this state. Else such pressure would not have been put upon him to stay in Victoria when he was offered a professorship in California University a year or so ago. Else such universal satisfaction would not have been expressed when he announced his intention to remain here.

Yet no man in the history of the development of this state has had such a trying experience as had Mr. Mead, and in such a short space of time. Only a man with a calm mental and strong physical make-up like that of Mr. Mead could have withstood the strain, and suffered the wear and tear without a complete physical and mental collapse. Behind the steady countenance and beneath the solid frame only Mr. Mead knows to what extent his health has been impaired. In recent months when the heavens were as brass, when people who had contracted for water and could not be supplied, when people who had no water rights pleaded in the name of humanity, and sometimes in the name of the Deity, for water for their human kind, as well as their stock, and could get none, when not a few settlers were "biting the hand" that fed them, when a section of the press and an increasing number of politicians were casting their eyes upon him as a scapegoat for the irrigation misfortunes, it is not to be wondered that his grey hairs were thickening and his step was not so elastic.



Irrigating vegetables with a Lauson pumping plant in the San Joaquin valley of California.

He came to this state to find that irrigation had been started altogether on wrong lines. He found that the water storages were entirely inadequate, and that the water channels had been stretched out from those storages to inordinate distances. He found that the landholders only appreciated the irrigation system to the extent of ensuring them water in time of drought. In normal years they did not want it, and were little disposed to pay what may be regarded as

"an insurance premium" against complete failure in drought time. In short, there had been too much politics and too little expert engineering in the whole system.

Mr. Mead saw these difficulties standing out with uncompromising boldness. Had he foreseen the fierceness of the fight when he tackled it, he, indeed, had a stout heart and much more optimism than he was generally credited with—and that was a great deal. The first pitched fights in this battle were with the large landholders, who wished to remain in undisturbed possession of their broad and almost innumerable

acres, and follow their conservative ways. Mr. Mead soon showed his strength. He induced the legislature to make an unprecedented departure in effecting closer settlement in this state in the matter of irrigation. When he put a ring round a certain area on the map of Northern Victoria or the Goulburn Valley, and called it an irrigation district, in spite of the protests of the large landholders, there was no need for the state to enter into unequal bargaining with the landholders to purchase land for closer settlement. Why? Because Mr. Mead had prevailed upon the legislature to introduce what may be termed an automatic closer settling machine. It was the compulsory water charge amounting in the fourth year, and for every year thereafter to 5s and 6s per acre. For that charge the Water Commission guaranteed to supply one acre foot of water, in other words, sufficient water to cover an acre with water 1 foot in depth. Thus it did not pay a large landholder to hold more acres than he could work under the intenser form of agriculture brought about by irrigation. Thus he sold his surplus acres, and thus closer settlement was achieved. It was only in those cases where the commission thought it necessary to hasten the movement even more quickly that land was bought from the old landholders. That the commission did not buy badly is proved by the frequency of cases in which the original landholders have returned and bought irrigation blocks in their old farms at £5 and upwards additional per acre to the price at which they had sold to the commissioner.

Not far from Tongala, and in many other places, large landholders would scarcely give Mr. Mead a hearing when addressing them on the advantages of worse was often feared. But Mr. Mead would calmly

(Continued on page 250)

IRRIGATION WATER MEASURING DEVICES

*By California Agents of Irrigation Investigations, Office of Experiment Stations, U. S. Department of Agriculture

THIS is the third of a series of articles prepared from a bulletin issued by the College of Agriculture of the University of California, at Berkeley. The articles are illustrated with photographs and drawings of the various structures and devices used in compiling the data.—THE EDITOR.

In sections where the irrigated lands have a considerable slope, so that water can very easily be led from the supply ditches or laterals to the land without having to check the water nearly as high as the ditch banks, some form of weir is the most common type of measuring device.

No attempt will be made to present a broad and full discussion of weirs, only enough being given to enable the farmer who is unfamiliar with water measurements to understand their use in irrigation. The weir tables that are given are those that are generally used in irrigation practice and are therefore based on the well-known formulas. Engineers have recognized that these formulas do not apply throughout the wide range of conditions met in the field and for that reason numerous engineers have made experiments designed to correct the formulas for the conditions to which the Francis and other formulas do not properly apply.

Taken singly, a weir, like other non-mechanical meters, measures the rate of flow and does not indicate the total quantity delivered. In conjunction with a water register, which graphically records the depth of water passing over the weir, or in conjunction with such a device as the Hanna meter (Fig. 25), which may be arranged to read directly in acre-feet, measurement by means of a weir gives entirely satisfactory results. Where conditions permit its use the weir is thus far the generally accepted device



Fig. 12—Measuring water with a small Cipolletti weir.



Fig. 25—A Hanna meter.

*The installation of the measuring devices described in this series of articles has been carried out chiefly by S. H. Beckett and R. D. Robertson, irrigation engineers, assisted by Roy Wray. The tests of the devices have been made under the immediate direction of S. T. Harding, irrigation engineer, in charge of irrigation investigations in Montana, temporarily on duty in California, who has also prepared the reports of the tests. The weir tables have been prepared by Wells A. Hotchkiss. The drawings and diagrams have been prepared by Stephen C. Whipple, scientific assistant, F. L. Bixby, irrigation engineer, in charge of irrigation investigations in New Mexico, temporarily on duty in California, assisted in designing the general plan of installation. The full study has been

for measuring lateral diversions from main canals. It is also an accepted standard device for testing the rate of flow from pumping plants, just as it has been the standard device in the tests that have been made of the various devices installed at Davis. Small movable weirs are convenient for use by farmers for measuring the water carried in their individual ditches or discharged by pumping plants.

Three types of weirs are chiefly in use in irrigation practice; viz.: the Cipolletti weir, the weir extending the entire distance across the ditch or flume carrying the water measured, known as the weir without end contractions, and the rectangular weir that does not extend entirely across the ditch or flume, known as the rectangular weir with end contractions. The first two only of these are installed at Davis and described in this article.

Briefly, a weir is merely a board or other crest set across a stream or other water channel and over which the water carried is made to flow. If the velocity of the water directly above the weir, known as the velocity of approach, is very small and due only to the falling of

the water over the weir crest, the quantity of water passing depends entirely on the depth of the water over the crest and the length of the crest. In the case of the rectangular weir with end contractions the discharge is not proportional to the length of the weir crest. In fact, the discharge is not precisely proportional to the length in the case of the weir without end contractions, but is so nearly so as to involve no error of consequence by assuming it to be. As tables have been prepared that show the quantity passing over both a Cipolletti weir and a weir without end contrac-

planned and, in general, supervised, and the data has been arranged for publication by Frank Adams, irrigation manager.

The installation of the Davis field laboratory, and the testing of the devices have been jointly paid for from funds contributed by the state engineering department of California, the office of experiment stations of the United States department of agriculture, and the California agricultural experiment station. Co-operation with the state engineering department of California has been effected through agreement between that department and the office of experiment stations, the irrigation investigations at Davis having formerly been carried on by those two agencies without financial aid from the California agricultural experiment station.

tions (as well as other types of weirs), measurement with a weir only involves measuring the depth of water over the weir crest and reference to the appropriate table to determine the quantity passing for the given depth and crest length.

The Cipolletti weir, as installed at Davis, is shown in figures 12 and 13. The length of weir and size of box to make are, of course, dependent on the quantity of water to be measured. In general, it may be said that a Cipolletti weir should be small enough so that the amount of water to be measured will never give less than a depth of one inch over the weir crest, and large enough so that the depth will never need to be much more than one-third of the crest length. Care should also be taken to see that the weir crest is long enough so that the water can be measured without raising it higher over the weir crest than is permitted by the available fall. A number of other conditions are usually laid down as necessary for the weir. The most important of these, briefly paraphrased, follow:

1. The distance from the crest of the weir to the bottom of the canal or floor of the weir box should be at least three times the depth of water on the weir. That is, with an 18-inch weir intended to measure up to 2 cubic feet per second, which requires a depth on the weir of about 6 inches, the crest of the weir should be about 18 inches above the floor.

2. The distance from the ends of the weir crest to the sides of the weir box should be about twice the depth of the water on the weir, or, say, from 10 to 12 inches in the case of an 18-inch weir measuring about 2 cubic feet per second.

3. The bottom and sides of the weir notch should be beveled on the down-stream side to give a narrow edge. The use of a galvanized iron crest is quite common and very satis-



A Cipolletti weir and a Hanna meter in action

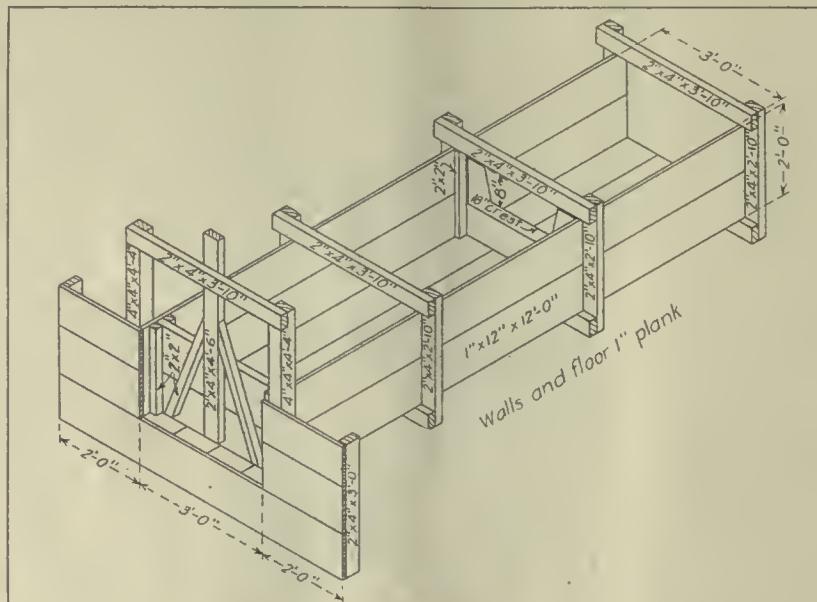


Fig. 13—Drawing of a Cipolletti weir.



Fig. 14.—A weir without end contractions.

factory, but not necessary. Sometimes thin pieces of strap iron are fastened on the upstream side of the weir notch. In other cases the board in which the weir notch is cut is merely bevelled down to a crest thickness of one-eighth or one-quarter of an inch.

4. Water should not be allowed to approach the weir with a velocity exceeding 6 inches per second. Also, it should flow to the weir in a smooth stream free from eddies or swirls. Both of these conditions are most easily met by placing the weir in a straight section of the ditch.

5. The water passing over the weir should, if possible, have a free over-fall. Where necessary, however, it may rise to the level of the weir crest without appreciable error in the measurement.

6. The depth of water on the weir crest must be measured sufficiently above the weir to be free from the downward curve of the water as it passes over the weir. For convenience in making this measurement of depth a stake with its top level with the crest

of the weir is usually set at one side of the ditch 2 or 3 feet above the weir, the measurements of depth then being made from the top of this stake to the top of the water.

The tables accompanying this article give the discharge over Cipolletti weirs from 1 to 5 feet long. For lengths of from 1 to 2 feet the length of weir crest is given in inches and the depths in inches and feet (Table 1). For weirs with crest lengths of 3, 4 and 5 feet the lengths and depths are given in feet only (Table 2). If it is desired to measure the discharge in inches instead of cubic feet per second, multiply the cubic feet per second given in the table by 50, if the old customary Californian miner's inch is desired, or by 40, if it is desired to use the statute miner's inch of California.

The bill of material given below
(Continued on page 250)

TABLE 1

Discharge of Cipolletti Weirs 12 to 24 Inches Long in Cubic Feet per Second, Computed from Formula $Q=3.367 LH^2$

Head, H		Length of weir L, inches												
In.	Ft.	12	13	14	15	16	17	18	19	20	21	22	23	24
$\frac{1}{2}$	.042	.03	.03	.04	.04	.04	.04	.04	.04	.04	.05	.06	.06	.06
$\frac{5}{8}$	.052	.04	.04	.05	.05	.05	.06	.06	.06	.07	.07	.07	.08	.08
$\frac{3}{4}$	.062	.05	.05	.06	.06	.07	.07	.08	.08	.08	.09	.09	.10	.10
$\frac{7}{8}$	.073	.07	.08	.08	.09	.09	.10	.10	.11	.12	.12	.13	.13	.13
1	.083	.08	.09	.09	.10	.11	.11	.12	.13	.13	.14	.15	.15	.16
$1\frac{1}{4}$	.094	.10	.11	.12	.12	.13	.14	.15	.16	.17	.18	.18	.19	.19
$1\frac{1}{2}$	.104	.11	.12	.13	.14	.15	.16	.17	.17	.18	.19	.20	.21	.23
$1\frac{3}{4}$	.115	.13	.14	.15	.16	.17	.18	.20	.21	.22	.23	.24	.25	.26
$1\frac{1}{2}$	.125	.15	.16	.18	.19	.20	.21	.22	.24	.25	.26	.28	.29	.30
$1\frac{5}{8}$	.135	.17	.18	.20	.21	.23	.24	.25	.27	.28	.30	.31	.33	.33
$1\frac{3}{4}$	.146	.19	.21	.22	.24	.25	.27	.28	.30	.32	.33	.35	.36	.38
$1\frac{1}{8}$	.156	.21	.23	.24	.26	.28	.30	.31	.33	.35	.37	.38	.40	.42
2	.167	.23	.25	.27	.29	.31	.33	.34	.36	.38	.40	.42	.44	.46
$2\frac{1}{8}$	.177	.25	.27	.29	.31	.33	.35	.38	.40	.42	.44	.46	.48	.50
$2\frac{1}{4}$	.188	.27	.29	.32	.34	.36	.38	.41	.43	.45	.47	.50	.52	.55
$2\frac{3}{8}$	.198	.30	.32	.35	.38	.40	.42	.45	.48	.50	.52	.55	.57	.59
$2\frac{1}{2}$	.208	.32	.35	.37	.40	.43	.45	.48	.51	.53	.56	.59	.61	.64
$2\frac{5}{8}$	.219	.34	.37	.40	.42	.45	.48	.52	.55	.58	.61	.63	.66	.69
$2\frac{3}{4}$	.229	.37	.40	.43	.46	.49	.52	.55	.59	.62	.65	.68	.71	.74
$2\frac{7}{8}$	.240	.40	.43	.47	.50	.53	.56	.59	.63	.67	.70	.73	.76	.79
3	.250	.42	.46	.49	.52	.56	.60	.63	.66	.70	.74	.77	.80	.84
$3\frac{1}{8}$	.260	.45	.49	.52	.56	.60	.64	.67	.71	.75	.79	.82	.86	.89
$3\frac{1}{4}$	.271	.47	.51	.55	.59	.63	.67	.71	.74	.78	.82	.86	.90	.95
$3\frac{3}{8}$	.281	.50	.54	.58	.62	.67	.71	.75	.79	.83	.88	.92	.96	1.00
$3\frac{1}{2}$	.292	.53	.57	.62	.66	.71	.75	.80	.84	.88	.93	.97	1.02	1.06
$3\frac{5}{8}$	.302	.56	.61	.65	.70	.75	.79	.84	.89	.93	.98	1.03	1.07	1.12
$3\frac{3}{4}$	.312	.59	.64	.69	.74	.79	.84	.88	.93	.98	1.03	1.08	1.13	1.17
$3\frac{7}{8}$	.323	.62	.67	.72	.78	.83	.88	.93	.98	1.03	1.08	1.14	1.19	1.24
4	.333	.65	.70	.76	.81	.87	.92	.97	1.03	1.08	1.14	1.19	1.24	1.29
$4\frac{1}{8}$	.344	.68	.74	.79	.85	.91	.96	1.02	1.08	1.13	1.19	1.25	1.30	1.36
$4\frac{1}{4}$	.354	.71	.77	.83	.89	.95	1.01	1.06	1.12	1.18	1.24	1.30	1.36	1.42
$4\frac{3}{8}$	.365	.74	.80	.86	.92	.99	1.05	1.11	1.17	1.23	1.30	1.36	1.42	1.48
$4\frac{1}{2}$	.375	.77	.84	.90	.96	1.03	1.09	1.16	1.22	1.28	1.35	1.41	1.48	1.55
$4\frac{5}{8}$	.385	.80	.87	.93	1.00	1.07	1.13	1.21	1.27	1.33	1.40	1.47	1.54	1.61
$4\frac{3}{4}$	.396	.84	.91	.98	1.05	1.12	1.19	1.26	1.33	1.40	1.47	1.54	1.61	1.68
$4\frac{7}{8}$	.406	.87	.94	1.01	1.09	1.16	1.23	1.31	1.38	1.45	1.52	1.60	1.67	1.74
5	.417	.91	.99	1.06	1.14	1.21	1.29	1.36	1.44	1.52	1.59	1.67	1.74	1.81
$5\frac{1}{8}$	.427	.94	1.02	1.10	1.18	1.25	1.33	1.41	1.49	1.57	1.64	1.72	1.80	1.88
$5\frac{1}{4}$	.438	.98	1.06	1.14	1.22	1.30	1.38	1.46	1.55	1.63	1.72	1.80	1.88	1.95
$5\frac{3}{8}$	.448	1.01	1.09	1.18	1.26	1.35	1.43	1.51	1.60	1.68	1.77	1.85	1.93	2.02
$5\frac{1}{2}$	.458	1.04	1.13	1.21	1.30	1.39	1.47	1.56	1.65	1.73	1.82	1.91	2.00	2.09
$5\frac{5}{8}$	.469	1.08	1.17	1.26	1.35	1.44	1.53	1.62	1.71	1.80	1.89	1.98	2.07	2.16
$5\frac{3}{4}$	.479	1.12	1.21	1.31	1.40	1.49	1.58	1.67	1.77	1.87	1.96	2.05	2.14	2.23
$5\frac{7}{8}$	.490	1.15	1.25	1.34	1.44	1.53	1.63	1.73	1.82	1.92	2.01	2.11	2.21	2.31
6	.500	1.19	1.29	1.39	1.49	1.59	1.68	1.78	1.88	1.98	2.08	2.18	2.28	2.38
$6\frac{1}{8}$	.510	....	1.33	1.43	1.53	1.64	1.74	1.84	1.94	2.04	2.15	2.25	2.35	2.45
$6\frac{1}{4}$	.521	....	1.37	1.48	1.58	1.69	1.79	1.90	2.01	2.11	2.22	2.32	2.43	2.53
$6\frac{3}{8}$	.531	....	1.41	1.52	1.62	1.73	1.84	1.95	2.06	2.17	2.28	2.38	2.49	2.61
$6\frac{1}{2}$	.542	....	1.46	1.57	1.68	1.80	1.91	2.02	2.13	2.24	2.36	2.47	2.58	2.69
$6\frac{5}{8}$	....	....	1.61	1.72	1.84	1.96	2.07	2.18	2.30	2.42	2.53	2.64	2.76	2.86
$6\frac{3}{4}$	....	....	1.66	1.78	1.89	2.01	2.13	2.25	2.37	2.48	2.60	2.72	2.84	2.96
$6\frac{7}{8}$	....	....	1.70	1.83	1.95	2.07	2.19	2.31	2.43	2.56	2.68	2.80	2.92	3.04
7	.583	....	1.75	1.88	2.00	2.12	2.25	2.38	2.50	2.62	2.75	2.88	3.00	3.12
$7\frac{1}{8}$	.594	....	....	1.92	2.05	2.18	2.31	2.44	2.56	2.69	2.82	2.95	3.08	3.20
$7\frac{1}{4}$	.604	....	....	1.98	2.11	2.24	2.37	2.50	2.63	2.76	2.90	3.03	3.16	3.30
$7\frac{3}{8}$	.615	....	....	2.03	2.17	2.30	2.44	2.58	2.71	2.85	2.98	3.12	3.25	3.40
$7\frac{1}{2}$	.625	....	....	2.08	2.22	2.36	2.50	2.64	2.78	2.92	3.06	3.20	3.33	3.48
$7\frac{5}{8}$	.635	....	....	....	2.28	2.42	2.56	2.70	2.84	2.99	3.13	3.27	3.41	3.55
$7\frac{3}{4}$	.646	....	....	....	2.33	2.48	2.62	2.77	2.91	3.06	3.20	3.35	3.50	3.65
$7\frac{7}{8}$	.656	....	....	....	2.38	2.53	2.68	2.83	2.98	3.13	3.28	3.43	3.58	3.73
8	.667	....	....	....	2.44	2.60	2.75	2.90	3.06	3.21	3.36	3.51	3.67	3.82
$8\frac{1}{8}$	.677	....	....	....	....	2.65	2.81	2.96	3.12	3.28	3.43	3.59	3.75	3.91
$8\frac{1}{4}$	.688	....	....	....	....	2.72	2.88	3.04	3.20	3.36	3.52	3.68	3.84	4.00
$8\frac{3}{8}$	.698	....	....	....	....	2.79	2.95	3.12	3.28	3.44	3.61	3.77	3.93	4.10
$8\frac{1}{2}$	.708	....	....	....	....	2.84	3.01	3.18	3.34	3.51	3.68	3.85	4.01	4.18
$8\frac{5}{8}$	.719	....	....	....	....	....	3.08	3.25	3.42	3.59	3.76	3.94	4.11	4.29
$8\frac{3}{4}$	.729	....	....	....	....	....	3.14	3.31	3.49	3.66	3.84	4.02	4.19	4.37
$8\frac{7}{8}$	.740	....	....	....	....	....	3.22	3.40	3.58	3.76	3.94	4.12	4.29	4.47
9	.750	....	....	....	....	....	....	3.28	3.46	3.64	3.82	4.01	4.19	4.37
$8\frac{1}{8}$	.760	....	....	....	....	....	....	3.53	3.72	3.90	4.09	4.28	4.46	4.64
$9\frac{1}{4}$	.771	....	....	....	....	....	....	3.61	3.80	3.99	4.18	4.37	4.56	4.75
$9\frac{3}{8}$	.781	....	....	....	....	....	....	3.67	3.87	4.06	4.25	4.45	4.64	4.83

THE IRRIGATION AGE.

TABLE 2

Discharge of Cipolletti Weirs 3 to 5 Feet Long in Cubic Feet per Second, Computed from Formula $Q = 3.367 LH$.

Head H, feet	Length of weir L, feet			Head H, feet	Length of weir L, feet			Head H, feet	Length of weir L, feet	
	3.0	4.0	5.0		3.0	4.0	5.0		4.0	5.0
....	....	....	....	0.76	6.69	8.92	11.15	1.51	24.99	31.24
....	....	....	....	.77	6.82	9.10	11.37	1.52	25.24	31.55
....	....	....	....	.78	6.96	9.28	11.60	1.53	25.48	31.85
....	....	....	....	.79	7.09	9.46	11.82	1.54	25.74	32.17
0.05	0.11	0.15	0.19	.80	7.23	9.64	12.04	1.55	25.99	32.49
0.06	.15	.20	.25	.81	7.36	9.82	12.27	1.56	26.24	32.80
0.07	.19	.25	.31	.82	7.50	10.00	12.50	1.57	26.49	33.12
0.08	.23	.30	.38	.83	7.64	10.18	12.73	1.58	26.75	33.44
0.09	.27	.36	.46	.84	7.78	10.37	12.96	1.59	27.00	33.75
0.10	.32	.43	.53	.85	7.92	10.55	13.19	1.60	27.25	34.07
0.11	.37	.49	.61	.86	8.06	10.74	13.42	1.61	27.51	34.39
0.12	.42	.56	.70	.87	8.20	10.93	13.66	1.62	27.77	34.71
0.13	.47	.63	.79	.88	8.34	11.12	13.90	1.63	28.03	35.04
0.14	.53	.70	.88	.89	8.48	11.31	14.13	1.64	28.29	35.36
0.15	.59	.78	.98	.90	8.62	11.50	14.37	1.65	28.54	35.68
0.16	.65	.86	1.08	.91	8.77	11.69	14.61	1.66	28.80	36.01
0.17	.71	.94	1.18	.92	8.91	11.88	14.85	1.67	29.07	36.33
0.18	.77	1.03	1.28	.93	9.06	12.08	15.10	1.68	29.33	36.66
0.19	.84	1.12	1.39	.94	9.20	12.27	15.34	1.69	29.59	36.99
0.20	.90	1.20	1.51	.95	9.35	12.47	15.59	1.70	29.85	37.32
0.21	.97	1.30	1.62	.96	9.50	12.67	15.83	1.71	30.12	37.64
0.22	1.04	1.39	1.74	.97	9.65	12.86	16.08	1.72	30.38	37.98
0.23	1.11	1.48	1.86	.98	9.80	13.06	16.33	1.73	30.65	38.31
0.24	1.19	1.58	1.98	.99	9.95	13.26	16.58	1.74	30.91	38.64
0.25	1.26	1.68	2.10	1.00	10.10	13.47	16.83	1.75	31.18	38.97
0.26	1.34	1.78	2.23	1.01	....	13.67	17.09	1.76	31.45	39.31
0.27	1.42	1.89	2.36	1.02	....	13.87	17.34	1.77	31.72	39.64
0.28	1.50	2.00	2.49	1.03	....	14.08	17.60	1.78	31.98	39.98
0.29	1.58	2.10	2.63	1.04	....	14.28	17.86	1.79	32.25	40.32
0.30	1.66	2.21	2.77	1.05	....	14.49	18.11	1.80	32.52	40.66
0.31	1.74	2.32	2.90	1.06	....	14.70	18.37	1.81	32.80	41.00
0.32	1.83	2.44	3.05	1.07	....	14.91	18.63	1.82	33.07	41.34
0.33	1.92	2.55	3.19	1.08	....	15.12	18.90	1.83	33.34	41.68
0.34	2.00	2.67	3.34	1.09	....	15.33	19.16	1.84	33.61	42.02
0.35	2.09	2.79	3.49	1.10	....	15.54	19.42	1.85	33.89	42.36
0.36	2.18	2.91	3.64	1.11	....	15.75	19.69	1.86	34.16	42.70
0.37	2.27	3.03	3.79	1.12	....	15.96	19.96	1.87	34.44	43.05
0.38	2.37	3.16	3.94	1.13	....	16.18	20.22	1.88	34.72	43.40
0.39	2.46	3.28	4.10	1.14	....	16.39	20.49	1.89	34.99	43.74
0.40	2.56	3.41	4.26	1.15	....	16.61	20.76	1.90	35.27	44.09
0.41	2.65	3.54	4.42	1.16	....	16.83	21.03	1.91	35.55	44.44
0.42	2.75	3.66	4.58	1.17	....	17.04	21.30	1.92	35.83	44.79
0.43	2.85	3.80	4.75	1.18	....	17.26	21.58	1.93	36.11	45.14
0.44	2.95	3.93	4.91	1.19	....	17.48	21.85	1.94	36.39	45.49
0.45	3.05	4.06	5.08	1.20	....	17.70	22.13	1.95	36.67	45.84
0.46	3.15	4.20	5.25	1.21	....	17.93	22.41	1.96	36.96	46.20
0.47	3.25	4.34	5.42	1.22	....	18.15	22.69	1.97	37.24	46.55
0.48	3.36	4.48	5.60	1.23	....	18.37	22.96	1.98	37.52	46.90
0.49	3.46	4.62	5.77	1.24	....	18.60	23.25	1.99	37.81	47.26
0.50	3.57	4.76	5.95	1.25	....	18.87	23.53	2.00	38.09	47.62
0.51	3.68	4.90	6.13	1.26	....	19.05	23.81	2.01	....	47.97
0.52	3.79	5.05	6.31	1.27	....	19.28	24.10	2.02	....	48.33
0.53	3.90	5.20	6.50	1.28	....	19.50	24.38	2.03	....	48.69
0.54	4.01	5.34	6.68	1.29	....	19.73	24.67	2.04	....	49.05
0.55	4.12	5.49	6.87	1.30	....	19.96	24.95	2.05	....	49.41
0.56	4.23	5.64	7.05	1.31	....	20.15	25.24	2.06	....	49.78
0.57	4.35	5.80	7.24	1.32	....	20.42	25.53	2.07	....	50.14
0.58	4.46	5.95	7.44	1.33	....	20.66	25.82	2.08	....	50.50
0.59	4.58	6.10	7.63	1.34	....	20.89	26.11	2.09	....	50.87
0.60	4.69	6.26	7.82	1.35	....	21.12	26.41	2.10	....	51.22
0.61	4.81	6.42	8.02	1.36	....	21.36	26.70	2.11	....	51.60
0.62	4.93	6.57	8.22	1.37	....	21.60	27.00	2.12	....	51.97
0.63	5.05	6.73	8.42	1.38	....	21.83	27.29	2.13	....	52.34
0.64	5.17	6.90	8.62	1.39	....	22.07	27.59	2.14	....	52.70
0.65	5.29	7.06	8.82	1.40	....	22.31	27.89	2.15	....	53.07
0.66	5.42	7.22	9.03	1.41	....	22.55	28.19	2.16	....	53.44
0.67	5.54	7.38	9.23	1.42	....	22.79	28.49	2.17	....	53.82
0.68	5.66	7.55	9.44	1.43	....	23.03	28.79	2.18	....	54.18
0.69	5.79	7.72	9.65	1.44	....	23.27	29.09	2.19	....	54.56
0.70	5.92	7.89	9.86	1.45	....	23.52	29.40	2.20	....	54.93
0.71	6.04	8.06	10.07	1.46	....	23.76	29.70	2.21	....	55.31
0.72	6.17	8.23	10.28	1.47	....	24.00	30.00	2.22	....	55.69
0.73	6.30	8.40	10.50	1.48	....	24.25	30.31	2.23	....	56.06
0.74	6.43	8.57	10.72	1.49	....	24.50	30.62	2.24	....	56.44
0.75	6.56	8.75	10.93	1.50	....	24.70	30.93	2.25	....	56.82

CUT PROJECT COST 60 PER CENT

(Continued from page 239)

Place.	Weight of heaviest team.	Weight of average team.
County of Dallas.....	2700 lbs.	2300 lbs.
City of Dallas	2680 lbs.	2500 lbs. .
City of Houston	2560 lbs.	2400 lbs.
City of Ft. Worth.....	2800 lbs.	2200 lbs.
City of Austin	2250 lbs.	1990 lbs. .

The county of Dallas does excellent work and owns 80 teams and does not have a single team that would come up to the Reclamation specifications.

3. The clause in the specifications of the Service which provides that work (concrete or other kinds), could be rejected although it had been accepted by the inspectors or local engineers.

According to this some district or supervising engineer could appear upon the scene and order work taken out of the base of a structure after it has been inspected and placed under the very eyes of the local employes of the Reclamation Service.

This clause within itself would be enough to drive contractors away, even if the said contractors had the 1400 pound mules.

It is not surprising that no bids were received on the Carlsbad project for the Avalon dam.

There is only one class of contractors that could or would take a contract under these two clauses.

It is with profound regrets that I now make these further remarks bearing on the whole question of cost and its payments.

Having a warm personal regard and a fondness for the present and former directors of the United States Reclamation Service, I make the following remarks as a duty to the Reclamation Service and the water users and with a desire to protect the Service:

1. I would that the Reclamation Service as a whole, its line of officers and its rank and file, spurn the doctrine that "The king can do no wrong," that it deal with the "water users as the water users would deal with another, yielding nothing in charity, but dealing together as men and brothers on the basis of what is reasonable and just."

2. I would that the Reclamation Service in its whole organization realize that the water user is the ultimate vital unit of all projects and that if the farmer fails to make a living on account of improper construction costs, or unreasonable or unnecessary operation and maintenance charges, the project will fail, and it will be a monumental failure and that these silent monuments will stand upon the desert to remind posterity of a government failure and a civilization that failed.

3. I would that the water user could have secured to him some means of approaching the "Great White Throne" with his humble petition without being answered with the financial lash of paying all the freight.

4. I would that the United States government could realize that the water user digs down in his jeans, sells his cow or his fattening hog to pay his humble part or assessment for the simple privilege of saying his official prayers to the Great White Father, and that when his prayers are listened to he is compelled to pay an additional cost for the judge, jury, witness, and attorneys for both sides of the hearing.

5. I would that the Reclamation Service be soon delivered from the Cormorant of the "Force Account."

6. I would that the water user should have guaranteed to him some measure of security in his little cottage with his family of human beings without financial bondage like the sword of Damocles hanging over his head and that of his children.

At the present there seems no possible end to the construction cost per acre.

A big dam may fail on account of engineer or the unpardonable neglect, the incompetence of a watchman employed by the Service.

The water user had no voice or vote in the selection of either, and had neither the right to hire or fire, and yet he is absolutely compelled to agree to another increased construction cost per acre or let his land go back to the wilderness.

He Has Only the Right to Pray and Pay

7. I would that each project could have an efficient project manager and that each would be as frank as the project manager of the Carlsbad project was, when he stated to the Review Board (page 987), that under conditions of 1915 with a maintenance charge of \$1.45 for three acre feet of water, a farmer whose home is six miles from the railroad can not make a living.

8. I would that each Reclamation official could be compelled to spend one month in a water user's cabin, eat his simple fare of bacon, beans and bread, and that he could be compelled to learn this lesson from the original record of cold facts.

9. The record of the Carlsbad hearing shows that the water user on the Carlsbad project has fought a good fight to build a home; has kept faith and all he asks here is that the government of the people, by the people and for the people, keep its word.

10. And now realizing the total costs, with all reverence and with a full realization of the present conditions obtained by careful research, I utter the prayer:

"GOD PITY THE WATER USERS ON THE CARLSBAD PROJECT."

CONGRESSMEN TO SEE PROJECTS

A subcommittee of the Committee on Appropriations of the lower house of Congress left Chicago a few days ago in a trip over the Federal irrigation projects. Under the Reclamation Extension Act, irrigation appropriations are now made by Congress, and the Eastern members propose to find out at first hand what the money has been aid is being used for.

The junket may prove of unusual significance, as the revaluations of the projects are now under way. Settlers will have opportunity in nearly all the projects to tell the Congressmen about conditions.

The Congressmen in the party are: John J. Fitzgerald, chairman of the Committee on Appropriations; Swager Sherley of Kentucky, William P. Borland of Missouri, Joseph W. Byrus of Tennessee, Charles R. Davis of Minnesota, Frederick H. Gillette of Massachusetts, James W. Good of Iowa, Frank W. Mandell of Wyoming, and James McAndrews of Illinois.

AUSTRALIA SORRY TO LOSE MEAD

(Continued from page 244)

face the most hostile audience, and generally not only have his say out, but would leave them partly, if not thoroughly, convinced. Frequently he has found an audience of roaring lions, and his cool, persuasive and convincing way and arguments have converted them into the proverbial lambs. Deputations have been appointed by indignant meetings to wait upon him and go as close to eating him as possible. They invariably returned smoothed and full of Mr. Mead's arguments and expectations for a less troublesome but brighter future.

Mr. Mead gave evidence of possessing qualifications that were the envy of politicians, and such as would have brought him to the forefront in any line of life. He could give "the soft answer that turneth away wrath." He had a genuine warmth of feeling and kindness of heart that prompted him to take a personal interest in everyone with whom he had dealings, and particularly the settlers and the officers of the water department. He had a remarkably retentive memory, and could not only reel off huge figures connected with such a vast enterprise as the irrigation settlements of the state with readiness and unerring precision, but would remember faces and incidents. He was one of the most popular men to travel with. Although every now and again he would revert to features of the great work the commission had in hand, he had a reservoir of humor and incidents to draw upon with which to relieve the tedium of a long train journey. But never would his irrigation maps, statistics, and bulletins be far from his knees. They would certainly be somewhere in the railway compartment projecting from bags or the racks. Every one who traveled with Mr. Mead, whether he be politician, reporter, or land seeker, would soon be a willing student, learning of the great possibilities of irrigation in this state, as well as getting an insight of the difficulties of the past, and those to be overcome and avoided in the future. Mr. Mead could answer any question readily, and with convincing satisfaction, no matter how intricate the issues involved. It would be a magnificent thing for this state and the commonwealth if before he returns to America, Mr. Mead were invited to address both the state and Federal Parliaments on the Murray waters question. This special information is just what the country needs, and would appreciate before taking the momentous step of ratifying the agreement. If they heard him it would be ratified.

This unexampled drought has raised new problems, or, rather, has given edge to the contentions of Mr. Mead when he first came to this country. Chiefly they relate to the economic waste in sending water long distances, which could be used with a minimum of waste in irrigating areas surrounding the water storages, such as Waranga. Mr. Mead had strong views on this matter, and his representations to the political heads would make interesting reading were they published. Even yet politics prevail too largely in the administration, and their influence is more discouraging to a strong man like Mr. Mead than are the wails of a thousand large landholders who are only learning the possibilities of irrigation. But as far as the large landholders are concerned, there has been a complete reversal in their attitude towards Mr. Mead.

They have been clamoring for water rights. They have admitted that the water charges are remarkably low compared with the advantages, but they have found to be true what they were warned by Mr. Mead at the beginning, that the amount of water available for irrigation was limited, and there would soon come a time when the whole of it could be allotted with safety. No one more than these selfsame men will regret his departure.

WATER MEASURING DEVICES

(Continued from page 246)

covers what is necessary for an 18-inch Cipolletti weir box and weir as installed at Davis. This box is long enough and of such other dimensions as to meet the general conditions that have been named. In some situations the box might be made somewhat shorter, but the additional cost required for a 12-foot over, say, an 8-foot box is not sufficient to justify using the shorter box where only a small number of weirs are involved. This box is suitable for measuring from about 0.25 to about 1.75 or 2 cubic feet per second, equivalent to 12½ to 100 customary California minister's inches.

BILL OF MATERIAL FOR CIPOLLETTI WEIR BOX.

	Board Feet.
4 pc. 1" X 12" X 2' (cut-off walls).....	8
1 pc. 1" X 12" X 7' (cut-off walls).....	7
4 pc. 1" X 12" X 12' (main walls).....	48
7 pc. 1" X 12" X 12' (floor)	84
8 pc. 2" X 4" X 3' (posts)	16
2 pc. 4" X 4" X 4'-4" (posts)	12
8 pc. 1" X 2" X 2' (cleats)	3
1 pc. 2" X 4" X 4'-6" (gate stem)	3
1 pc. 2" X 2" X 6' (gate stem brace)	2
2 pc. 2" X 12" X 3' (gate)	12
2 pc. 2" X 12" X 3' (weir board)	12
8 pc. 2" X 4" X 3'-10" (caps and sills).....	21
Total	228

The weir without end contractions is illustrated by Figure 14, which is from a photograph of the weir of this type installed at Davis. It is different from the Cipolletti weir just described mainly in having the weir board extend the full width of the weir box. The same bill of material can therefore be used except that more or less lumber will be necessary according to the width and height of the weir chosen. This type of weir can only be used in a channel of constant cross-section and vertical sides directly above the weir, such as is provided in the box shown. This weir must be so constructed as to allow free access of air to the under side of the falling sheet of water. This can be accomplished by making a horizontal notch in the side of the weir box directly below the crest and extending down stream to the end of the wall. The water must not be allowed to approach the weir with an appreciable velocity. The velocity of approach is largely governed by the height of the weir board above the bottom of the box. It has been suggested by Professor Richard R. Lyman of the University of Utah, that a weir of this type 1 foot or less long should be 6 inches high, that with lengths of 1.5 to 2.5 feet, it should be 9 inches high, that with lengths of 3 to 4 feet it should be 1 foot high, and that with lengths of 5 to 7 feet it should be 1.5 feet high.

The next article will deal with the measurement of water through submerged orifices.

HOW TO BUILD A PIT SILO

(Continued from page 235)

Concentrates: Oats, bran, oil-meal, cotton-seed meal, gluten feed, beans, peas.

Roughages: Alfalfa hay, clover hay, pea hay.

A dairy cow should receive some of the feeds belonging to each class. For instance, corn silage and alfalfa hay constitute a balanced ration. Prairie hay and corn-silage do not make a balanced ration.

Four experimental pit silos were built in different parts of western South Dakota.

Two of these silos were filled with corn partly green, one was filled with corn and Russian thistles and the other was filled with dry corn.

During the winter, while feeding was in progress, samples of these silages were sent to this experiment station to be analyzed, with the following results:

Silo	Moisture	Ash	Crude protein	Ether extract	Crude fiber	Nitrogen free extract	Acidity
Newell Pit Silo.....	50.74	2.21	3.98	1.44	8.46	33.17	1.58
Rapid City Pit Silo..	62.57	1.65	3.80	0.73	7.17	24.08	2.03
Ida Pit Silo.....	78.33	0.93	1.47	0.73	5.74	12.80	1.20
Philip Pit Silo.....	63.02	8.54	6.96	0.47	7.83	12.18	0.11
College Dairy Farm, Brookings	70.09	1.88	2.68	0.74	6.54	18.07	2.10

The Pacific Pipe & Tank Company of Portland, Oregon, has obtained the contract for the construction of wood stave pipe for the Snipes Mountain pumping plant of the Sunnyside Unit, Yakima project, Washington. The bid of the company was \$11,093.73. The contract calls for 905 feet of 60-inch and 3,355 feet of 30-inch pipe and the necessary steel bands and shoes in place.

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Lough, Scott,
Kan., writes:

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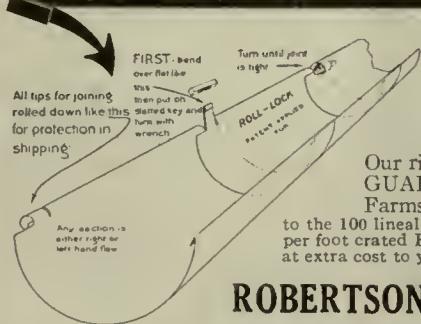
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above the ground under a storm-proof covering that enables you to use the Tent-Cot every night in the year, and all the doors and windows are fitted with both storm and mosquito curtains that can be raised and lowered at will of the occupant. For anyone afflicted with lung trouble there is nothing equals the Tent-Cot. It also has a splendid appearance and can be set up on your porch, lawn or roof and taken down when not in use. Can be set up in a space 30x78 inches and only requires about 30 seconds to operate. It is ideal for hunters, fishers and campers as it eliminates all the annoyance of "making camp." With a Tent-Cot you carry your camp with you under your arm and sleep safe and sound any place.



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SPECIFICATIONS—Length of cot open, 6 ft. 6 in.; width of cot, one person, 28 in.; width of cot, two persons, 44 in.; height of bed from ground, 17 in.; height of tent over cot, 32 in.; size of cot folded, for 1 person, 28x36; size of cot folded, for 2 persons, 44x56; weight, 1 person, 29 lbs.; weight, 2 persons, 44 lbs.; frame is of hard maple, painted green; covering is of heavy waterproof canvas in colors, tan or olive green.

PRICE—Tent-Cot 28 in. wide, open 1 side, \$9.00; Tent-Cot 28 in. wide, open 2 sides, \$9.50; Tent-Cot 44 in. wide, open 2 sides, \$11.50.

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PLASTERING WITH A GUN

By CARL WEBER, C. E.

President Cement-Gun Construction Company, Chicago.

The mortar lining applied by the Cement-Gun process differs greatly from any hand-applied or poured material and shows characteristics all of its own. Numerous comparative tests have been made to compare the qualities of "Gunite" with other materials of the same composition and it has been found that in every instance Gunite is vastly superior. Tested for tension and compression the strength of Gunite is from 1.5 to 4 times greater than the best hand applied mortars. Gunite is waterproof and adheres to hard surfaces with utmost tenacity. Steel girders have been coated with Gunite and after the coating was removed by bending and dropping the steel members it was found that a film of cement still remained on the steel, protecting the same effectively against corrosion.

These qualities make Gunite very desirable for encasing of steel structures for rust prevention and numerous large and small railroad bridges have been protected in this manner. For the fireproofing of the structural steel in large buildings, Gunite has also found wide adoption and amongst others, the steel work of the Woolworth building in New York has received Gunite encasing.

Another large field for Gunite work is the repair of old disintegrating stone and concrete walls, etc. Large sea walls, bridge foundations and similar structures have been successfully restored even after decay had gone so far as to endanger the safety of the work.

Another most successful use of Gunite has been found in the waterproofing of large and small water reservoirs. As stated before, Gunite is waterproof on account of its density and no compounds, soap, paraffin or other mixtures are ever used. Large concrete reservoirs which would not be considered safe on account of excessive seepage have been treated with the Cement-Gun and in a reservoir in San Francisco a Gunite application of from only $\frac{1}{4}$ inch to $\frac{1}{2}$ inch thickness was found sufficient to make the same absolutely safe against a water pressure of about 27 feet depth. The subject of waterproofing of reservoirs, etc., is of so great an importance to irrigation interests that I decided to give a full account of the same in a later part of this paper and therefore will only mention it here briefly. Just at this time we are executing extremely interesting work of this kind for a large water power plant in Illinois and I will give a description of the same with illustration in a later issue of IRRIGATION AGE.

(To be continued)

RAILROADS CAN CROSS PROJECTS

The decision of the Ninth United States Circuit Court of Appeals that railroads cannot be constructed across reclamation projects, even with the authorization of the entrymen, without the consent of the Secretary of the Interior, has been reversed by the Supreme court in the suit of the government to enjoin the Minidoka & Southwestern Railroad Company from extending its line across the South Side Minidoka Project in Idaho.

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BRIEF NOTES FROM IRRIGATION PROJECTS

South Dakota

An irrigation project along Spring creek, near Rapid City, S. D., is being organized. The storage dam and reservoir will be about eight miles south of Rapid City and will hold about 13,600 acre feet of water or enough to irrigate about 12,000 acres, allowing a foot to the acre. The main canal will be about 28 miles in length and the water will be conveyed to the reservoir through about two miles of concrete lined ditch which will prevent waste through seepage. The estimated cost is \$30 per acre or about \$360,000 for the project with operation and maintenance is expected to be at 50 cents per acre.

Utah

Directors of the Davis & Weber Counties Canal Company, which furnishes water for thousands of acres of lands south and west of Ogden, Utah, have forwarded the contract to the Utah Construction Company for the building of an immense concrete dam in East Creek canyon, through which the amount of conserved water supply for irrigation will be doubled. The dam will cost about \$150,000.

Bonds in the amount of \$25,000 will be issued by the Lower Mill Creek Irr-

igation Company, operating between Twenty-first and Seventh East streets and Thirteenth and Fifteenth South streets in Salt Lake City, Utah, for putting in wood stave piping to take place of the main canal, for irrigation and culinary purposes, if plans now being made are carried out. The purpose of the proposed new line is to save the water now lost through seepage and evaporation.

Colorado

An attempt will be made to adjust out of court differences between creditors of the Denver Reservoir & Irrigation Company of Colorado and the Chicago Title & Trust Company, which acted as trustee, and receiver, appointed by the federal court. During the receivership, and trusteeship it is charged the debts of the company increased from \$4,000,000 to \$7,000,000. R. M. Quigley, chairman of the committee, declared that, following a conference with officials of the Chicago Title & Trust Company, it was decided to resort to the courts only if no other settlement can be effected.

Oregon

Eugene, Ore., men are planning to drain and irrigate 10,000 acres of the

rich land on the peninsula between the Willamette and McKenzie rivers.

The Western Land & Irrigation Company, of Hermiston, Ore., has filed application with the state engineer for permission to construct two reservoirs to store 14,350 acre feet of water of the Umatilla river, the water stored to be used as a supplemental supply for the reclamation of 15,576 acres of land. The cost of the work is to be \$370,000.

California

The California supreme court has ruled that the Sacramento Valley West Side Canal Company is a public service corporation and must serve all lands within the old Central irrigation district without the preliminary purchase of water rights.

Attorney Charles L. Donohoe, who is one of the big land owners affected, said in regard to the decision: "By the terms of this decision the canal company cannot sell water outside of the 156,000 acres in the old irrigation district until all needs within it have been supplied.

"Neither will the company be able to furnish water to 50,000 acres of its own lands outside of the district until requirements within have been met.

"The Mills Orchard project, west of

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Maxwell, will be affected. It is situated outside of the project and must take its chances of an oversupply of water."

Two concrete automatic gates have been installed by Water Company No. 3 in its irrigation system in the Imperial valley of California.

Plans have been drawn for another million-dollar reservoir project in the mountains above Oakdale, to supply water for the Utica Gold Mining Company and furnish irrigation flow for the Oakdale irrigation district of California. This is the second source of storage offered to the Oakdale and the south San Joaquin district. The cost of the reservoir alone is estimated at \$1,100,000, which does not include the power plant, nor the canals which must be constructed.

Filings have been quietly made by the power company and by the irrigation districts jointly, with the federal and state governments, and if the irrigation districts vote to combine with the Utica company in the undertaking they will have title to all the water for irrigation purposes.

The proposed reservoir will cover over 900 acres and will hold 62,836 acre feet of water. The water is to be taken from Highland creek, and it will develop 2,700 horsepower. It will require three years to complete the undertaking.

After being withheld from the mar-

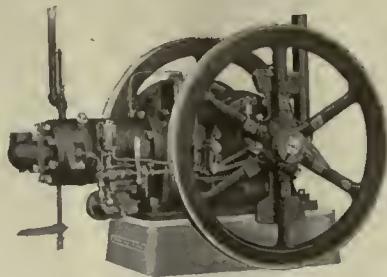
ket for many years what is declared to be E. J. ("Lucky") Baldwin's choicest tract of citrus land in California has been subdivided and is being sold under the name of Baldwin Heights in parcels ranging from one acre upward for groves and country homes. The land adjoins the city of Covina and consists of 1,400 acres of Baldwin's famous La Puente ranch. Baldwin would not allow this property to be sold during his life, as he is said to have considered it the best of his holdings. After his death the heirs sold the property to the present owners. The land is watered by a good irrigation system.

A record for installing an irrigation pump was made recently. J. P. Shelton of Burbank placed an order with a Los Angeles concern for the immediate delivery of a turbine centrifugal pump and the same week the pump was in running order, throwing a fine stream of water. The pump was manufactured by the Layne & Bowler Corporation.

New Mexico

A new development company has been formed at Playas, N. M., and active work has begun in reclaiming several thousand acres of land in the

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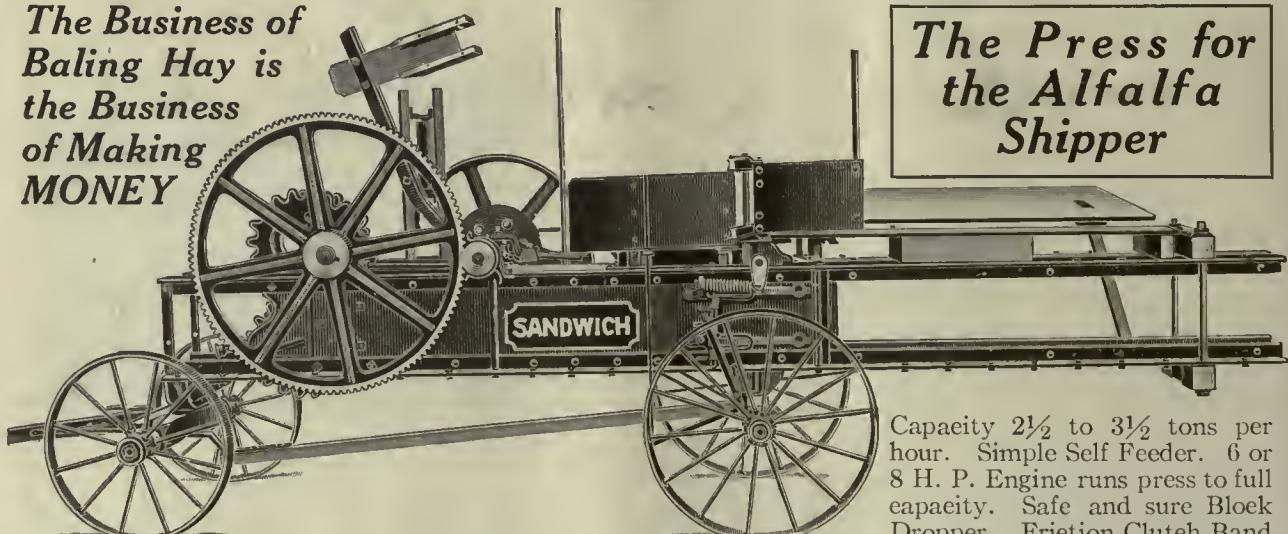
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Playas valley. The company has been organized by California capitalists, headed by Milton McWhorter and J. F. Winner, of Oakland, Cal.

O. W. Johnson is planning to irrigate 1,000 acres near Maxwell, N. M., by pumping water from the Red river.

State Engineer French of New Mexico is preparing to sink three test wells for irrigation in Torrance county. He expects to develop a large underground supply of water.

E. E. Hartshorne, Carlsbad, N. M., is installing an irrigation pumping plant on the Pecos river.

J. A. Gore and L. G. Lilly, Alamogordo, N. M., are installing an irrigation pumping plant.

Texas

Farmers around Donna, Texas, are planning a \$900,000 bond issue for the purchase of the La Donna Canal Company's holdings and to put the whole system in first-class condition. C. E. Clark, engineer for the irrigation district, places the cost at \$889,000.

Montana

A \$140,000 irrigation project around Brady, Teton county, Mont., has been launched.

The Billings Land & Irrigation Company of Montana has sold 16,000 acres in the Billings bench to the Montana Ranches Company.

Foreign

President Benavides of Peru has issued a supreme decree accepting, with slight modifications, the contract proposed by Breitung & Company, Lim-

ited, of New York, for the irrigation and colonization of Peruvian coast lands. The government will issue bonds to the amount of £2,000,000 sterling (\$10,000,000), which Edward N. Breitung will negotiate. The bond issue matures in thirty years and the lands are to be sold on twenty-year payments. Approximately 100,000 acres will be added to the cultivated area of the country. The company has until July 15 to examine and approve the contract and transfer the

twenty-thousand-pound guarantee to Lima.

A large ranch near Medicine Hat, Alberta, will be brought under irrigation if drillers now at work are successful in striking natural gas, which is altogether likely, as the whole country around Medicine Hat appears to be underlaid with gas. The owner of the property intends to use the natural gas for generating power with which to pump water from the Saskatchewan river to irrigate his land.

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Iowa, Independence
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Pennsylvania Metal Cul. Co.
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Tennessee Metal Culvert Co.
Texas, Dallas
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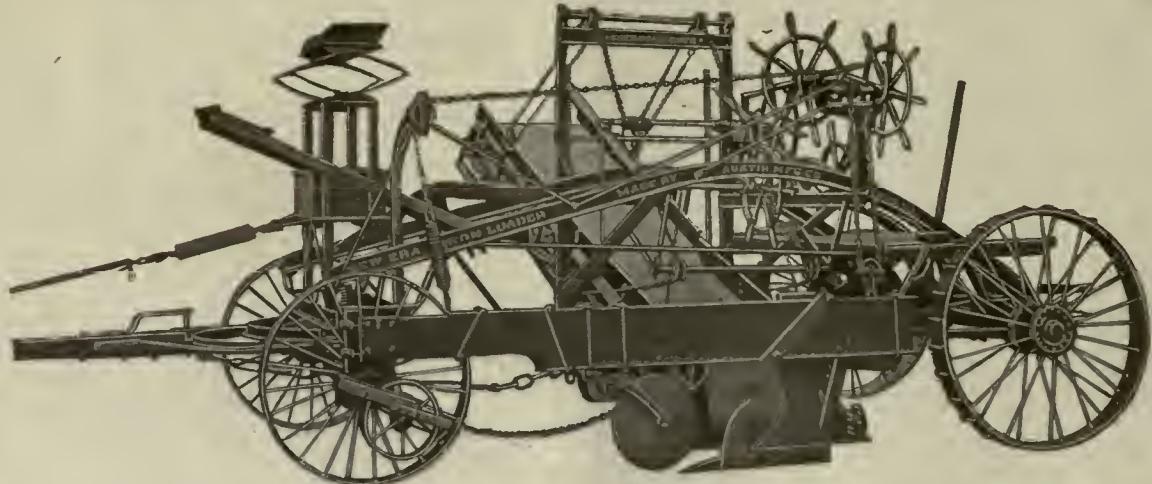


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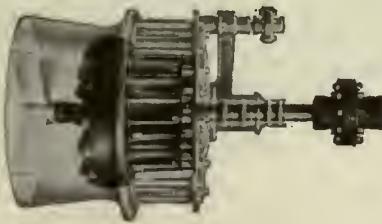
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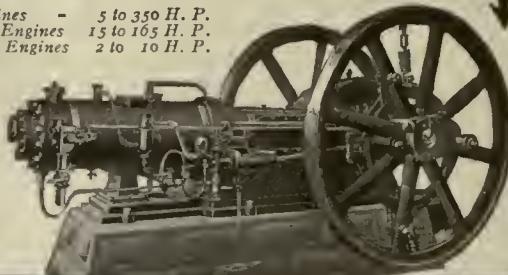
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All the above—just what you have always wanted in an oil engine—are to be found in the Bessemer. Not experimental, but the matured result of years of experience. Two stroke cycle, built with crosshead, thus adding years of life to the engine. 15 to 165 H. P. ready for quick delivery. **FREE CATALOGUE.**

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Thirtieth Year

THE IRRIGATION AGE

VOL. XXX

CHICAGO, JULY, 1915.

No. 9

THE IRRIGATION AGE

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THE IRRIGATION ERA

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THE WATER USERS' BULLETIN

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THE IRRIGATOR

D. H. ANDERSON

PUBLISHER,

Published Monthly at 30 No. Dearborn Street,
CHICAGO

Entered as second-class matter October 3, 1897, at the Postoffice
at Chicago, Ill., under Act of March 3, 1879.

D. H. ANDERSON, Editor

ANNOUNCEMENT.

The "Primer of Hydraulics" is now ready; Price \$2.00.
If ordered in connection with subscription \$2.50.

Settlers
Must Act
as Unit,
and Quickly

The costs of the Federal irrigation projects are to be fixed soon, "for all time." Secretary of the Interior Lane's final Board of Review will meet this month to begin passing upon the reports of the various project revaluation boards. Once the Lane supreme court hands down its decision, the water users' hands are tied.

Now is the time for action. It must be concerted action—action participated in by the settlers on every Federal project. The executive committee of the National Federation of Water Users' Associations should call a meeting of representatives from each project. This meeting should be held at an early date. A general policy should be agreed upon. Able men, acquainted with the problems of the water users, should be selected to present the settlers' case before the final board and Secretary of the Interior Lane. No expensive lawyers need be hired. There are plenty of brainy, whole-hearted men among the settlers themselves who are competent to present the case. Any one of these men, no doubt, will volunteer, gladly, to give of his time any amount necessary to fight his battle and that of his brother water users.

It will cost some money; not much; only a

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Associations has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Interesting to Advertisers

It may interest advertisers to know that The Irrigation Age is the only publication in the world having an actual paid in advance circulation among individual irrigators and large irrigation corporations. It is read regularly by all interested in this subject and has readers in all parts of the world. The Irrigation Age is 30 years old and is the pioneer publication of its class in the world.

few cents per settler. The returns will be in dollars. Every project, every settler, should help.

The National Federation, which is the most powerful weapon in the hands of the settlers, has been hampered for more than a year through lack of funds. Nevertheless, the officers of the Federation have fought on, paying their own expenses and many other costs. They have already accomplished much. They can do lots more if each project will contribute its share toward the expenses of running the Federation.

Battles are won by organized, concentrated armies. Scattered fire is wasted ammunition.

We urge President Earl B. Smith of Somerton, Ariz. (Yuma project), and Secretary O. E. Farnham of Newell, S. D. (Belle Fourche project), to take this matter into their own hands, set a date, a place of meeting and call a convention of delegates from all the projects, under the auspices of the National Federation. We bespeak the full support of the other members of the Executive committee. Fulton H. Sears of Fallon, Nev. (Truckee-Carson project); Scott Etter of Carlsbad, N. M. (Carlsbad project), and George E. Rodman of Sunnyside, Wash. (Sunnyside project). We are confident each one of them will endorse quick action by the President and Secretary in this crisis.

If the meeting is called, we urge every Water Users' Association to send delegates—delegates with power to act; with power to vote sufficient money to make a real fight in the interests of the settlers at Washington.

Ogden, Utah, offered sometime ago to entertain a convention of the National Federation. We believe she is willing still to throw open her doors. Ogden is centrally located for all the projects. The place, therefore, is easily fixed. Now for the date and the call for the meeting.

Act settlers! As one man, act! Your interests are common.

Play the Game Fair, Mr. Lane

Secretary of the Interior Lane has placed a ban of secrecy upon all decisions by the various project Boards of Review, which are investigating costs of Federal irrigation work. This ruling is wrong.

Summer Diet?
Yes, If You
Want One, But
Don't Under Eat,

One frequently hears the unmodified statements that it is well to eat very sparingly in the summer time, and, that very little or no meat should be taken.

In summer, it is true that there is not the body demand for the concentrated fuel, and so we instinctively turn from the rich fatty foods, such as fat meats, rich gravies, pastries, and fried foods.

Because meat contains in large proportions protein, which is a quick fuel, it is reasoned that therefore meat should be eliminated from the diet. The amount of meat may well be cut some, yet it is reasonable to assume that there is need for its tissue building value in summer as in winter, and it has not yet been shown that other protein types of food adequately take the place of meat.

Lusk in his Human Nutrition makes this statement: "But if a cool climate, there is no strongly substantiated argument why one should not follow the general custom of taking a medium amount of protein in moderate accordance with the dictates of his appetite."

In our eagerness to trim the corners let us not forget that the ill effects of under eating are no less to be avoided than those resulting from over eating, and that the advice of Mrs. Means, "Get a plenty while you're a gittin'" is a safe dietary maxim for most of us to follow.

**Do Not Keep
Cows That
Do Not
Pay Profits**

Year after year many farmers milk cows that do not pay for the feed they consume. Indeed, the average annual production of a cow in this country is approximately 4,000 pounds of milk, containing 160 pounds of butter fat. The best dairymen say there is no profit in such production, and, of course, there are vast numbers of cows that fall far below these figures. To make his herd a success, therefore, the farmer must weed out the animals that are costing him money and keep those that are bringing it in to him.

This, however, is not so easy as it may seem. Experiments continually show that it is impossible for any man, however experienced he may be, to estimate with any accuracy the yearly production of milk from any cow. Some animals start with a very good production and then drop to a very ordinary flow, while others give a much more regular yield. The latter may at the end of the year have given the farmer much more milk, but he will probably consider the former to be the profitable ones. As a matter of fact a man can not guess within a quart how much milk there is in a pail, and if he is selling the product of his herd on a

butter-fat basis he knows even less of the yield from each individual animal.

The co-operative cow testing associations are doing much to put dairying on a real business basis. They are money makers for the farmers.

One hundred and sixty-three of these associations were in operation last year in the United States. This is a rapid growth when it is remembered that the first association in this country was organized in Fremont, Mich., in 1905, and that as late as 1908 only six associations had been formed. America is, nevertheless, still far behind Europe, where there are at the present time between 2,500 and 3,000 such associations, the first having been started in Denmark in 1895.

**It's Better
To Stick
To the
Old Crops**

Although a large amount of money is spent annually for the importations of crude drugs, and the extermination of a number of valuable native drug plants is threatened, government specialists do not believe that the growing of drug plants offers any unusual opportunities for profit to the American farmer.

Drug plants are subject to the same diseases and risks as other crops and, in addition, knowledge of the best methods of cultivation and handling is less general than in the case of other and better known crops. In order to have the cultivation of drug plants financially successful in this country, the introduction of improved methods and the extensive use of machinery is probably necessary. Under these circumstances the natural tendency will be to increase the production in the interest of economy.

The demand for many drug plants, however, is so limited that if large areas are brought under cultivation there is considerable danger of overproduction. Prospective growers are urged, therefore, to acquaint themselves with market conditions before investing any considerable sum of money in this way.

**Stony
Soils
And the
Orchard**

A stony loam is often recommended as a desirable fruit soil, but stones are advantageous only in that they may help a soil that is too heavy or clayey or too impervious, by making it somewhat more pervious to water. The fact that a soil is stony does not necessarily imply that it is productive. If apples are to be grown with profit, and competition is keen, the soil must be productive or at least capable of being brought to a productive state and so maintained. Much of the current belief that "stony" soils possess some peculiar advantage for orchard fruits has undoubtedly arisen from the success of many orchards located on stony hills.

The Federal Water Users



A Department Devoted to the Interests of the Farmers on the Government Irrigation Projects

EDITED BY GEORGE J. SCHARSCHUG.

WHY NOT THE FRAUD LAW? SETTLER ASKS

WATER USER RANKIN told the Revaluation board on the Boise project in Idaho that if any private citizen had issued the glowing literature, published over the signature of the United States Reclamation Service to attract settlers, that private citizen would now be languishing behind prison bars for using the mails for fraudulent purposes. Water User Hubbard and several others backed up Mr. Rankin's statement.

Mr. Rankin explained to the board that he had been induced to settle on the Boise project through reading the booklets of the Reclamation Service, offering free land and water rights at \$25 per acre. And now the Reclamation Service insists upon the settlers paying \$75 per acre for the water rights.

Mr. Rankin added that if the government was cognizant of the facts shown in the literature which was sent, it ought to be subject to the same treatment which would be accorded an individual or a private company. At least the government ought to recognize the moral obligation it owed the settlers to be fair with them in the matter of fixing the cost of the project, and that within a reasonable range of the original \$25 representations.

It was pointed out that by reason of certain contracts entered into between the government and the Pioneer Irrigation District and other districts at the very time the \$25 per acre estimate was made proves that the government understood that that was the estimate they had recognized and that the government through the Reclamation Service, led the people to conclude that \$25 per acre would be charged.

The real construction of the physical part of the works, less overhead charges, probably would not be more than the \$25 per acre, but it was stated that the overhead charges have been four times the cost of

the actual construction.

A committee was appointed by the president of the board, Mr. Hubbard, to gather information which will prove the contention that the government did represent to settlers that the cost would be \$25 per acre.

And in the matter of ownership of the Arrow Rock storage dam. The settlers seem inclined to urge the government to retain that dam, and not to charge its cost up to this project. There was some opposition shown to the matter of the settlers owning the power and light feature. Many preferred that the government retain that feature.

Secretary Lane appointed a "settlers representative" on the Yuma (Ariz.) project to act on the Board of Review for that project, after the water users had voted practically unanimously against participating in the revaluation. The "settlers' representative" is reported "not satisfactory to the water users."

The revaluation proceedings on the Umatilla project in Oregon revealed the fact that the settlers were charged by the Reclamation Service for a canal on the site of which a Baptist church and a public school now stand. Charges, altogether, for about fifteen miles of large pipe lines, now abandoned, were uncovered.

Several of these canals never carried a drop of water.

An item of nearly \$200,000, known as maintenance, is being carried on the books against the project. This covers land to the extreme north of the project and which has never been opened for settlement.

Charged as examination, and which settlers are expected to pay, is an item of \$29,000, incurred before there was any project, and for work done in the Blue Moun-



Velocity Area Gaging Station, Wiahole Stream, Oahu, Hawaiian Islands.

tains and the John Day country. There is also an item of \$65,000 west extension investigations charged against this project. The settlers asked the removal of these two charges.

Under the head of general expense was found a charge of \$64,000 for maintaining the Portland, Chicago and Washington offices. It was contended that much of this was needless expense.

In all, nearly \$500,000 needless and worthless expenditures have been listed.

The Board of Review on the Belle Fourche project in South Dakota will resume its sessions again this month. In a letter to the editor of this department, O. E. Farnham, secretary of the Belle Fourche Valley Water Users' Association, says:

"We went into the review under protest, and protested against being charged with the expense. But were advised that Secretary Lane proposed to proceed with the review whether we participated therein or not.

"I have read the findings of Carlsbad Board with considerable interest, and the proceedings ought to be of considerable aid to other associations in presenting their case. We are expecting to make a very thorough and exhaustive investigation into expenditures on the Belle Fourche project. Our case has not developed, however, sufficiently to permit of any particular comments at this time. Presume that we shall

request a finding by the board that the main works be considered as public internal improvements, owned and controlled by the Government, and should be held in perpetual ownership and control by the Federal Government, and the cost thereof charged to the Government, leaving only the distributing system to be paid for by the water users, and the cost to represent the cost of the water-right. It has been suggested that perhaps the Government might be justified in collecting from the owners of the water rights taken out on said project a nominal rate of interest on the cost of the main works, which, in time, say, 50 years, would return to the fund the entire amount expended, or properly expended, as found by the board. It is our purpose, as a basis for these findings, to determine the proper cost of each structure connected with the project."

Commenting upon the majority decision of the Reclamation Board on the Carlsbad (New Mexico) project, as published in the June issue of THE IRRIGATION AGE, the Montrose (Colo.) Enterprise, published on the Uncompahgre project, says:

"Having listened to some of the testimony presented at the recent sitting of the review board for the Uncompahgre project, we have come to the conclusion that the situation on the Carlsbad project is not nearly so gloomy as the report pictures it. And on the other hand it is quite probable that the conditions are not so bright as the minority will picture it. A picture about half way between, although somewhat drab in color, would probably be a picture nearer the truth.

"The human equation has entered, to a remarkable extent, into the testimony which has been given at the board of review hearings. The natural impression being

that the darker that picture could be painted as to conditions on the Reclamation projects the greater the chances to secure concessions from the Government in connection with the charges against the land for the cost of the project, there has been an almost irresistible incentive to bear down heavy on the gloomy side. Having a goodly sized axe to grind, we of the Reclamation projects have proceeded to make what we have considered as the most of

our opportunities for grinding the same.

"Not that we have necessarily indulged in any falsehoods, however, for there is a dark side to a great many things of life, including trying to make a living under Reclamation projects. Our sin, if it be a sin, has not been in out and out prevaricating, but rather in the tendency to dwell at too great length on the gloomy side, to the exclusion of the brighter side, for there is a bright side as well as a dark side.

"If we would arrive at the truth as to conditions on our particular project, for instance, it would be a good idea to take the optimism of our boomiest days and place them on one side, and then take the pessimism of the testimony presented before the board of review, and then draw a line half way between the two as a means for arriving at a



A peach orchard in the Mimbres valley of New Mexico. Courtesy of The Earth.

general average.

"The danger in this instance of such great pessimism as shown by the report from the Carlsbad project is that Secretary Lane is liable to question its sincerity, thus lessening its weight as an official document in respect to the fulfillment of the purposes for which it is intended."

The Rupert (Idaho) Democrat publishes the Carlsbad decision in full, thanking THE IRRIGATION AGE for the opportunity. F. G. Burroughs, its editor, makes this comment on the decision:

"Meaty with food for thought is the report on our first page of the Board of Revision and Revaluation which has been at work on the Carlsbad project. This is the first report to be presented to the Secretary of the Interior, and certainly demonstrates that the sooner the completed projects are turned over to the settlers to manage themselves, the better it will be for the financial interests of the water users.

"It is an unfortunate thing that so grand and noble a work as that which the Government has undertaken, and, in many places, as in our own project, carried to a successful conclusion, is attended with so great amount of waste and injustice. The system of irrigation as contemplated in the Reclamation Act is the greatest, most wonderful, most beneficial thing on earth. That its accomplishment has been marred by the defects evidenced in the report under discussion is merely an incident, and in no wise reflects on the wisdom or expediency of Government operations along these lines.

"It is possible—it surely must be—for the Government to do things that can be done by private enterprise, just as skillfully and just as economically. Now that waste, extravagance, blind disregard for the interests of the settlers, has been conclusively shown and proven, it is up to the Secretary to remedy the wrong. A searching investigation should fix the blame, the culprits should be made to suffer, and the Government should shoulder the loss for the errors, or worse, committed by its agents.

"We think this will be done. We have great faith in Secretary Lane and in his desire to be just to the water users. The Carlsbad project is not a failure. It is a success. At the cost per acre established by the Government's own board of revision, successful homesteading is possible, but



Wailuku River at 2,500 feet elevation, near Hilo, Hawaii. Waters from this river are used for irrigation.

when the \$35.71 per acre is added for waste and bad management, and the cost raised thereby from \$20.71 to \$55 an acre, failure, instead of success, looms dark before the settlers and their families.

"We hope to believe that the conditions proven to exist on the Carlsbad project form a striking exception to conditions upon the greater part of the Government projects.

The report demonstrates to the fullest the wisdom of Secretary Lane's idea of creating these boards of investigation. The Secretary wants the facts, and it looks as though he was going to get them."

IRRIGATION BONDS FAVORED

Irrigation districts bonds in California have developed into the most secure securities in the state and now have a better standing in the money markets of the United States than municipal bonds, according to a comparative report furnished by Major Paul M. Norboe, assistant state engineer. Before the establishment of an irrigation bonding commission, composed of the attorney-general, state engineer and superintendent of state banks, irrigation bonds were discredited, according to Norboe, but now their backing and assessments are considered preferable to other bonds.

The Turlock irrigation district has issued \$2,169,622.73 in bonds and of this sum there is uncollected \$7,925.77, or 36/100 of 1 per cent; Modesto's issue amounted to \$1,773,175.72, of which \$852.95, or 5/100 of 1 per cent, is uncollected; Oakdale irrigation district has issued \$587,970.03, of which \$749.78, or 13/100 of 1 per cent is uncollected. The San Joaquin basin irrigation district leads them all with uncollected assessments, it having issued \$848,269.49, of which \$3,964.01 stands uncollected, being 47/100 of 1 per cent.

As a comparison with municipal bonds, Los Angeles municipal bonds, one of the best sureties in the state, are quoted as follows: Of an issue at various times of \$32,816,380.48, there remains uncollected \$226,848.28, or 69/100 of 1 per cent.

HUMAN PROBLEMS TOLD TO CONGRESSMEN

THE Congressmen, who will control largely the appropriations for future work on the Federal irrigation projects, are getting just a fleeting glimpse of the vast Reclamation works on their journey through the West. They are nearly all from the East, however, many of them have never previously seen an irrigation ditch or had any knowledge of the trials of the irrigation farmer, so even this moving picture sort of trip may prove of great value to them.

The entire Reclamation Commission and many of the Reclamation Service Engineers are sleeping, eating and talking with the Congressmen, day and night. Despite this, the settlers on most of the projects are finding opportunity to let the Congressmen know something about the human problems of government irrigation.

The members of the Congressional committee, a sub-committee of the committee on Appropriations, visiting the projects are:

- John Fitzgerald of New York, chairman.
- Swager Sherley, Kentucky.
- Joseph W. Byrnes, Tennessee.
- Wm. P. Boreland, Missouri.
- Geo. W. Rauch, Indiana.
- Jas. W. McAndrews, Illinois.
- Frederick H. Gillett, Massachusetts.
- Charles R. Davis, Minnesota.
- Frank W. Mondell, Wyoming.

Water users on the Truckee-Carson project in Nevada were loaded for the visiting Congressmen. At least one settler, who was not afraid to talk of the difficulties which the water users face in trying to develop a farm home on the project and in dealing with the Reclamation Service, was assigned to each auto used to show the party over the project. The settlers pointed out the spots of interest, but also kept the ear of the Congressmen with statements of conditions which they felt should be remedied.

At a public meeting, Fulton H. Sears, a settler and member of the executive committee of the National Federation of Water Users' Associations, and A. D. Drumm, who had been selected by the settlers, made short, pithy talks.

"It is a question," said Mr. Sears, "whether we shall have funds or have them cut off; we came here with full faith that the government would fulfill its promises; any one familiar with irrigation knows that with it must go a drainage system; the first drainage here was inadequate; then \$3,500 was spent on a system that was a failure, and now we are asked to pay \$9 an acre and the farmers of the project rejected the proposition. Men, women and their children have been brought here and we expect the government to keep faith with us."

Mr. Drumm asked how 500

poor water users could be expected to carry the burden that was intended for 2,500 people and then pay for an irrigation system.

"We started in at 40 cents an acre for maintenance," he said, "and this year it will in some cases be \$1.40 and \$1.50. This community cannot carry it. We cannot exist and carry the burden. Take a proposition that is intended for 2,500 people and let 2,000 of them step out, and what is the result?"

Congressman Byrnes of Tennessee said it was the desire of Congress to aid the people in every way and he trusted the project settlers would receive all that it was possible to do for them.

Commenting on the visit to the Truckee-Carson project, the Churchill County Eagle of Fallon, Nev., says:

"Several members of the appropriation committee expressed themselves very favorably impressed with the possibilities of the West, and especially with the actual development in Carson Valley and the conditions thus far attained on the Truckee-Carson project."



An irrigation pumping plant in the Mimbres valley of New Mexico.

IRRIGATION WATER MEASURING DEVICES

**By California Agents of Irrigation Investigations, Office of Experiment Stations, U. S. Department of Agriculture*

This is the fourth of a series of articles prepared from a bulletin issued by the College of Agriculture of the University of California, at Berkeley. The articles are illustrated with photographs and drawings of the various structures and devices used in compiling the data.—THE EDITOR.

The measurement of water through orifices has long been common in irrigation practice,

and various forms of orifices have been developed. The essential condition in the use of an orifice, eliminating the question of form, is that the water on the up-stream side of the orifice shall completely submerge it. If, when in use, the surface of the water on the lower side of the orifice is below the bottom thereof, the orifice is said to have a free discharge. If the surface of the water on the lower side of the orifice is above the top of the orifice, completely submerging it, it is classed as a submerged orifice. Except in the case of the miner's inch box, which is really but a form of orifice with free discharge, use of the orifice in irrigation practice is confined to the submerged form.

Submerged orifices, as used, can be divided into two general types, viz.: those with orifices of fixed dimensions (Figs. 15 and 16) and those built so that the height of the opening may be varied (Figs. 17 and 18). Orifices with fixed dimensions are usually made with sharp edges similar to the crest of a weir. The most usual type of the second class is the simple head gate (Figs. 17 and 18), which is also used as a submerged orifice, the height of opening and the loss of head being adjusted to the amount which it is desired to turn out and to the loss of head available. Of these two types, the sharp-edged orifice with fixed dimensions is much the more accurate.

The submerged orifice with fixed dimensions



Fig. 16—Photograph of submerged orifice used by the United States Reclamation Service.

is used for measurement only, the fixing of the size of the opening preventing its use as a head gate. The experiments which have been made by hydraulic engineers to determine the coefficient of discharge for the standard sharp-edged orifice approach in accuracy and number those that have been made for sharp-edged weirs. These experiments have shown the

coefficients to vary slightly with the size of the orifice. For the sizes used in the measurement of individual deliveries of irrigation water this variation may be overlooked and one formula used for all sizes.

In order that the known formula for the discharge through such orifices shall apply, certain standard conditions must be observed in the construction and use of these orifices. The edges of the orifice must be sharp and definite in shape. It is preferable to use a thin metal plate, as this is not subject to wear and change. The edges of the orifice should not be too near to the sides of the box on either the upper or lower sides; a distance equal to twice the least dimension of the orifice is sufficient. The orifice should be vertical with the top and bottom edges level. The ditch above the orifice should be sufficiently large so that the velocity of approach will be small, as is necessary in the case of a weir. Corrections can be made in the computations for any velocity of approach but such corrections are more or less uncertain.

The principal sources of error in measurements with this type of orifice are due to errors in the gage readings to determine the difference in the elevation of the water on the two sides, this being the head or pressure that forces the water through the orifice. As these orifices are generally used where there is but little loss of head available, the

ranged for publication by Frank Adams, irrigation manager.

The installation of the Davis field laboratory, and the testing of the devices have been jointly paid for from funds contributed by the state engineering department of California, the office of experiment stations of the United States department of agriculture, and the California agricultural experiment station. Co-operation with the state engineering department of California has been effected through agreement between that department and the office of experiment stations, the irrigation investigations at Davis having formerly been carried on by those two agencies without financial aid from the California agricultural experiment station.

(The next article will deal with mechanical devices that measure and register the total flow of water.)

*The installation of the measuring devices described in this series of articles has been carried out chiefly by S. H. Beckett and R. D. Robertson, irrigation engineers, assisted by Roy Wray. The tests of the devices have been made under the immediate direction of S. T. Harding, irrigation engineer, in charge of irrigation investigations in Montana, temporarily on duty in California, who has also prepared the reports of the tests. The weir tables have been prepared by Wells A. Hotchkiss. The drawings and diagrams have been prepared by Stephen C. Whipple, scientific assistant. F. L. Bixby, irrigation engineer, in charge of irrigation investigations in New Mexico, temporarily on duty in California, assisted in designing the general plan of installation. The full study has been planned and, in general, supervised, and the data has been ar-

opening is usually made sufficiently large to require as little loss of head as is practicable. Any error in reading this loss of head is thus a larger percentage of the whole than it would be for greater total differences.

In the use of the submerged orifice two gage readings are required, one above and one below the orifice. The reading above the orifice should be taken back from the edge of the orifice. In the type of structure shown in figures 13 and 14 this can be taken on the side wing wall. The measurement below the orifice should be taken at least two feet below it, and farther if the discharging water is rough. A convenient method of obtaining the difference in the elevation of the water above and below the orifice is to set marks at equal elevations above and below the orifice or to set a board with its top level extending above and below the orifice sufficiently far to give good points for measurements.

The difference in measurements from this level board to the surface of the water above and below the orifice gives the head or pressure under which the water is passing through the orifice.

The type of orifice described above and illustrated in figures 13 and 14 has been adopted by the U.S. Reclamation Service for use where sufficient loss of head is not available for weirs. The data given here regarding

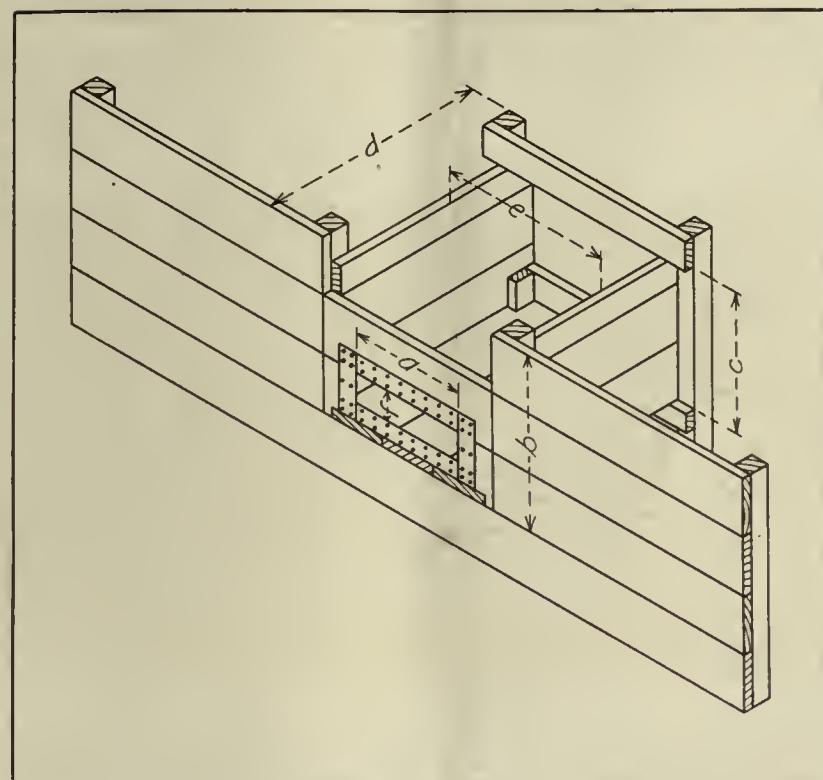


Fig. 15—Drawings of submerged orifice used by the United States Reclamation Service.

mean of all tests gave a coefficient for use in the formula given with the table of 0.61, which is the same as has been found in other experiments.

When properly installed this type of submerged orifice should give dependable results if the difference in head is correctly measured. Care should be taken to prevent silting in front of the orifice or the catching of drift.

DIMENSIONS AND LUMBER FOR STANDARD SIZES OF SUBMERGED RECTANGULAR ORIFICES.							
Size of Orifice	Headwall	Side	Structure	Floor	Approximate		
Height	Length	Area	height	height	length	width	quantity
f	a	sq. ft.	b	c	d	e	in ft. B.M.
0.25	1.00 2.00 3.00	0.25 0.50 0.75	3.0 3.0 3.0	2.5 2.5 2.5	4.0 4.0 4.0	2.0 3.0 4.0	150 170 185
0.50	1.00 1.50 2.00 2.50 3.00	0.50 0.75 1.00 1.25 1.50	3.0 3.0 3.0 3.0 3.5	2.5 2.5 2.5 2.5 2.5	4.0 4.0 4.0 4.0 4.0	2.0 2.5 3.0 3.5 4.0	150 160 170 175 210
0.75	1.33 1.67 2.00 2.33 2.67	1.00 1.25 1.50 1.75 2.00	3.0 3.0 3.0 3.5 3.5	2.5 2.5 2.5 3.0 3.0	4.0 4.0 4.0 4.0 4.0	2.0 2.5 3.0 3.0 3.5	150 160 170 190 200

TABLE 4—DISCHARGE OF SUBMERGED RECTANGULAR ORIFICES IN CUBIC FEET PER SECOND, COMPUTED FROM THE FORMULA $Q = 0.61 \sqrt{2gH} A$.

Head	Cross-sectional area A of orifice, square feet						
feet							
0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.00
0.01	0.122	0.245	0.367	0.489	0.611	0.734	0.856
.05	.273	.547	.820	1.093	1.367	1.640	1.913
.10	.387	.773	1.160	1.557	1.933	2.320	2.707
.15	.474	.947	1.421	1.895	2.369	2.842	3.316
.20	.547	1.004	1.641	2.188	2.735	3.282	3.829
.25	.612	1.223	1.834	2.446	3.057	3.668	4.280
.30	.670	1.339	2.009	2.678	3.347	4.017	4.687
.35	.724	1.446	2.169	2.892	3.615	4.338	5.061
.40	.774	1.547	2.321	3.094	3.867	4.641	5.415
.45	.820	1.640	2.461	3.281	4.101	4.921	5.741
.50	.865	1.729	2.594	3.458	4.323	5.188	6.052
.55	.907	1.813	2.719	3.626	4.533	5.439	6.345
.60	.947	1.895	2.842	3.790	4.737	5.684	6.632
.65	.986	1.972	2.958	3.944	4.930	5.916	6.902
.70	1.023	2.046	3.069	4.092	5.115	6.188	7.161
.75	1.059	2.118	3.178	4.237	5.296	6.355	7.413
.80	1.094	2.188	3.282	4.376	5.470	6.564	7.658

the sizes of the structures, and the table of discharges (Table 4) are taken from the publication of the Reclamation Service on the measurement of irrigation water and from their standard plans for submerged orifices. The cost of one of these devices installed will vary from about \$5 to about \$15.

One of the orifices described above, 2.0 feet wide and 0.5 foot high, has been installed at Davis and a series of tests made with discharges of from 1 to 2.2 cubic feet per second. The

submerged orifice headgate (Figs. 17 and 18) has been used to a large extent on systems where the small loss of head available makes a combination of head gate and measuring device necessary. While all such devices have many points of similarity, different canal companies have adopted slightly different forms as their standard.

The accuracy of measurement of water through a submerged

opening depends on the measurement of the loss of head, the area of the opening, and the selection of the coefficient for use in the formula of discharge.

Measurements of the pressure for such gates are made in the same way as described for the submerged orifice with fixed opening. The best method is to make the measurements sufficiently far from the gate to avoid any sucking of the water on the upper side or rough water below. The pressure sometimes is determined by

measuring down to the water surface on the upper and lower sides of the gate. This is a poor method, as the water is liable to be drawn down below its true level above the gate and to shoot out from the gate below. The area of the opening is generally measured between a fixed mark on the gate stem and the top frame of the gate, the mark being placed so that it is even with the top of the frame when the gate is closed. The width is the same for any height of opening.

The proper coefficient to use in computing the discharge through such orifices is uncertain. Within

general limits for any fixed set of conditions, the coefficient is probably nearly constant, but the actual coefficient to use may depend on many variables. For this reason discharge tables are not included. The values for sharp-edged orifices 0.61 or 0.62 have been used by some canal companies. It is certain that these values are too low for the orifices made of either 1-inch or 2-inch lumber. The Yolo Water and Power Co. have adopted a standard form of headgate 3 feet wide with spreading wing walls, the bottom of the gate being 1 inch above the floor. Experiments made with this gate under the direction of Professor B. A. Etcheverry gave a mean value for the coefficient of 0.73, which has been adopted by the company for use in the delivery of water.

Tests of a submerged orifice gate under two conditions were made at Davis. One gate 3 feet wide with the bottom 6 inches above the floor was

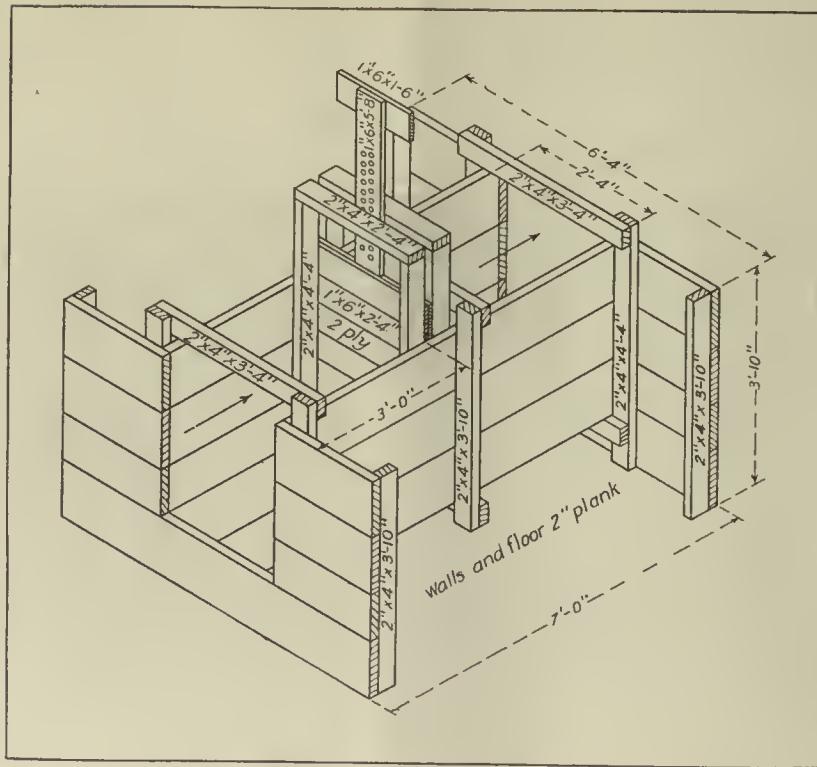


Fig. 17—Drawing of a submerged orifice head gate.

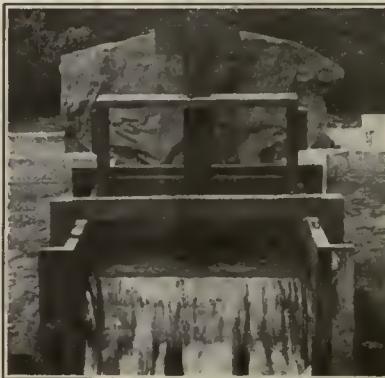


Fig. 18—A submerged orifice head gate in action.

set at the upper end of the turnout box diverting from a concrete flume. This gate is similar in type to the one shown in Figure 15. It was tested with discharges of from 0.50 to 4.25 cubic feet per second. The height of the side walls prevented the use of larger discharges, although the gate can handle much larger heads. The loss of head was determined by measuring down from a level board above and below the gate and also on the gate. The mean of all measurements using

the level board gave a mean coefficient of 0.80; the measurements on the gate gave a mean of 0.72 but were more variable than the others.

A similar gate set across the 3-foot wide concrete flume of the field laboratory was also tested, giving a mean value of 0.79 for the coefficient with level board readings. The discharges varied from 1.6 to 6.9 cubic feet per second in these experiments.

 From these results it is seen that the coefficient for such measuring gates varies with the type of gate. It is possible that the coefficient would have been lower for higher rates of discharge at Davis if such tests could have been made.

There are several types of these gates in use in California. The gate used by Imperial Co. No. 1 is set 4 feet back from the front of the box. In the box used by the Kern County Land Co. the gate is set at the front, flush with the side of the canal.

Where the lack of sufficient fall for the use of a better measuring device makes the use of this type of submerged orifice necessary, a standard size and structure should be adopted, and special discharge tables prepared. This should then be rated under the condition in which it will be used. As long as the conditions of use can be maintained, fairly satisfactory measurements can be made. Care should be taken to prevent the deposit of silt or sand near the gates, as this will change the conditions of discharge and affect the rating. The

velocity above the gate should also be made as small as practicable.

The cost of these orifice headgates in Imperial Valley is given by the Superintendent of Mutual

Water Company No. 1 as about \$20. The items making up the total are: lumber, about \$9; labor, exclusive of excavation, about \$8; excavation and incidentals, about \$3.

SOME SEEDS FLY; OTHERS USE PARACHUTES

This Article Is Written Especially for Boys and Girls, But Any Man or Woman Will Find It Worth Reading

SOME seeds make journeys with wings, and others travel from place to place by attaching themselves to the clothes of men or the hair of animals; still others make their journey in the stomachs of birds. These are facts that will interest young people who are taking an interest in agriculture and are working in a garden at home or at school. According to the United States Department of Agriculture's specialist, the seed as the starting point in the life cycle of a plant may well be studied first by young gardeners.

The seeds of the maple tree are particularly interesting. They are provided with wings, and when they become detached from the parent tree a gentle breeze will carry them a considerable distance from the branch to which they were attached. There are many forms and modifications of the winged seed, as the linden, the hornbeam, the elm, and the pine. These are all common trees, from which seeds for illustrative purposes can be secured.

Some seeds also are provided with parachutes or umbrellas, not for protection from rain and storm, but for purposes of locomotion. The seeds of the thistle, the milkweed, and the dandelion—in fact, the seeds of all plants which have a cottony growth—are provided for these aerial journeys.

Besides these, some seeds are provided with hooked appendages by which they can attach themselves to the clothing of men or to the hair of animals, so that they become transported from place to place. Other seeds have hard seed coats, or shells, which are covered in many cases by edible fruit. The fruits are eaten by birds, but the seeds are not digested, and in this way become distributed from place to place. The groves of cedars which are characteristic of the landscape in many sections of the country, it will be noted, are chiefly placed along the lines of fences or fence rows. The fruit of the cedar is an edible one, but the seed is not digestible, and in this way the existence of these hedge rows of cedars is explained. Cherries, grapes and other fruits are to a considerable extent disseminated in like manner.

The hard nuts of our nut-bearing trees are not used as food by birds or large animals, but are usually sought by squirrels and small rodents, which are in the habit of gathering and burying them in various places or storing them in large quantities for winter use. The result is that a considerable percentage of those which are buried in this manner are never rediscovered by those hiding them, and in time nature causes the hard shell to crack open, and the warmth and moisture of the soil brings the germ contained in the kernel into life and a tree springs into existence. It will be

noted that the nuts which were buried by the squirrels did not germinate immediately after being buried, but waited until the warm weather of the spring came before they put forth their tender shoots. This is not because they willed it, but because the hard outer walls of the shell would not admit the air and water to the germ, so as to stimulate its growth.

It was necessary that the shell be frozen and broken by the action of the frosts and the weather before the moisture could gain an entrance to cause the swelling of the germ. This peculiarity, when taken advantage of commercially, is called stratification. Seeds with hard shells, such as cherries, peaches, plums, and the like, have to be stratified—that is, they must be planted in the fall where the plants are to grow or they must be packed away in boxes of sand in a position where they will freeze and remain frozen during the winter in order that they may germinate the following spring. If seeds of this character are stored and kept dry during the winter they will not germinate if planted in the spring. Seeds with thin seed coats, however, like peas, beans, etc., if treated in like manner, will be destroyed by the action of the cold, and no plants will result from planting them in the autumn. Such seeds must, from the nature of the case, be retained in a dry and comparatively warm place during the winter season, in order that their vitality may not be destroyed.

NEW KANSAS COMMISSIONER

J. W. Lough, of Scott City, Kans., has been appointed Irrigation Commissioner of Kansas by Governor Capper. Mr. Lough has made a success of irrigation on his own broad acres in Scott county. He has tapped the underflow, and made it pay, in dollars and cents. Visitors at the Kansas State Irrigation Congress last September were much interested in Lough's place near Scott City. Mr. Lough showed them his alfalfa fields. He obtained about two tons an acre for each of his four cuttings of alfalfa last season.

BACK UP TWO RIVERS 80 MILES

The New South Wales government is investigating an irrigation scheme which will back up the waters of the Clarence and Mitchell rivers for a distance of 80 miles. Being close to the junction of the two rivers and having precipitous hills on both sides, the site for the dam at Gorge is ideal.

IRRIGATION FARMING ISN'T JUST PLAY

BY W. F. WILCOX

In the Denver Field and Farm

THE irrigationist is compelled to put much more work into fitting his ground than does the rainbelt farmer. Nowhere in the dry region do farmers make their fields look so attractive as do those of the irrigation districts.

The plowing must be done deeply so as to leave no dead furrows or ridges. For this purpose the new two-way plow is admirably adapted. The harrowing must be perfect, reducing all lumps to fineness. Then after the plowing and harrowing, a big float or leveler hauled by three or four or more horses is pulled over the field, packing and leveling it. If any especially uneven places remain, a slip or scraper or similar device is used to remove the high places and fill the low ones. The great aim is to make the surface perfectly smooth so that water will run over it.

After the field has been properly prepared and the seed placed in the ground, much work must still be done with the marker or furrowing machine, which is pulled across the field the way the water is to run, making furrows from thirty to thirty-six inches apart according to the nature of the crop, condition of the soil, slope, etc. Then with the team work done there are the patient days and days of applying the water. The seed will seldom germinate until water is applied.

If it is new land, a new ranch or farm, ditches must be plowed and prepared leading from the nearest canal. All this is hard work and requires time. When once the water is at the ranch, then the laterals and head ditches must be constructed along the highest points so that each field may be covered. With the ditches completed and the water at hand, the farmer proceeds to apply it.

Irrigation is not automatic. It isn't anything like starting a phonograph and sitting down to listen. When you have turned in the water you have started something and you have to stay with it, regardless of fatigue, hunger or want of sleep. The head ditch runs across the upper end of the field. This carries the main head. Every twenty to thirty feet, a part of the water is cut out into another ditch and this supplies the lateral from which at right angles the marks or furrows run across the field. It is a delicate task to cut out the water at the proper places and to regulate the flow until at last just the right amount is running in each of the marks.

You work and work for hours and think you have each of the marks running just right, each uniformly carrying just the right amount. You start along the head ditch to take a final look, and lo and behold, only about a third of the rills are running. No one has any idea of the way the soil will wash until he tries to set a head of water. So back and forth he goes, regulating and regulating; placing a bit of stone here, a sage brush there, some straw or weeds or wood here, endeavoring to check the flow.

Finally at last after wearied effort the water reaches a normal flow and ceases washing. The marks

run uniformly, each carrying just the proper amount of water down through the desert field. It is a trying task. There are fields so situated and located that irrigation is rendered comparatively easy. There are thousands of others with a little slope where irrigation becomes more of a burden.

Once the water is set running right, the irrigationist may leave and attend to other work, always returning, however, every few hours the first half day to look at it and see if it is running right. Perhaps a straw will wash down here, then another, soon a bit of silt collects, then a dam forms, one section ceases running and a double proportion is thrown on to the next section, all of which causes trouble and when the irrigationist returns he finds all the water running down one or two furrows with disastrous results, washing out a channel in his nicely prepared field.

But the matter of starting the water at the head is not the whole thing. Despite all that can be done in many fields there will be low places. Here the tendency is for the marks to fill up with silt during the first irrigation. Once a mark fills up, the water laps over into another; then the double head overflows into another and so it goes—the water following its natural course across the low place in the field with the result that the part of the field beyond the low place gets no water.

The irrigationist goes down into the field with his gum boots and attempts to clean out the marks and dike them up. It is a hard task. No sooner has he gotten each mark diked up and the water flowing than they fill up again and run over. In trying to get the water over he digs up as much grain in the low place as the land beyond would raise were it irrigated. All the time he wallows about in the saturated soil to the top of his gum boots, sweating and fuming and with mosquitoes drilling .22 holes in various parts of his anatomy.

After once running nicely, the water will, like Tennyson's brook, go on forever in the rows. But after forty-eight hours or so, sometimes sooner, according to the slope and condition of the soil, the irrigationist must re-set the water. Seeing it running on so nicely and knowing that an attempt to re-set it on another part of the field is like stirring up a hornet's nest or disturbing a wild cat, he dreads it, but it has to be done. So he moves the water down onto another part of the field and goes all through the work again. This is his task the livelong summer.

The second irrigation is not so bad. The sets at the head of the marks remain. They are firm and undisturbed so that all he has to do is to turn the water from the laterals at the proper places and with but a fraction of the former work has the water running again. Alfalfa fields irrigate best. The ground not being newly plowed is hard and firm and does not wash. Moreover, the head ditches and laterals remain permanent and the work of planning and setting is reduced to a minimum in comparison with irrigating grain fields. But each spring the alfalfa fields have to be marked and this is some task for a team on account of the big tough roots.

DRAINAGE NEEDED FOR IRRIGATED LANDS

MORE than ten per cent of the irrigated lands in the United States which have had water for any considerable period of time are now either absolutely unproductive or given over to poor pastures and unprofitable crops, according to the United States Department of Agriculture. Waterlogging and the accumulation of harmful mineral salts are responsible. Even in some of the most recent irrigation projects serious injury from these causes has been wrought.

Methods of reclaiming land which has fallen into this condition forms the subject of a new bulletin of the Department (No. 190), "The Drainage of Irrigated Land." Drainage supplemented by proper methods of cultivation, cropping, and irrigation, will restore these waterlogged areas to a condition in which they can be farmed with profit. Proper drainage will accomplish four objects:

(1) The lowering of the ground-water table to a depth where the moisture and air within the root zone will be properly balanced.

(2) The creation of an outlet for percolating water, so that the ground-water table will not fluctuate excessively.

(3) The rapid removal of excess moisture following spring thaws.

(4) The creation of an outlet for the downward moving water used to dissolve out the injurious salts.

Incrustations of alkali salts and the presence of highly alkali-resistant plants are frequently indications of overirrigation. In some cases ponds, bogs, and marshes are also found, but in others there are no visible signs of excessive wetness and its existence can only be inferred from its effects upon vegetation. Thorough knowledge of underground conditions is necessary.

To drain irrigated areas will cost, it is esti-

mated, on the average farm from \$10 to \$20 an acre except under unusual conditions, when the cost may run as high as \$50 an acre. Both open canals and covered conduits are in general use. The open canals, however, are intended primarily for the main outlet systems in which provision must be made for a considerable flow of water. The covered drains are for farm drainage proper, although, except for the additional expense, they could be used equally well for the main outlets. As a matter of fact, although they cost more than the open canals, the maintenance charges are usually lower, much valuable space is saved, and cultivation and irrigation are much easier with them than with open canals. Where covered conduits are employed they are usually made either of cement or clay tile. In some localities lumber box drains are used, but this is usually advantageous only in isolated places where lumber is cheap and transportation rates high. The life of such a drain is reasonably long if the lumber is continuously wet, but if alternate wetting and drying takes place, the material may last only a few years.

In properly drained land bacterial activity is increased and more plant food provided by the admission of air into the soil to take the place of the excess water which has been removed. The downward movement of water through the soil also leaches out the excess of harmful salts, and this is one of the most important functions of drainage in the irrigated sections. The water removed by the drainage system may be employed for the irrigation of other areas, thereby increasing the available irrigated area. Furthermore, drained land may be plowed earlier than undrained, and in consequence may be irrigated earlier. This is an obvious advantage in that it makes it possible for the land to be irrigated before the supply of water becomes reduced.

IS YOUR FARM PAYING YOU WAGES?

By E. H. THOMPSON

U. S. Department of Agriculture, Bureau of Plant Industry, Office of Farm Management

A CAREFUL study in regard to the profits made by a large number of farmers in different parts of the United States shows that the size of the farm business is one of the most important factors controlling the farmer's income. The problem of how large an investment is needed in order to carry on a certain type of farming to advantage is of the utmost importance. The amount of this investment will vary according to the type of farming and to the region selected.

In a survey of more than 100 farms in an irrigated district in Utah only three farm owners with less than \$10,000 total capital received a labor income of more than \$1,000 for their year's work. In a group of 35 of these men, who had small farms and an average capital of \$5,345, the average labor

income was \$235. One out of every five received nothing for his labor and made less than 5 per cent interest on his farm investment. With high-priced land this amount of capital gave him too small an area to utilize to advantage. If land were cheaper, so that a much larger area could be obtained with this same amount of money, then \$10,000 might be sufficient investment to give the farmer a substantial income.

In the Central States, where corn, wheat, and oats are the prevailing crops and where land is from \$150 to \$250 an acre, \$10,000 would be entirely too small an investment to yield the owner a good income, for the reason that 40 to 50 acres, the total amount of land he could possibly buy with this amount of money, would not utilize his teams, machinery, or labor to the fullest advantage.

On the other hand, the number of acres is not

always a true measure, as a big business can be conducted on a small area. Forty acres of truck and small fruits may equal a 200-acre farm devoted to grain, hay, cattle and hogs. It is the type of farming that determines the number of acres necessary for efficient operation. Many persons have made the mistake of buying too high-priced land for successful general farming. In other words, they paid truck farming prices for land which on account of market relations should be used for only grain and general farming.

The proportion of the total investment that should be used as working capital is equally as important as the size of the investment. Generally speaking, about 75 per cent to 88 per cent of the farmer's investment is in real estate, the other 12 per cent to 25 per cent being in livestock and other equipment. This proportion will vary according to the type of farming followed. In regions where

dairying is the main enterprise the amount of working capital may represent one-fourth of the entire investment.

A third point in the consideration of the farmer's investment is the quality of material in which working capital is invested. This is especially true in regard to livestock. Investigations relating to profits in farming show conclusively that the efficiency of the animals to which the crops are fed is one of the most important factors in determining the farmer's net income. This is to be expected, since on a large majority of farms in this country the bulk of the crops is in reality sold to the dairy herd or to meat producing animals. If these are of such poor quality that they yield low returns for their feed the income to the farmer must be correspondingly small. Hence, no matter how large the total investment, if the quality of the equipment is deficient financial failure is inevitable.

DO YOU KNOW THE FINE POINTS OF A DAIRY COW?

ARE you starting to build up a profitable dairy herd? If so, you want to be a good judge of a cow. To know how to pick out a good dairy animal means saving in loss of time and money. James R. Garver, head of the Dairy Extension Department of Purdue University, has prepared the following rules for selection of a cow:

CONSTITUTION—In order that a cow may perform, efficiently, her work of production and reproduction for a long period of time, she must have a strong constitution, and the following characteristics indicate this first essential point in a dairy cow.

Large, mild, bright, expressive eyes, good width of forehead, broad muzzle with large mouth and nostrils, prominent windpipe, strong jaw, deep heart girth, good width between front legs, full crops and breast, and horns that are rather thick at the base and tapering at the ends.

Most of these points are, more or less, closely associated to the vital organs, namely, the heart and lungs, which must be well developed with plenty of room in which to operate properly, if an animal is to have constitutional vigor.

CAPACITY—There are only a few cows of consistent high production, but what are amply provided with storage room for consuming immense quantities of feed and water. The large producer is almost always the most profitable producer and must, therefore, be provided with a large capacity, which is indicated by the following points:

Great length from withers to hip bone, large barrel, full crops, well sprung ribs that are broad, deep, and wide apart.

When judging the capacity of a cow, it is important to notice the efficiency of her digestive organs by studying her handling qualities, see whether her hide is soft, pliable, of medium thickness, and covered with a soft, silky coat of hair, which indicates that the organs of digestion are in perfect working order.

NERVOUS TEMPERAMENT—When speaking of a cow having a good nervous or dairy temperament, it isn't meant that she ought to be excitable, fretful, and

hard to manage. On the contrary, she should show a disposition to work under almost any condition. The cow that is busy eating or chewing her cud most of the time and, at the same time, is using a medium amount of the feed eaten for maintaining her own life processes, is usually a profitable cow, having the following points of conformation:

A clean, dished face; neat throat; long, slender neck, that is thin and smoothly joined to the shoulders; withers sharp; back bone prominent; no fleshiness on the shoulders, neck, withers, back, loin, rump, and thighs; eyes that are large, bright, mild, expressive and general actions and movements indicating more or less alertness and freedom from sluggishness.

Cows that are recognized as good workers generally have most of these characteristics.

BLOOD CIRCULATION—A cow may have a strong constitution and a large capacity, but if her blood does not circulate through the right portions of her anatomy she would be worthless as a dairy cow.

The udder is the part of a cow's anatomy where milk is manufactured, consequently, we like to see a maximum amount of blood passing through this organ. A good dairy cow should have most of her blood circulating through the lower part of her anatomy and the way to ascertain this is to study the udder, milk veins, and milk wells.

A large well-placed udder, hung high behind, and well forward, flat on the bottom or floor, well veined, accompanied with large tortuous milk veins that are long, having one or more large wells, indicates whether or not the cow is distributing food nutrients in the right part of her body.

ABILITY—It is possible for a cow to have all the essential points mentioned so far, and yet, if she lacks ability she would be an absolute failure as a profitable milk producer. Since the udder is the milk plant of the cow's conformation, we logically study this organ to learn of the ability she possesses to transform feed stuffs into dairy products.

If the udder is large, shapely, showing that it has a copious blood supply, that it is free from fleshy

tendencies, that it collapses into soft pliable folds resembling a folded glove, when the milk has been drawn, and that all the quarters are free from scars, that they all milk down equally well, we have reason to believe that such a cow has ability to transform farm crops into a finished product with great econ-

omy. This inherent tendency of dairy cows, to produce milk persistently, is a thing dairymen have been striving to establish for over a thousand years and, as a result, we have the Jersey, Holstein, Guernsey, and Ayrshire breeds of dairy cattle which reflect credit upon the ingenuity of man.

U. S. DOES NOT HAVE TO IMPORT DRAFT HORSES

WITH the exception of a very limited number from England, importation into the United States of pure bred draft horses for breeding purposes has been practically stopped by the outbreak of the European war. For several years previous from 2,500 to 4,000 stallions and mares have been brought annually into this country. In the opinion of experts in the United States Department of Agriculture, however, the standard of draft horses in America will not suffer from the interruption of these importations. There is, it is said, a sufficiently large amount of pure blood already in the country to answer all requirements, and the American draft horse will now have an opportunity to demonstrate its own qualities. Hitherto a certain fascination has hung over the word "imported" which has had a marked effect upon prices. For example, an imported Percheron stallion might sell for \$2,000, where an equally well-bred American Percheron would bring only \$1,200 to \$1,500.

We no longer go to England and Scotland for Shorthorn, Hereford and Aberdeen-Angus cattle except to a very limited extent. The breeders of these breeds in America have and are producing the equal, if not the superior, of the English cattle.

There is no apparent reason why the same

thing should not take place in the case of draft horses. The principal breeds of these are now thoroughly established in the United States. Their various characteristics and merits are discussed in a new bulletin published by the United States Department of Agriculture under the title of Farmers' Bulletin No. 619, "Breeds of Draft Horses." This bulletin deals with the Belgian, Percheron, French Draft, Clydesdale, Shire, and Suffolk types.

Of these the Percheron probably outnumbers, in this country, all other breeds combined. Grade Percherons, the product of pure bred stallions crossed with ordinary mares, have proved very popular on our markets. Of late years the Belgian has also made great strides, but this breed is still comparatively new in America. It is found chiefly in the middle West, where the heaviest types of draft horses are prevalent. During the past ten years approximately 100 Clydesdales have been imported each year. This type is particularly well liked by those who want style and action, and in consequence is used to a great extent in cities. The Shires, though similar to the Clydesdales, are massive and less active. They are popular on the Pacific Coast and in the central West.

KEEP POTATO VINES A PEA GREEN COLOR

By EUGENE GRUBB

The Colorado Potato King

FARMERS have become imbued with the idea that potatoes must not be watered until they bloom, and we cannot get that out of their heads. Some of them are set in their ways and will not water them in June. Others will not water them until the leaves become dark color. All this is wrong. Potatoes do best when they have enough moisture to keep them growing well and the leaves of pea green color. Keep pea green in mind and be sure the potato vines are that color no matter when or how often they have to be watered. This does not mean flooding or saturating the ground—it means giving it moisture. The growing season is so short in the Rocky Mountain region that spuds must be pushed all summer to develop the crop and every interruption by drouth or flooding checks the growth and blights the plans of nature in the plant.

The grower should study the question of moisture so carefully that he will know beforehand and not let the ground become dry. He should not wait for the plant to wilt and put on its distress signals. Pay no attention to bloom but dig in the ground as

deep as the roots go and keep the soil moist enough so it will mold when compressed firmly in the hand. When it will not mold under pressure give it more moisture. It is true that we can raise potatoes in ground that is too dry, but we can raise many more when conditions are right and these things keep out disease.

MAY ISSUE A DANDY

Editor of THE IRRIGATION AGE: The May number of your paper is a dandy, especially the article by Earl Smith of Arizona. I would like to see more like it, in defense of the settler on the projects. What do you think of the opportunities on The Elephant Butte project just being finished in New Mexico? Would you recommend irrigation from wells in preference to it in west Texas or southern New Mexico?

Wishing you success, I am,

Respectfully yours,

Clermont, Iowa.

LOUIS ROUNDS.

Urge your friends to subscribe for the IRRIGATION AGE and obtain one of our valuable premiums. The AGE is getting better every month. See advertising pages.

THE IRRIGATION WELL

THE irrigation well is becoming a more important factor in the development of the arid states each year. In practically all the arid districts there are underlying strata of water, sufficient to irrigate the lands above, providing water from rivers or creeks is not available at a less cost. These pumping districts are being "discovered" in the West almost every week. A number of new artesian belts have also been opened up this year.

There are two general types of wells—the open or dug well and the drilled well. Often wells are combinations of the two.

The open well is used where the water bearing stratum is close to the surface. Such wells depend for their supply on the inflow of water from a large lateral area. These wells are usually walled with wood, iron, stone or concrete.

Driven or drilled wells are sunk where the water stratum is at a considerable depth, but tilting strata which cap and underlie the water zone may so carry the water of a higher elevation that the water level will be near the surface in the well when completed, or it may form a flowing, or artesian well. Persons accustomed to open wells are often surprised at the quantity of water delivered by a deep drilled well of only a few inches in diameter. This type of well depends for its water supply on the depth to which it is sunk in the water zone. Bored wells are usually cased at the surface with iron pipe, the piping generally extending to bed rock, but frequently the entire depth of the well. When cased the entire depth the lower part of the casing is usually perforated to form a strainer. The perforated section of the pipe is sometimes as great as 90 feet in length, but usually is eight to 20 feet. Sometimes wells are cased with solid pipe and the strainer is attached to the suction pipe of the pump.

The combination of dug and driven, or drilled, well is used where it is desired to supplement the flow of a water stratum near the surface with that of a deeper water bearing zone, the head on the lower stratum being such that it will raise the water to the higher level. Wells of this type are also sunk where some type of pump is to be used, the form



Testing a pump in a New Mexican Ranch



Pumping water with a centrifugal pump on the Ralph C. Ely Ranch at Deming, N.M. Photograph taken before pump house was built.

of which will not admit of its being installed in a small tubular drill hole and it is desired to place the pump as near the water supply level as possible. In this case the pump is placed in an open pit near the water level and its suction pipe extends down into the drill hole.

No general recommendation can be given as to the most desirable type of well, as the depths at which water can be obtained vary greatly in different localities and it should also be taken into consideration whether water is desired for irrigation only or is to be used for drinking purposes in addition to furnishing the irrigation supply.

Open wells always receive their water supply from surface leachings containing more or less disease germs and filth, and water from such wells should never be drunk. It is estimated that 90 per cent of all fevers in rural districts are directly due to drinking water from open wells. A driven or drilled well is always cased with iron pipe to bed-rock and if the piping is driven tightly into the rock all surface leachings are excluded and the supply must come from below protected by an overcapping rock formation and filtered through a deep sand or gravel stratum which precludes the possibility of its becoming contaminated with disease germs and filth.

If wells are to be sunk only for irrigation purposes there is to consider only the depth at which a sufficient supply of water can be procured and the form of pump that is to be used in pumping. It is important, however, that the most economical style of pump for the locality be considered when putting down the well, as cost of pumping is the principal element in determining the economy of the installation. Usually the kind of well that will admit of the use of the most efficient pump should be sunk.

In most localities the approximate depth at which water is found is already known by the depth of existing wells in the vicinity or by the geological formation. In sinking a well, however, the quantity of water it is to supply must be considered, as it frequently occurs that a small water-bearing stratum near the surface will prove adequate for

a small pumping plant but insufficient for one of larger capacity. The source of the supply should be, therefore, considered; whether it is the percolation of local rainfall or an underflow, and if possible the well should be thoroughly tested by pumping for several days to determine how much the water level will be lowered and thus determine the permanent working head before the final pump installation is made.

There are many localities, particularly in undeveloped parts of the West, where there is supposed to be a water supply at considerable depth but its location has not been definitely determined. In such places it is usually advisable to sink a test well before undertaking to supply water for irrigation. If this work is done with power well drilling machines the test hole should not be less than five or six inches in diameter, as experience has proved that a well up to six inches in diameter can be drilled as cheaply as one of smaller size and the larger well often proves an economical permanent well, whereas one of very small size is only of temporary value.

DISTRICT MUST FULFILL CONTRACTS

The status of irrigation districts was defined in a decision handed down by the supreme court of Idaho recently in the case of W. M. Briggs against the Nampa-Meridian irrigation district. The majority of the court held that an irrigation district was a public service corporation only as it distributed water to the members of the district and it was to be considered as a public service corporation with regard to any contracts it may have with other parties.

The case was decided in favor of the plaintiff, Briggs. Under a contract he held with a corporation absorbed by the district he claimed the right to receive water from the district and pay a maintenance charge of \$12 per acre for service. Members of the district were required to pay approximately \$50 per acre for the same service.

The court held that under his prior contract Mr. Briggs was entitled to the service and that his contract was valid. The opinion was written by Justice Morgan and was concurred in by Justice Budge. Chief Justice Sullivan dissented, holding that an irrigation district is a public service corporation when it distributes water to anybody.

DYNAMITE TO SLOPE SLIDES

Burton Smith, chief engineer of the Oakdale (California) irrigation district, has discovered a method which may prevent expensive slides in the irrigation canals in the near future. Superintendent Smith has been experimenting with dynamite and has blown up a number of threatened slides which were caving in on the canals. As soon as the masses of earth and rock began to move into the canals, the sliding mass was drilled and shot with dynamite. Where the experiment was tried it has proved successful as a method of preventing the canals from being filled, and from now on the ditch riders will patrol the banks of the canals where they

are between high cliffs, and at the first sign of danger dynamite will be used.

If this method proves successful, thousands of dollars will be saved to the various irrigation districts of the San Joaquin Valley, as every winter rains cause the ditches to fill with rock and earth.

IRRIGATE WHEN IT RAINS

E. W. HAMILTON

Agricultural Engineer, Idaho Experiment Station.

Many people, particularly those who have been used to farming without irrigation, are liable to overestimate the value of summer showers. They may brighten the lawn and help the grass but there is no comparison with the lasting benefits of a normal application of irrigation water.

Last summer south Idaho experienced two weeks of showery weather to the damage of much hay. Probably two and a half inches of rain fell. The soil showed wetting for a foot to eighteen inches below the surface. But three days after sunshine came the sandier soils showed need of irrigation.

All crops and all farmers demanded water at once instead of one crop and one farmer after another, as would have been the case had it not been for the rainy weather. While canals had been running part full, pumping plants shut down or run at part capacity during the wet weather, a week later many of them could not supply all the water the farmer could use to advantage and crops were damaged. It is easier to irrigate in showery weather and we should do it if we are to avoid these "runs" on the water supply.

IRRIGATION PUMPS IN JAPAN

Primitive methods still are employed in Japan for supplying water to the rice fields. The apparatus used consists essentially of an undershot mill-wheel in which power is applied to the wheel to raise the water. In other words, the operation of the wheel is reversed.

The construction of the wheel is ingenious, particularly in the case of the wheel operated by foot power. Each paddle is carried by a pair of spokes braced by a pair of struts that lie in the direction of the thrust of the operator's weight. At the end of each paddle wheel is a short treadle piece on which the operator walks.

Of course, the advantage of this water wheel lies in the fact that it can be made cheaply and the operating cost is low, because labor is cheap in the orient.

To grow a good crop of onions requires rich soil, free from weeds, and thorough cultivation.

Subscribe now for the IRRIGATION AGE. We are now offering some valuable premiums. See advertising pages.

SHOOTING CEMENT LININGS INTO DITCHES

By CARL WEBER, C. E.
President Cement-Gun Construction Company, Chicago
(Continued from May issue)

THE mortar lining applied by the Cement-Gun process differs greatly from any hand-applied or poured material and shows characteristics all of its own. Numerous comparative tests have been made to compare the quantities of "Gunite" with other materials of the same composition and it has been found that in every instance Gunite is vastly superior. Tested for tension and compression, the strength of Gunite is from 1.5 to 4 times greater than the best hand-applied mortars. Gunite is waterproof and adheres to hard surfaces with utmost tenacity. Steel girders have been coated with Gunite and after the coating was removed by bending and dropping the steel members it was found that a film of cement still remained on the steel, protecting the same effectively against corrosion.

These qualities make Gunite very desirable for encasing of steel structures for rust prevention and numerous large and small railroad bridges have been protected in this manner. of the structural steel in large buildings, Gunite has also found wide adoption and amongst others, the steel work of the Woolworth Building in New York (the largest skyscraper in existence) has received Gunite encasing.

Another large field for Gunite work is the repair of old disintegrating stone and concrete walls, etc. Large sea walls, bridge foundations and similar structures have been successfully restored even after decay had gone so far as to endanger the safety of the work. Figs. 6 and 7 illustrate the method which was used for the repair of the piers for a bridge of the Chicago & Western Indiana R. R. Co. over the Chicago drainage canal. The piers were built of limestone blocks and the depth of deterioration varied from 2 inches deep to the depth of 16 inches.

The stone work was thoroughly cleaned, all loose and decayed surfaces were carefully removed and the hollows were filled with Gunite to within about 2 inches from the original surface. Then a strong wire mesh was evenly stretched and securely fastened over the entire pier and the last 2 inches of Gunite were applied over and enveloping this wire mesh as shown in Fig. 7. The wire mesh reinforcement is not always necessary and where the disintegration is of a more uniform depth or where only a thin coating is applied over a rigid surface not subject to vibrations the wire mesh may be omitted.

Another most successful use of Gunite has been



Fig. 6—Repairing piers of a bridge on the Chicago & Western Indiana Railroad Company with a cement gun.

For the fireproofing of the structural steel in large buildings, Gunite has also found wide adoption and amongst others, the steel work of the Woolworth Building in New York (the largest skyscraper in existence) has received Gunite encasing.

IRRIGATION AGE.

Before giving a detailed description of successful work for the lining of irrigation canals, I want to call again special attention to the density of Gunite, which is best illustrated by the fact that the weight of Gunite is about 18 to 20% more than the best concrete made in the usual way. A cubic foot of Gunite made of a 1 to 3½ mixture of Portland cement and Torpedo sand weighed 153.8 lbs., while a cubic foot of the same material mixed by hand and tamped in place in the ordinary manner weighed 136.3 lbs. This conclusively proves that the difference of 17.5 lbs. represents voids in the handmade concrete and that it takes more cement and sand to produce a cubic foot of Gunite. This, of course, must be considered in planning for Gunite work and therefore considerable thinner linings are made if Gunite is used. For the lining of irrigation ditches a Gunite slope lining 1½ to 2 inches thick is usually sufficient, while for bottom linings a slightly increased thickness is often advisable.

Another important factor is the ease with which a Gunite lining can be reinforced to withstand shrinkage and expansion and to impart a high degree of elasticity, which is of greatest value in canal protection. Gunite linings, if properly reinforced, do not need any expansion joints and all danger of weakness of the lining due to these joints is entirely avoided.

As reinforcing material, a wire mesh of required strength is most conveniently used. The same is usually placed in the center line of the protective

found in the waterproofing of large and small water reservoirs. As stated before, Gunite is waterproof on account of its density and no compounds, soap, paraffin or other mixtures are ever used. Large concrete reservoirs which could not be considered safe on account of excessive seepage have been treated with the Cement-Gun and in a reservoir in San Francisco a Gunite application of from only ¼ inch to ½ inch thickness was found sufficient to make the same absolutely safe against a water pressure of about 27 feet depth. The subject of waterproofing of reservoirs, etc., is of so great an importance to irrigation interests that I decided to give a full account of the same in a later part of this paper and therefore will only mention it here briefly. Just at this time we are executing extremely interesting work of this kind for a large water power plant in Illinois and I will give a description of the same with illustrations in a later issue of

coating in such a manner as to form an unbroken continuous fabric. Wire mesh is furnished in rolls from 24 in. to 58 in. wide and up to 600 ft. in length. Wherever length or cross connections are necessary



Fig. 7—Another view of cement gun repair work on the C. & W. I. R. R.

the same are made by overlapping the mesh and loosely wiring the ends together.

For the determination of the size and weight of the reinforcing mesh to be selected, the following rules are applied:

(To be continued)

MANURE IRRIGATED FARMS

Years ago the best soil experts in those days considered the use of manure on new or anything but worn-out land a useless expenditure of time and energy. Not only this, but it was considered even harmful to place barnyard manure on new soil. Especially was this true in the opinion of some believers of the old school.

Today experience and modern experimental evidence is producing an entirely contrary view. Barnyard manure finds a profitable place in the development of even the newest soils and in increasing the productiveness of the richest soils. There is no place, no land, no soil whatever which cannot be improved upon and enriched and made to produce better crops by the proper use of barnyard manure.

This change of viewpoint, as a result of absolute knowledge, has led to the great increased sale and use of the modern manure spreader. Many of our irrigated farms have been lacking in this particular equipment but today are taking up diligently the question and are placing these machines in operation.

We have been very much interested recently in the different makes of manure spreaders as we have encountered them, and while there are a number of good machines on the market we, ourselves, have found nothing that seems to fill the demand and meet the requirements of all classes of soil and all kinds of conditions as does the Litchfield low-down spreader, made by the Litchfield Manufacturing Company, of Waterloo, Iowa. These machines are found on the experimental farms. They are found in the hands of the most critical land owners and it has been our observation that they flourish with the greatest amount of increase where they are best known—a true mark of character and quality in any machine.

The Litchfield spreader has a right to command the position that is claimed for it because of its age and ripe maturity. It is the oldest spreader on the market and still its makers claim that it has the most up-to-date features and is strictly modern in every little detail and in all general respects.

It is a practically all steel machine and will stand the rigorous and deteriorating effects of all climates. It also is made to resist the rough and hard usage and the wear and tear that this kind of a machine usually encounters.

The company are experts in this business, they are specialists in the line, making little else than spreaders, and have devoted many years to the manufacture and steady development of the manure spreader. They naturally are able to give as much or more for the price paid than any of the newer concerns that have started in the business in more recent years.

They also are in position to give the quality that is necessary and to guarantee this with unhesitating assurance and feel that they are taking no chances in the five-year guarantee bond which they issue with every machine when requested. This issuing of a guarantee bond is one of the evidences of the quality behind this line of machines and we feel that our subscribers who are at all interested in the spreader question should take pains to order a catalogue, investigate the machine and determine from their own judgment whether our opinion is correct or not.

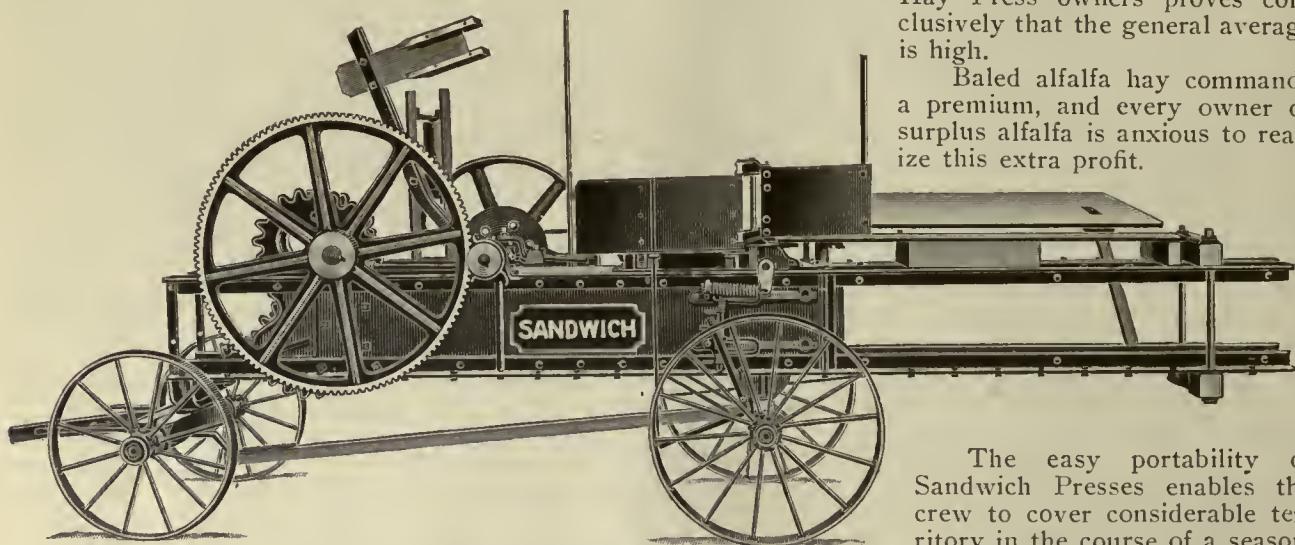
TEXAS BECOMING A SILO STATE

On September 1, 1914, there were 8,560 silos on the farms of Texas, and their original cost was \$4,520,000, according to data just compiled by the Texas Business Men's Association. Nearly two-thirds of the silos in Texas have been built during the past year, and their construction is one of the most important events ever recorded in the history of Texas agriculture. The movement seems to be just well under way, as 4,800 more have been ordered from manufacturers and will be put up in Texas before the close of the present year. Fifteen silos have been built on Texas farms every day during the past twelve months, and present indications are that this record will be greatly exceeded during the remainder of 1915.

Urge your friends to subscribe for the **IRRIGATION AGE** and obtain one of our valuable premiums. The **AGE** is getting better every month. See advertising pages.

THERE IS MONEY IN BALING ALFAFA

THE SANDWICH MFG. CO., Sandwich, Illinois, issued recently an elaborate catalogue under the title, "Tons Tell the Story of Profits," wherein is fully described the Sandwich Hay Presses, and particular attention is given to their steel belt



A haypress that shows big tonnage.

machine, which is described on the first page of this catalogue.

The big tonnage which Sandwich Hay Presses successfully handle opens to the owner of one of these outfits an important and attractive money-making opportunity in any locality where alfalfa,

hay and straw are produced in commercial quantities.

While the profits in the baling business are necessarily dependent, to a certain extent, on local conditions, the experience of hundreds of Sandwich

Hay Press owners proves conclusively that the general average is high.

Baled alfalfa hay commands a premium, and every owner of surplus alfalfa is anxious to realize this extra profit.

The easy portability of Sandwich Presses enables the crew to cover considerable territory in the course of a season. Baling contracts sufficient to keep the outfit busy for the fall and winter season can generally be secured.

Taking it for granted that alfalfa, hay and straw are produced in such quantities in your locality to create a field for a baler, success in making money with a hay press depends on these two factors.

POTASH DISCOVERIES CONFIRMED

Some time ago announcement came from the general offices of Rock Island Lines in Chicago that indications of potash deposits had been discovered in the Panhandle of Texas. Further investigations have since been made with the result that the Texas Bureau of Geology has found the discoveries so important as to merit a special bulletin that will attract international attention.

The war in Europe shut off the American importations of potash, causing a shortage that has been keenly felt, and spurring geologists to greater efforts to find a source of supply in this country that would make the agricultural and other industries independent of the German kali mines, which now practically control the world's output. Potash finds its greatest use as fertilizer and American imports have run as high as \$11,000,000 a year.

Previous reports were based on indications found in a well at Spur, Tex., and at that time it was thought the location of the deposits would be disclosed some-

where in southwestern Oklahoma. Later investigation, however, leads to the belief that the source of the potash is in the immediate vicinity of Amarillo, Tex., this being based on analysis of rock from borings at Glenrio, Boden and Miller. Potash bearing salts were found in wells at these points at depths so much shallower than the discoveries at Spur, that geologists are convinced they are now near the source.

And still the war goes on. No man can tell when it will end. Each day that the conflict continues piles up new opportunities for the United States, particularly the farmers of this nation. Prepare now to get the full benefits of your share of these opportunities. Plan your next season's farming now. Work out those plans so that every inch of your ground will work to full capacity.

To grow a good crop of onions requires rich soil, free from weeds, and thorough cultivation.

THE FARMER AND THE ROAD PROBLEM.

In Eastern Pennsylvania certain portions of that historic highway known as "Old York Road" are still controlled by turnpike companies, and the tollgate continues to be a respected institution. A company controlling about two miles of this old road, over which Washington and the continental army marched at various times, has had a profitable investment, paying from 7 to 8 per cent dividends. In by-gone days another section of turnpike leading from Old York Road paid its owners as high as 12 per cent. Good stone and gravel pits made the maintenance of this road comparatively easy, and the much-talked-about patrol system was established many years ago. Always there were men at work cracking stone by hand and putting it into such depressions and washouts as occurred. But in spite of its solid bed and constant supervision, the road is going to pieces, as does the aver-

tunity to build roads that would not be utterly destroyed long before state or county bonds should mature. In Connecticut, Maryland, New Jersey, New York, Delaware and Pennsylvania, both state and local communities are turning to the concrete road as the solution of their problem and with excellent results. Taking a 16-foot concrete road as a basis, highways of this character have cost on the average about \$12,000 per mile, while maintenance costs have been practically nothing. For example, in Bellefontaine, Ohio, a concrete road put down twenty years ago has cost less than \$25 per mile per year for maintenance, while the average maintenance cost of macadam roads in five eastern states in 1912 exceeded \$800 per mile per year. The farmer, in adopting concrete, has figured the matter in this way: A road is an investment. The most conservative estimate of maintenance cost on macadam per mile per year would be certain to reach \$300 if the road is subject to motor-driven traffic and kept passable at all seasons. An equally conservative estimate for construction is \$6,000 per mile. The \$300 maintenance cost represents interest on \$6,000 at 5 per cent, thus making the real investment \$12,000 per mile, or the cost of a mile of indestructible concrete road. As a matter of fact, taking New York, New Jersey and Pennsylvania costs, the investment would be some \$25,000 per mile. From considering a single mile of roadway it became interesting to figure costs on many miles to see what would happen in the case of macadam as compared with concrete. For example, let it be assumed that 500 miles are to be built during a period of five years at the rate of 100 miles per year, and that repairs will not be required on either type of road for two years. Beginning, then, at the third year, and estimating maintenance costs for concrete at \$25 per mile per year, the Bellefontaine figures, the total maintenance costs on 500 miles of concrete road would, at the expiration of seven years, be only \$37,500. In the case of macadam, basing costs on New York and New Jersey figures for 1912, repair costs would reach the enormous total of \$1,350,000. Where concrete roads are very narrow, say 9 feet wide, and have a dirt road at the sides, they could be built for \$7,500 per mile. Maryland has built excellent concrete roads of standard width for a little less than \$12,000 per mile.

It is upon the above economic basis that farmers are beginning to look at the road question.

But aside from moderate first cost and practically negligible maintenance costs, the popularity of the concrete road is rapidly growing in rural communities due to the experience of those who have used it. For the farmer it is the ideal highway. Described briefly, the building of a concrete road consists of putting a wet and mushy mass of Portland cement, sand and stone in the center of a highway, where it hardens into imperishable rock. The accompanying illustrations give a very good idea of the building of a road and its appearance when finished. The above picture shows the construction



METHOD OF CONSTRUCTING A TYPICAL SIXTEEN-FOOT CONCRETE ROAD.

The templet used to strike the crown is shown against the concrete in the foreground. Back of this are the installing devices for expansion joints. They are holding steel protecting plates in position and will be removed before the concrete hardens. Beyond, men are troweling the surface. This road is near Mason City, Iowa.

age road when subjected to automobile traffic. The rapidly revolving tires disperse the rock dust or binding material in clouds, and the stones, upon exposure, are ripped out and hurled aside. The situation is akin to that in every rural community, and the turnpike company and farmers who dwell along this old turnpike are up against a problem. They must decide whether they will submit to bad roads, pay excessive annual maintenance charges or pay for a road so solid that it will never get out of repair. In many localities farmers have dismissed the first two propositions as impossible and they are building durable roads. And some of them believe it is better to do this by local taxation rather than to have the state take over and control the roads, thus depriving them of the right to say what type of road shall be built. It was the farmers who defeated the recently proposed 50-million dollar bond issue in Pennsylvania. They wanted the oppor-

of a concrete road near Mason City, Iowa. The concrete has been placed between rigidly staked side forms. The road is then troweled with wooden floats. The finished road presents a smooth and admirable surface. This type of road appeals especially to the farmer and his family, because it provides them at all seasons with an excellent place to walk as well as a thoroughfare for vehicles. It is a fact that in Wayne county, Michigan, children go to and from school on roller skates over the wonderful concrete roads of that locality. Horses never slip or fall upon these roads and will draw twice or three times their accustomed load. In Wayne county one farmer has driven an unshod horse over the concrete roads for a long period of time without injury to the animal. It is needless to

say torrential rains cannot wash through these roads. The water must go over or under them. Another especially good feature of the concrete road is its freedom from dust as well as mud. Wherever farmers have used these roads they are enthusiastic in their commendation, not only because of their great durability and low maintenance cost, but because in every sense they represent the ideal highway and, therefore, the solution of the road problem as it applies to rural communities.

CHILE WATERS 2,300,000 ACRES

Chile is irrigating more than 2,300,000 acres of land and has nearly as many more available for irrigation.

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Always ready when you want it—a most important consideration to the man dependent on irrigation. In your consideration of various makes of engines offered you, remember that the CHARTER was the FIRST ENGINE ever built for the use of liquid fuel—over 30 years since we sold the first one.

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THE TENT-COT
OPEN AND FOLDED



above the ground under a storm-proof covering that enables you to use the Tent-Cot every night in the year, and all the doors and windows are fitted with both storm and mosquito curtains that can be raised and lowered at will of the occupant. For anyone afflicted with lung trouble there is nothing equals the Tent-Cot. It also has a splendid appearance and can be set up on your porch, lawn or roof and taken down when not in use. Can be set up in a space 30x78 inches and only requires about 30 seconds to operate. It is ideal for hunters, fishers and campers as it eliminates all the annoyance of "making camp." With a Tent-Cot you carry your camp with you under your arm and sleep safe and sound any place.

SPECIFICATIONS—Length of cot open, 6 ft. 6 in.; width of cot, one person, 28 in.; width of cot, two persons, 44 in.; height of bed from ground, 17 in.; height of tent over cot, 33 in.; size of cot folded, for 1 person, 25x36; size of cot folded, for 2 persons, 44x36; weight, 1 person, 29 lbs.; weight, 2 persons, 44 lbs.; frame is of hard maple, painted green; covering is of heavy waterproof canvas in colors, tan or olive green.

PRICE—Tent-Cot \$8 1/2 in. wide, open 1 side, \$9.00; Tent-Cot 28 in. wide, open 2 sides, \$9.50; Tent-Cot 44 in. wide, open 2 sides, \$11.50.

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YOU SHOULD USE The Enterprise Tent-Cot

"The Perfect Outdoor Bed"
For Porch, Lawn or Camp

The Enterprise Tent-Cot will protect you from all the discomforts and dangers of sleeping out. You sleep 17 inches above the ground under a storm-proof covering that enables you to use the Tent-Cot every night in the year, and all the doors and windows are fitted with both storm and mosquito curtains that can be raised and lowered at will of the occupant. For anyone afflicted with lung trouble there is nothing equals the Tent-Cot. It also has a splendid appearance and can be set up on your porch, lawn or roof and taken down when not in use. Can be set up in a space 30x78 inches and only requires about 30 seconds to operate. It is ideal for hunters, fishers and campers as it eliminates all the annoyance of "making camp." With a Tent-Cot you carry your camp with you under your arm and sleep safe and sound any place.

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H O M E

ON THE DESERT OR IN THE HILLS this little Brown Bungalow will be a comfortable home for you. Can be set up in less than a half day. Can be moved as often as desired and is good for ten years service.

Complete with varnished floors, screens, windows, doors and a perfect system of ventilation. KENYON TAKE DOWN HOUSES are guaranteed water and wind proof. Are made in twenty sizes from one to five rooms and cost as little as \$35.00 and as much as \$325.00 for the largest size.

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BRIEF NOTES FROM IRRIGATION PROJECTS

Arkansas

The largest irrigation plant in Arkansas, and what is believed to be the largest in the rice fields, is being operated by Prang & Tindall at Crockett's Bluff. The water is pumped direct from the White river, and is conducted through the fields in canals. The pump is throwing 12,500 gallons per minute, and is irrigating 1,000 acres of rice, with water to spare.

Machinery is being installed, which will double the capacity of the plant. Additional canals will be dug so that by another season not less than 2,000 acres of rice will be watered from this pumping station. The water is lifted 35 feet from the river to the head of the canal.

Illinois

J. C. Summers, an enterprising farmer of Bath township, in Mason county, Illinois, has commenced an irrigation project, embracing an area of about 1,000 acres of land. He is damming up a dredge ditch on the land. He will also put in a 12-inch pump.

The promoters of an irrigation plant on the Douglass farm west of Marseilles, Ill., contemplate branching out into an extensive business should their present experiment prove successful. They have in view the erection of a large canning factory and are assured of the capital with which to build it.

The irrigating system, which is an overhead pipe line covers 22 acres. The water is pumped from the Illinois river.

The promoters of the project, Messrs. Gebbard and Clark of Mendota, Ill., say they have no doubt about the sprinkler system doing what is expected of it, and they will raise all kinds of garden truck and fruit.

California

John P. Ryan, who is fathering an irrigation project of 25,000 acres around Willows, Cal., has announced he proposes to ask the United States government to enter into a water exchange agreement, whereby the proposed project would get water from the East Park reservoir of the Orland Federal Irrigation project.

In return for this water, Ryan will pour into the government project ditches the flow of Briscoe creek and that part of Stony creek between the government reservoir and a point six miles or so north of the town of Elk creek.

The Ione Valley Development Association of California, is fathering the organization of a big irrigation project in the Ione Valley.

Nearly fifteen thousand acres more land will be brought under irrigation

in Stanislaus county, California, as a result of a tentative agreement, by which the Waterford Irrigation district, taking in land between Waterford and Oakdale, will get water from the Modesto Irrigation district. The Waterford district was organized several years ago to put water on 20,000 acres of land, part of which has since been withdrawn. The water is to be taken from the Toulumne river, the Waterford district having secured water rights some time ago. All the preliminary surveys have been made, to take the water from the river direct, but this would be a much more expensive proposition than to tap the canal of the Modesto Irrigation district, or to build a joint canal which would water both districts.

The Oakdale irrigation district of California, will offer for sale \$400,000 worth of bonds this month. The money will be used for completing and extending the district's irrigation system.

In a friendly suit filed by the Equitable Trust company as trustees for other companies, William F. Fowler has been appointed receiver for the Sacramento Valley Irrigation Company and the Sacramento Valley West Side Canal Company of California, by Judge Van Fleet, United States district judge. Fowler's bonds are \$40,000.

Both companies are subsidiaries of the California-Idaho Company, controlled by the Kuhn interests of Pittsburg.

Fowler was general manager of the Sacramento Valley Irrigation Company with headquarters at Willows, Glenn county. He says the proceedings were instituted to protect the interests of the bondholders, who took over the two companies April 1, 1914, when the interest on the bonds was defaulted and to legalize their action in taking possession of the property.

Oregon

The Department of the Interior, has approved for patent 11,135 acres of land in Oregon, reclaimed by the Central Oregon Irrigation Company.

According to a report today by Engineer John S. Young to State Engineer Lewis, there are between 10,000 and 15,000 irrigable acres in the proposed Suttles Lake Irrigation district and the project is entirely feasible. The district is located at Grandview, Jefferson county, and water for it can be obtained from Suttles lake, Blue lake and Clear creek. This water must be carried a distance of 25 miles, and will be good for domestic as well as irrigation purposes. The engineer estimates that cost of completing the project would be \$517,500.

The settlers will form an irrigation district and propose to proceed with the improvement themselves.

Rogue River Valley, Oregon, settlers have completed an organization to obtain an irrigation system. It is believed that Seattle capital will construct an irrigation system in the valley if sufficient acreage can be secured. It is proposed to utilize the waters of Big Butte creek for the system.

Arizona

The directors of the Hassayampa Alfalfa Farms Company, has closed a contract with the firm of Many Bros.,



THE attention of our readers is directed to the numerous premium offers in this issue. We will present to new subscribers, postage paid, who send in \$1.00 for 1 year's subscription to IRRIGATION AGE, either one paper bound copy of THE PRIMER OF IRRIGATION, or one Crocodile Wrench. (See advertisement elsewhere) This offer applies also to all old subscribers who pay for the current year and one year in advance.

THE IRRIGATION AGE

30 North Dearborn Street
CHICAGO

of Oklahoma City, Okla., for the construction of the Terre Haute main canal and diversion dam on the property of the company near Prescott, Arizona. The main dam, costing more than \$100,000, was recently dedicated, and the new work is for the purpose of distributing the water for irrigating purposes to the 35,000 acres of land owned by the company. The canal, dam and syphons incidental to the work will have a length of seven miles, and there will be much concrete used in the work. The estimated cost of the contract is in the neighborhood of \$50,000.

New Mexico

The Lake Charette Land & Irrigation Company, which is constructing irrigation works in Mora and Colfax counties, New Mexico, has been granted an extension of one year for the completion of construction by State Engineer James A. French. The extension dates from May 4, last.

The Lake Charette Company is operating under the Carey act, having Segregation No. 1, consisting of 7,500 acres in the Sweetwater valley of Colfax county. However, it is expected to be able to irrigate a total of 20,000 acres. The waters of the Ocate river and Sweetwater creek will be utilized. All of the land that will be watered is in Colfax county, but a part of the company's storage system is in Mora county.

Detroit and Colorado capitalists are interested in the company. The esti-

mated cost of the irrigation system is \$175,000, and to date \$63,000 has been expended.

Utah

The Davis and Weber Counties Canal Company, near Morgan, Utah, has let the contract to the Utah Construction Company for the erection of a dam to cost \$150,000. The proposed structure, which will be the highest structure of its kind in the state, will double the present capacity of the company's reservoir, which now impounds approximately 17,000 acre feet of water. The present dam is 100 feet in height.

The South Ogden Water Company of Ogden, Utah, with a capitalization of \$200,000, is completing preliminary work on an irrigation project involving large expenditures and designed to supply water for irrigation of several thousand acres of fertile bench land south and east of Ogden.

Idaho

J. W. Graff of Homesdale, Idaho, in Owyhee county, has applied to the Oregon desert land board for permission to appropriate 190 cubic feet per second from the waters of Succor creek for the purpose of irrigating 9,500 acres of land located on the



(650-42R)

"Crop Insurance"

is a term fittingly applied to irrigation. Economy urges the application of such insurance with centrifugal pumps driven by oil engines or electric motors.

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Baling Hay is
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JOBBERS:—C. W. Keith, Denver, Colo.; Miller-Cohoon Co., Murray, Utah; Mitchell-Lewis Co., Portland, Oregon, Spokane, Wash., and Boise, Idaho; Pacific Implement Co., Son Francisco, Calif.; Howley-King Co., Los Angeles, Calif.; F. B. Connelly, Billings, Mont

boundary between Oregon and Idaho. Part of the land is in Oregon and part in Idaho.

The irrigation and drainage commission of Idaho, recommends in its report to the state's chief executive and to the land board that the plans of the Utah Construction Company, owner of the Big Lost river project, be followed out and that the proposed new contract between the settlers and the company for water rights calling for the delivery of two acre feet be adopted. It is the latter recommendation that has been the main bone of contention between the settlers and the purchasing company, the settlers holding out for more water

and the company claiming it could not possibly guarantee to deliver more. Apparently the commission is satisfied that the contention of the company with regard to inability to deliver more water is correct.

Irrigation of several thousand acres in the Twin Falls district of Idaho, by pumping was made possible when the public utilities commission issued an order putting into effect a special flat rate for water services, which had

been asked by the Great Shoshone & Twin Falls Water Power Company.

Five projects are affected by the commission's order. Under the old contract the settlers were required to stand responsible for the charges on the entire acreage and owing to the failure during 1913 of the interests back of the Great Shoshone and kindred interests, settlers found conditions such that they could not profitably cultivate more than a small per-

How to Make Farming Pay

Agriculture

The Best Handbook for the Farm

By OSCAR H. BENSON
of the United States Department of Agriculture and

GEORGE H. BETTS
of Cornell College, Iowa

184 Photographic Illustrations, 444 Pages

THIS book shows how to raise bigger and better crops with less effort and with less expense, how to improve live-stock, how to increase the product of orchards. It teaches how to conserve resources and reclaim lands, and how to treat and cure live-stock diseases.

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On Farm Crops, Horticulture, Soil, Farm Animals and Farm Economics, this work contains the latest and most accurate knowledge obtained by the United States Department of Agriculture and by the leading Agricultural Schools.

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centage of the acreage included in the pumping projects.

As a result, according to the petition of the power company, only about fifteen hundred acres were cultivated during 1913 and 1914. The company, therefore, asked to be permitted to put into effect a flat rate for pumping purposes.

Montana

Plans for the turning of Hollings lake, three miles north of Billings, Mont., into a reservoir that will assure a reserve supply of irrigating water to hundreds of settlers in a 2,000-acre tract east of the lake are under consideration.

The first unit of the irrigation plant of the Little Missouri Irrigation Company, located in Fallon county, will be finished this spring, and will irrigate 8,000 acres of land, according to Attorney E. S. Booth. Mr. Booth says the plant will, when complete, irrigate upwards of 25,000 acres. The land is about 100 miles from a railroad at present, but a railroad through it is one of the probabilities of the near future. The company was organized by Butte men.

Nebraska

Refund bonds in the sum of \$50,000, to take up an original debt of \$22,000 due the estate of D. W. O. Rogers of Omaha, and incurred in 1895, have been issued by the Alfalfa Irrigation district of Keith county, Neb. The refund was resorted to by members of the district only after a long fight made upon the validity of the bonds, the same being carried through state and federal courts. The courts finally held the bonds to be good. The Alfalfa irrigation district was the first organized in the state. The project was never a success. No levy was made for either interest or principal, and during the score of years that has elapsed the debt has increased almost one and a half times. There are about 4,100 acres in the district and the bonds will make a mortgage upon the land amounting to about \$12 or \$13 an acre. The land is divided between only about eleven holders. Over 1,000 acres of the district are not actually subject to irrigation and arrangements are being made to release this land on the payment of about \$6,000.

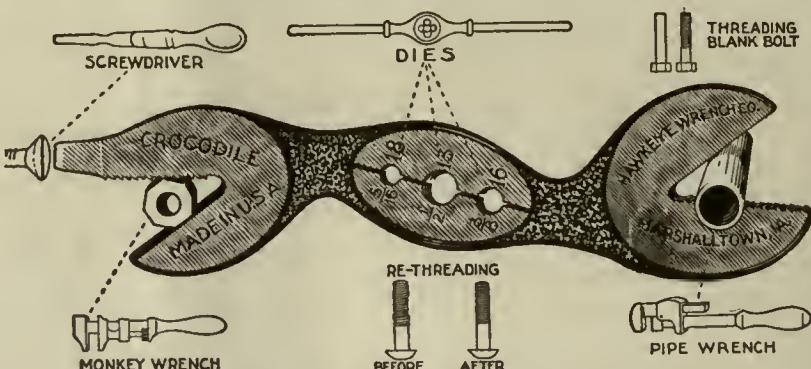
Florida

Theodore Strawn, of De Land, Fla., is installing a turbo-irrigation system on his land at Island Grove, Fla.

Colorado

A celebration on the occasion of the opening of the big project of the Fort Lyon Canal Company is being planned for July 4, 1915, at Lamar, Colo. For three and one-half years the work on the project has been going on. Day and night a dredge has been operating. To date it has removed 3,271,537 cubic yards of dirt. That has been done at an actual cost of operation and maintenance of 3.17 cents per cubic yard, according to President D. B. Nowels.

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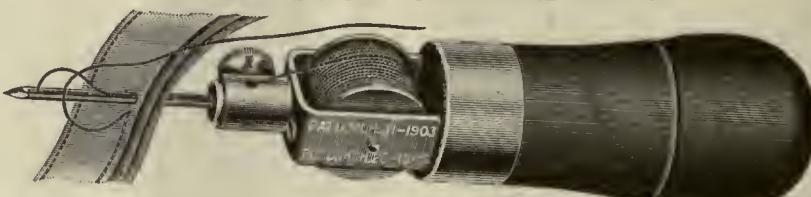
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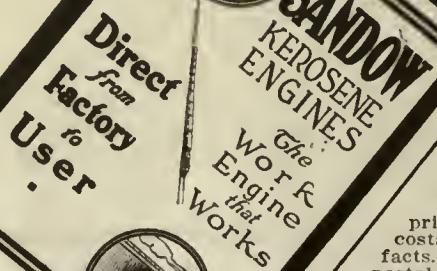
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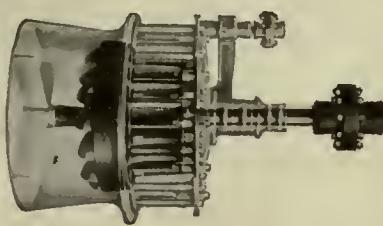
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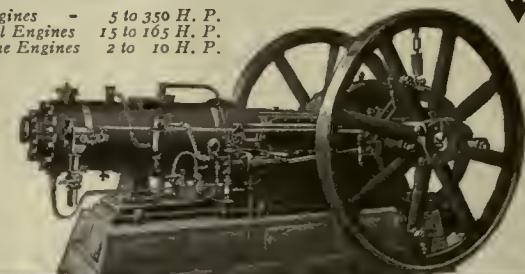
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Thirtieth Year

THE IRRIGATION AGE

VOL. XXX

CHICAGO, AUGUST, 1915.

No. 10

THE IRRIGATION AGE

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The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARID AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

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THE FARM HERALD

THE IRRIGATOR

D. H. ANDERSON
PUBLISHER,

Published Monthly at 30 No. Dearborn Street,
CHICAGO

Entered as second-class matter October 3, 1897, at the Postoffice
at Chicago, Ill., under Act of March 3, 1879.

D. H. ANDERSON, Editor

ANNOUNCEMENT.

The "Primer of Hydraulics" is now ready; Price \$2.00.
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Questions In a brief, which he presented to the Board of Costs Review and Revaluation on the Truckee-Carson (Nevada) project, Fulton H. Sears, a Project Cost Reviewers Should Answer water user, asked a series of important questions. If this board or any of the other boards failed to answer these questions fully in their investigations, Secretary of the Interior Lane should direct them to meet again and continue at their labors until they have found the answer to each question, except No. XVIII, which refers only to the Truckee-Carson project. Mr. Sears' interrogatories are as follows:

I. Have you examined the books of the Reclamation Service at Fallon, Nevada?

II. If so, did you find them in such shape that you could verify each item of cost for each feature of the project?

III. Did you find original entries in such conclusive shape as in your experience would be accepted by any business corporation engaging in enterprises of the magnitude of this project?

IV. Have you examined and found complete the original Engineers' Notes for the various features of this project?

V. If so, did you find them with cross-sections and computations so as to be enabled to determine cost and unit data?

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Associations has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

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It may interest advertisers to know that The Irrigation Age is the only publication in the world having an actual paid in advance circulation among individual irrigators and large irrigation corporations. It is read regularly by all interested in this subject and has readers in all parts of the world. The Irrigation Age is 30 years old and is the pioneer publication of its class in the world.

VI. In the case of Force Account Work, were the records complete so as to be enabled to properly determine classifications?

VII. Do you believe what is known as Progress Reports, as known in the service, would be accepted by any corporation or any court of law as original and proper evidence of the facts contained therein?

VIII. Is the original data of this office shown by original Engineering Notes, or by Progress Report?

IX. Have you checked up the vouchers and found that each was a proper charge to the Truckee-Carson Project?

X. Have you personally inspected each canal, both in use and not in use as a board, in order to determine waste in construction, if any?

XI. Have you inspected as a board each lateral, both in use and not in use, in order to determine whether they are useful or whether waste in construction has intervened?

XII. Have you counted the structures not in use and which were placed to serve lands which are not irrigable or agricultural, and computed the cost thereof?

XIII. Have these facts all been taken into consideration in your report?

XIV. Have you examined and determined the extent of agricultural lands within the project?

XV. Have you examined the canals and laterals that have been constructed to serve lands which are not apparently agricultural from view?

XVI. Have you computed the cost of same and taken this into consideration in your report?

XVII. In consideration of this entire subject, have you done so with a view of benefits obtained to the farmer, or with a view of protecting the Service?

XVIII. Have you investigated the status of litigation concerning Lake Tahoe and the prior right and ownership along the Truckee River, to ascertain whether any benefit can hope to be obtained from the structures built supposed to handle the waters in dispute?

XIX. Have you examined into the published statements of the Service in reference to the question of drainage, and considered, in view of the representations therein contained, that it is the duty of the Service to adequately drain this project at its own expense? If not, why?

XX. Do you believe the Government has entered into contracts in this project with the water user, and if so, should it carry the same out under conditions in which they now exist?

XXI. Do you believe that the estimated cost shall govern under the law as to the amount to be paid?

XXII. Do you believe that the Force Account System has been beneficial to the water user?

XXIII. Do you believe the theory of the Revolving Fund should be abandoned? If so, why?

XXIV. Do you believe that if all these questions were answered satisfactorily to the farmer and water user, it would remedy the unrest, the dissatisfaction that now exists in this and in other projects; and if not, why?

XXV. Should the board be convinced that mistakes have been made, should the water user, or the Government, stand the loss?

XXVI. Should the board find that any or all of these interrogatories are impertinent and should not be answered, kindly state the reason why.

Remove the Barriers to Settlement of Projects

The Montrose (Colo.) *Enterprise* protests vigorously against conditions on the Uncompahgre project in Colorado, which hamper the settlement of its unoccupied lands. Similar conditions prevail in other Federal projects and should be eliminated.

"If we had built a thirty-foot board fence around this project and studiously planned measures to keep the man with his plow off of this unde-

veloped land we could not have devised so effective a method for keeping this man out as has been developed with no particular thought of this kind in mind," says the *Enterprise*.

"Let the government throw open to entry the land which is now under water and still owned by the government and it would be taken up immediately."

"Then let those who are holding patented land as investments come down from their high horses and set a price on the land that is somewhere reasonable."

"No man in his right mind is going to pay a hundred dollars an acre for raw land, assume the obligation of the water subscription and on top of that devote five years of hard work in bringing the land up to a respectable state of cultivation."

"Make this undeveloped land reasonably easy to acquire and we will have no trouble in getting it settled up, but as long as the conditions are as impossible as they are at present these lands will never be developed."

What Is the Value of Irrigation?	A suit, in which Judge Thomas C. Wilson, of Wichita, Kans., must render a decision presents an interesting object lesson in the value of irrigation.
---	--

The case primarily is over the payment of rent on a 10-acre tract north of Wichita. The interesting side issue is this: If a 10-acre tract produces crops worth \$213 with rainfall, how much will it yield with irrigation?

Charles Smith says irrigation will increase the production of land around Wichita from five to five hundred times. Conservatively, though, he says one acre of irrigated ground will yield as much as ten that are watered only by the rain. Mr. Smith gave this testimony in defense of J. T. Graham's suit to collect \$230 rental on the ten acres.

According to contract of lease Graham was to install an irrigation plant on the 10-acre tract for the 1914 season. Smith agreed to pay \$300 a year rental, under those conditions. When the pump was not installed Smith refused to pay \$230 of the rent, claiming the land had produced only \$213 when it would have yielded between \$2,500 and \$3,500 had it been irrigated according to contract.

Honesty that's merely a policy is mighty poor policy to follow. It should be practiced for its own worth rather than as a preventive.

Now is a good time to take a day off for a trip to the lake, river, or some large park. We all work better for an occasional change.

IRRIGATION WATER MEASURING DEVICES

*By California Agents of Irrigation Investigations, Office of Experiment Stations, U. S. Department of Agriculture

THIS is the fifth of a series of articles prepared from a bulletin issued by the College of Agriculture of the University of California, at Berkeley. The articles are illustrated with photographs and drawings of the various structures and devices used in compiling the data. — THE EDITOR.

To be fully satisfactory for measuring individual deliveries of irrigation water a device should register the total amount of water passing, rather than the rate of flow. Three devices of this character—Dethridge, Grant-Mitchell, and Hill meters—have been installed at Davis and tested. A fourth, the Hanna meter, is to be installed as soon as available.

The Dethridge meter is shown in Figures 19 and 20. It was invented by J. S. Dethridge, of the State Rivers and Water Supply Commission of Victoria, Australia, and has been extensively installed in Victoria, where 5,000 are now in use. It has also been used quite extensively in New South Wales.

The Dethridge meter consists of a wheel or drum to which projecting pieces of sheet metal are fastened. The drum is placed with its axle horizontal and is set so that the projecting blades are in the current of the ditch to be measured. A special box is built around the wheel so that all water in passing has to strike against the blades. In this way the wheel turns in proportion to the amount of water passing. Knowing the number of revolutions of the wheel the amount of water passed can be determined.

The illustrations given show one of these wheels set in a concrete box, but wooden boxes of similar form can be used. The whole structure is set just below the



Fig. 20.—A Dethridge meter in operation.

turnout gate, which is shown in the drawing. The bottom of the box is curved to fit the shape of the wheel. About $\frac{3}{8}$ inch of clearance is left between the box and the blades. In use the water comes against each blade and pushes it around until the next blade strikes the water. In this way the space between the blades is filled with water, which is carried through the meter.

The meter shown seems to have a normal capacity of 4 cubic feet per second and can be crowded to carry 5 cubic feet per second. This higher quantity, however, causes splashing over the top of the box. The fall needed to turn the meter varies with the amount being measured, from $\frac{1}{2}$ inch for 1 cubic foot per second to $2\frac{1}{2}$ inches for 4 cubic feet per second. This small required fall makes the use of this meter practicable in ditches with low grade. A counter is attached to one end of the axle and this indicates the number of revolutions which the meter has made at any time. The difference in the reading of the counter at any two times gives the number of revolutions the meter has made between the times of reading. By multiplying this number of revolutions by the number of cubic feet passed per revolution, the total quantity of water received can be determined. It is most convenient to transfer the water received into terms of acre-feet.

If it is desired, with the Dethridge meter, to know the rate at which water is being received at any time it is only necessary to time the meter for one or more complete revolutions and divide the quantity passed per revolution by the time for one revolution. Thus, if it takes 30 seconds for the meter to make one complete turn and it is known from its rating that it passes

*The installation of the measuring devices described in this series of articles has been carried out chiefly by S. H. Beckett and R. D. Robertson, irrigation engineers, assisted by Roy Wray. The tests of the devices have been made under the immediate direction of S. T. Harding, irrigation engineer, in charge of irrigation investigations in Montana, temporarily on duty in California, who has also prepared the reports of the tests. The weir tables have been prepared by Wells A. Hotchkiss. The drawings and diagrams have been prepared by Stephen C. Whipple, scientific assistant. F. L. Bixby, irrigation engineer, in charge of irrigation investigations in New Mexico, temporarily on duty in California, assisted in designing the general plan of installation. The full study has been

planned and, in general, supervised, and the data has been arranged for publication by Frank Adams, irrigation manager.

The installation of the Davis field laboratory, and the testing of the devices have been jointly paid for from funds contributed by the state engineering department of California, the office of experiment stations of the United States department of agriculture, and the California agricultural experiment station. Co-operation with the state engineering department of California has been effected through agreement between that department and the office of experiment stations, the irrigation investigations at Davis having formerly been carried on by those two agencies without financial aid from the California agricultural experiment station.

30.5 cubic feet
for each turn, the
rate of flow is
30.5 divided by
30, or a little over
one cubic foot per
second.

The walls of the box in which the Dethridge meter is set are 4 inches thick when made of concrete. Care should be used in getting the bottom curved to the correct circle so that the leakage around the meter will be small. This meter is somewhat complicated in construction and it is better for it to be placed by canal companies than by land owners. It will probably cost less in this way as the drums can be bought in

quantities. In Australia the concrete box is made in parts and seasoned in the material yard, the parts being then cemented together when placed in the field. When built of concrete as shown in figures 17 and 18, 22.8 cubic feet of concrete and 40 board feet of lumber are required. The drums are best made by some sheet metal works. A special counter should be used made of rust resistant metal as the ordinary counters have been found to rust out rapidly in use. Where installed in large numbers in Australia the cost has been about \$40 per meter; the cost of the meter installed at Davis was about \$60.

The tests of this device made at Davis showed quite accurate under constant ditch conditions between rates of flow of 1 to 3.5 cubic feet per second. For both larger and smaller discharges the

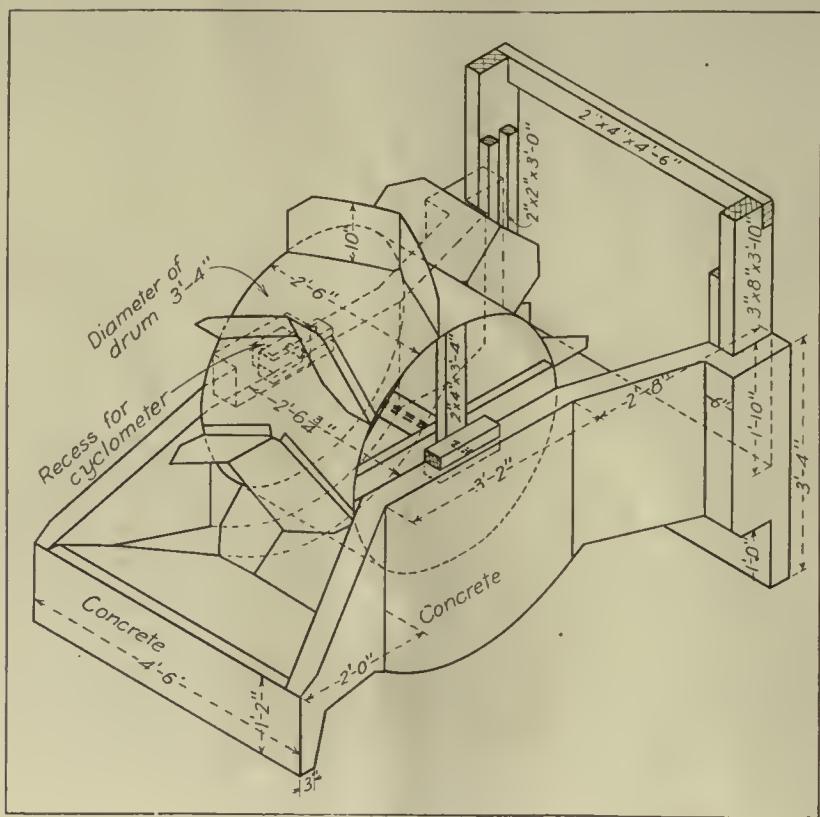


Fig. 19—Drawing of Dethridge meter.

In Australia it is considered satisfactory up to 5 cubic feet per second. Where the quantities are either larger or smaller than these amounts the error will be in favor of the water user. While rather expensive to install there are no parts which will wear out except possibly the counter. The bearings are merely oiled wooden blocks. Variations in the friction will not alter the discharge; if

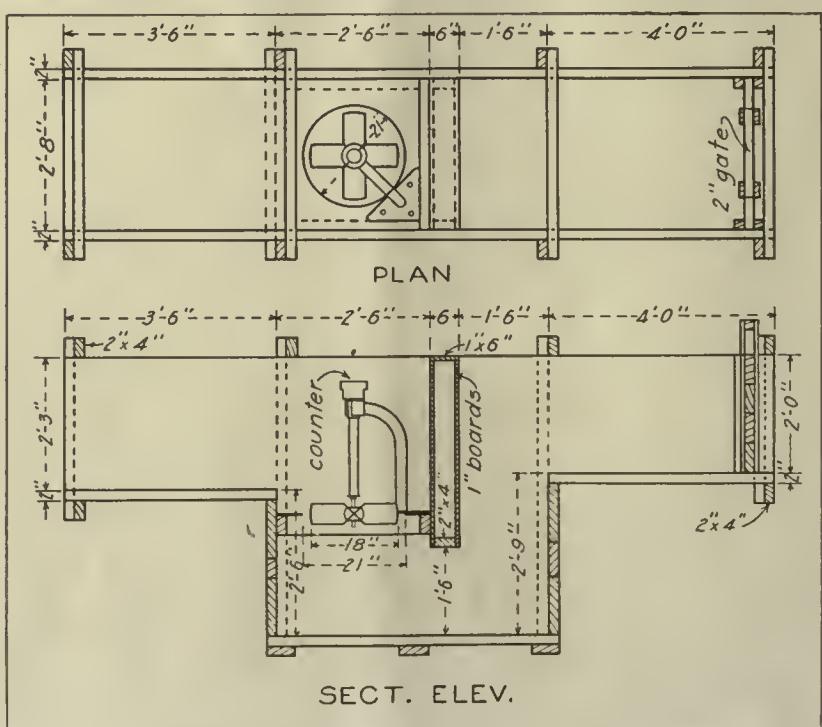


Fig. 21—Plan and elevation of installation of Grant-Mitchell meter.

meter passes more water than it does between these limits. The amount of water going through the meter varies with the depth of drowning. A meter set high in the ditch will discharge less water per revolution than one set low. Checking up the ditch below a meter so that the depth is increased at the meter may decrease the discharge by as much as 10 per cent in some cases.

The Dethridge meter of this size is adapted for accurate measurement of streams varying from 1 to 3 or 4 cubic feet per second; in Australia it is

In Fraserland it is
five feet per second.
arger or smaller than
the favor of the water
install there are no
possibly the counter.
den blocks. Varia-
the discharge; if
the bearings are
tight a greater fall
will be needed to
drive the wheel,
but unless tighter
than they will be-
come if not tam-
pered with, the
discharge per rev-
olution will not
change. Where
larger amounts
are to be turned
out, larger meters
can be built or
more than one in-
stalled. The me-
ter has the advan-
tage of being
easily understood.
The wheel stands
up in the air and
has a clumsy ap-
pearance, yet it is
so much advantage
to be able to look
across the field to

the turnout and see by the turning of the wheel that water is still coming. When users realize that every turn of the wheel means so much water charged to them they will be more liable to economize in its use.

The Grant-Mitchell meter is shown in figures 21 and 22. It consists of a wheel turning in a horizontal circular opening through which the water is made to pass. This opening sets a little below the bottom of the ditch. The water in entering drops into a box set below the ditch bottom, passes under a cross wall, rises through the circular opening in which the meter is set, and passes on down the ditch. The meter consists of four flat blades set so that the water in flowing through the circular opening strikes against them at an angle. In this way the wheel is turned similarly to a wind mill. On the upper end of the shaft carrying the wheel is a counter which records the number of revolutions of the wheel.

This meter is made in 4 sizes, 12-inch, 18-inch, 21-inch, and 39-inch. The size to be used is determined by the size of the circular opening. The rated capacities for these sizes given by the makers are 1.66, 3.75, 5.83 and 16.66 cubic feet per second, respectively. The wheel, counter, and standard for holding the wheel are sold and controlled by the patentees or their licensed agents. The prices quoted for Pacific Coast delivery, in lots of not less than 6, with freight but not duty paid, are \$52.25, \$66.75, \$74.20 and \$170.30, respectively for the four sizes. The meter

was invented by the two Australian engineers for whom it is named and has been used to some extent in that country, but it has been but little used in the United States. The box for the meter can be built of either wood or concrete; that installed at Davis is of wood. The standard for holding the meter is arranged so that the meter can be removed when not in use. On systems where the flow through each meter is not continuous, the meter can be used on more than one ditch, being moved around as water is turned out.

The tests made at Davis of a 21-inch Grant-Michell meter showed that for discharges of over 2 cubic feet per second and up to 6.5 cubic feet per second, the meter makes one revolution for every 6.1 cubic feet of water passed. More water is passed per revolution on lower rates of discharge. The 24 tests made show that the meter will probably register within 2.5 per cent of the true quantity. The fall required in the ditch to get the water through the meter varies

with the rate of flow. It is about 1 inch when the discharge is 3 cubic feet per second and rises to 4 inches with a flow of 5 cubic feet per second.

This meter is not as much affected by changing the depths of water on the lower side as some others. The tests at Davis were made with varying depths but showed no regular differences. This is an advantage when used on a ditch which is sometimes checked up. Its high cost, however, is against its general use.

The Hill meter is shown in figures 23 and 24. It consists of a circular opening set horizontally in the floor of a box

through which the water to be measured is made to pass. The meter consists of curved vanes set on a central drum. It sets in the center of the opening and is turned by the water as it strikes against the vanes on rising through the opening. The turning of the meter drives the gears of a counting device which records the water passed in acre-feet. Different sized openings and meters are used for different sized quantities of water. The box in which the meter is set resembles a siphon.

The Hill meter is patented and must be bought of the patentee or his licensed agents. While it has not been used to any extent as yet, and has not been pushed commercially, it is estimated that the meter alone, when manufactured in quantities, should cost about \$10 each for the 12-inch size and about from \$12 to \$15 for the larger size, with a probable reduction with
(Continued on page 302)



Fig. 22—The Grant-Mitchell meter measuring water.

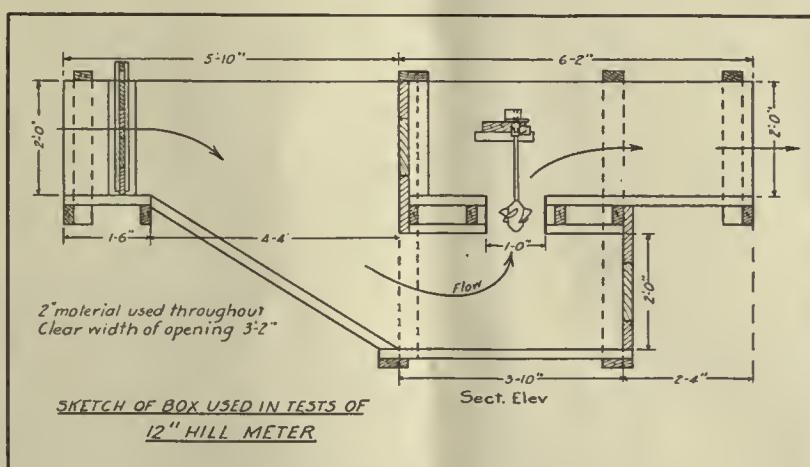


Fig. 23—Sectional elevation of a 12-inch Hill meter.



Fig. 24—A Hill meter in operation.

The Federal Water Users



A Department Devoted to the
Interests of the Farmers on the
Government Irrigation Projects

EDITED BY GEORGE J. SCHARSCHUG

CONGRESSMEN PLEDGE FAIR DEAL TO PROJECTS

THE Congressmen who have been inspecting the United States Reclamation Service projects found considerable time for speech-making while on the Shoshone project in Wyoming. As they are members of the House committee on appropriations, which will fix the future appropriations for the various projects, and as nearly all are Eastern men, almost totally unacquainted with irrigation in the West, their views are interesting.

* * *

REPRESENTATIVE SHIRLEY of Kentucky said:

"We have been hard at work ever since we started out on this trip. We hope that the trip will be of especial benefit to the people of the project. When the Reclamation fund was turned over to the committee on appropriations, we were at sea as to how much money should be granted to the different projects; most members of the committee are eastern men who know nothing at all of irrigation and are not in position to appreciate the existing conditions on the projects. Therefore it was decided to visit the projects to find out their needs that we may deal with them fairly and do them full justice. We want to help you; we want you to be successful and we are going to help you to help yourselves. Before starting out on this trip we were instructed not to make promises, but can assure you that each project will be judged without prejudice and according to its full merit. It is our duty to see that all moneys from the Reclamation fund are expended for worthy projects and that the settler's reimburse the United States within the specified time."

* * *

REPRESENTATIVE GILLETTE of Massachusetts said:

"I was surprised to find such a high standard of American citizenship on the projects. It takes the highest degree of intelligence and a vast amount of courage on the part of settlers to have transformed this raw land into such a beautiful valley as I have found here. If the farmers of the east would exercise only an ordinary share of the energy possessed by the people of the Shoshone project, the eastern farms would produce a great deal more."

* * *

REPRESENTATIVE BORLAND of Missouri said:

"When the government wished to turn the western country into a money paying proposition it was decided that the very best investment that Uncle Sam could make was to open the land to

entry and the establishment of good American home-makers. Uncle Sam has made no mistake in this. He has not been disappointed with the investment, but feels that he is being well repaid. To the homesteader is due the credit of the West's great progress.

"On the irrigation projects the government formerly gave the settler's ten years in which to pay back into the treasury the sum advanced for putting the project in condition for settlement. However, it seems that through unforeseen circumstances this period of ten years was not sufficient time to allow the settler to meet his obligations with the government. The United States is willing to do all in its power to help the settler in making a home, for success in the west means success in the east. Therefore, the United States has extended the time of payment from ten to twenty years.

"The cost of a project is enormous, making it necessary that the projects now being settled should be paid for in order to carry on the work on other projects for future settlement. Therefore, your contracts with the government should be as binding as though it were made with a private party."

* * *

REPRESENTATIVE BYRNS of Tennessee said:

"This is my first visit to the projects and I am more than deeply impressed with the character of their citizens, the thoroughness of their work, their courage and above all their high degree of success. In regard to appropriations all I can say is that when the needs of the projects are brought up each will be dealt with impartially and without prejudice and will be judged according to the merits."

3 H. P. MOTOR WATERS 10 ACRES

Irrigating 10 acres of olives, oranges and peaches in California with a 3 horsepower motor was made possible for R. L. Fuller by the use of underground pipes and a dozen hydrants. Three of these hydrants were on high points far distant from the well, but the water was forced thither very easily. The well is 140 feet deep and the pump has a 3-inch discharge, forcing the water to whatever section of the place Fuller wanted to cultivate a few days later. There is no loss of water on the way and no seepage which would prevent cultivation between the well and the farthest high point on the place. The hydrants enabled him to use a large or small stream of water as desired and to shut off just when enough had run onto the land.

SOME REVALUATION REPORTS WORTHLESS

STAR chamber sessions have characterized a majority of the recent meetings of the revaluation boards on the various projects. Reports by nearly all of the local boards have been completed and are ready for review by Secretary of the Interior Lane's "Supreme Court on Revaluation."

Several of the reports turned in are valueless to the settlers, who must pay the cost of the hearings. The reports represent merely some more waste of the water users' money.

Of the hearing on the Minidoka (Idaho) project, the *Rupert Democrat* says:

"Commissioner DeMary favored us with a brief resume of the actions taken, and from it can be gleaned the fact that nothing of any value to the settlers was accomplished. The whole thing reads like a pretty good brief for the defendant, if the Service can be placed in that position.

"One of the principal things that the committee was to ascertain was whether or not the original contract, or supposed contract, at a price for construction of \$26 an acre, should be binding on the government. On this point the committee returned a Scotch verdict and left the whole matter where it

was before. They defend this action, or rather lack of action, by the statement that the committee felt that this was a matter of law. Granting that this is a fact, it had been hoped that the board would have made some pertinent report upon a question so vital to the settlers.

"The board admits that it found a general agreement among the settlers that some eleven thousand dollars' worth of work done was worthless, and goes on to say that proportioned to the whole, this was too small to be considered, so they "hesitated in recommending that it be thrown out." It seems to a man up a tree that if the Minidoka Irrigation District, for instance, should be able to save to the settlers eleven thousand dollars, the latter would certainly feel that something had been accomplished.

"The only recommendation of value so far apparent is in regard to the drainage costs, and that recommendation will probably have not the slightest effect upon the Department of the Interior.

"Summing the matter up so far as the information at hand is competent evidence, the work of the commission is of little positive value, either to the Service or to the settlers."

HOW TO FIGURE A WELL'S IRRIGATION CAPACITY

By GEORGE W. KABLE

Assistant Irrigation Engineer of New Mexico Agricultural College

WHERE water is pumped for irrigation the question of how many acres can be irrigated with a given size of pump continually arises. The answer to this question depends on a great many factors, but by making a few assumptions results which are very close approximations may be easily determined.

Investigations in this state and elsewhere indicate that the average amount of water used in irrigating orchards is about $2\frac{1}{2}$ acre-feet per acre per season. Alfalfa is usually irrigated twice for each cutting, making ten irrigations or about 36 inches of water during the season. We will assume these figures to be correct for our New Mexico conditions.

Since the interest and depreciation on a pumping plant amount to about two-thirds of the total pumping cost, the pump should be idle very little during the irrigation season in order that its size and cost may be as small as possible. Let us assume that the pump will be run 18 hours per day. This will necessitate the use of a surface reservoir large enough to hold the water of about a twelve-hour run. The irrigation season in localities where water is pumped is about 180 days in length.

By computing the quantity of water in acre-feet that will be pumped during the season and dividing by the duty of water assumed in acre-feet per acre, we get the following simple rule: To find the number of acres of alfalfa a pump will irrigate, divide the capacity of the pump in gallons per min-

ute by 5; to find the number of acres of orchard a pump will irrigate, divide the capacity of the pump in gallons per minute by 4.

MEAD VISITS U. S. PROJECTS

"Do not prepare any banquets. I want to see the project and talk with the water users."

Elwood Mead, chairman of Secretary of the Interior Lane's supreme board of review on costs of the federal irrigation projects, sent this message to the various projects, which he is visiting.

Mr. Mead is seeking first hand information to aid him in passing upon the reports of the various local boards.

IRRIGATES MISSOURI FARM

C. C. Bush, of Reed's Spring, Mo., has constructed an irrigation system to water his corn and other crops.

Next season Mr. Bush expects to perfect the system and engage an experienced gardner for truck farming. Being sure of the produce, he can secure a market to a good advantage.

There are thousands of acres of excellent land in South Missouri that can be irrigated from the springs along the hillsides. While in general there is plenty of rainfall most seasons to insure abundant crops on the hills as well as in the valleys, yet irrigation would make a crop certain. With fruit farming and grazing for the hills, and all the crops of an irrigated country for the valleys, South Missouri could be made one of the most prosperous regions of the world.

PREDICTS GREAT PROGRESS IN IRRIGATION

"THE Newlands bill appropriating \$500,000,000 for the construction of huge reservoirs in Colorado, Montana and one or two other Western states will be passed at the next session of Congress," declared J. B. Case of Abilene, Kan., president of the international irrigation congress, which will meet in California during the week of September 17. President Case predicted that there would be more progress in irrigation and colonization in this country in the next ten years than in the last forty years.

"There is a widespread and genuine interest in the Newlands act throughout the territory interested," continued Mr. Case. "A systematic campaign is to be made in the interests of the passage of this act at the next session of Congress. Sufficient sentiment has already been crystallized to insure its passage, but we are going to take no chances. Meetings will be held in every state affected by the measure, and every effort will be made to bring out an overwhelming and unrefusuable demand for its passage.

The Newlands act proposes to appropriate \$500,000,000 in ten annual installments of \$50,000,-000 for the construction of huge reservoirs in the intermountain country containing headwaters of large streams for the purpose of supplying water and power to these and adjacent states.

"We propose to discuss at the next congress practical means for taking care of the immense army of colonists that will come to this country at the close of the present war in Europe. With the numerous irrigation projects now under construction and in process of creation, we will have plenty of available land for the thrifty and the honest farmer, whether from this country or abroad.

"There will be thousands attracted here by the wish to escape the taxes that will burden the countries of Europe for years as a result of the war, and we must be in a position to give these men a fair chance with our own people to win a competence from the soil."

The 1915 session of the Irrigation Congress will be held on wheels. One thousand automobiles have been tendered the officers of the convention for the purpose of transporting the delegates from Sacramento, where the convention will open, to Stockton for the second day's proceedings, and from thence to Fresno and then on to San Francisco, where the final sessions of the congress will be held in Festival Hall at the Panama-Pacific Exposition. Instead of exhibits in halls or buildings the delegates will see growing orchards, fields and vineyards during the automobile journey between the points named.

FLOATS GIANT EXCAVATOR ACROSS RIVER

From the Adelaide, Australia, Chronicle

THE Irrigation and Reclamation Works Department has performed a feat of some note in transferring intact across the River Murray the type A Austin excavator which was purchased in America and erected on the Mypolonga swamp during the regime of the Verran Government, at a cost of £6,826. A Parliamentary party was taken down to see the big machine in motion, and members were much impressed by its size. The excavator has two enormous arms, which rise up on either side to a height of about 30 ft. The spread of these arms is 80 ft. from tip to tip, and the complete machine, which travels over the earth upon "caterpillars," weighs 80 tons. It is a great labor-saver, but the department was criticised for having bought such a costly machine, for it was considered much too heavy and unwieldy to be moved across the stream to other swamps without being dismantled. Mr. S. McIntosh (Director of Irrigation and Reclamation Works) enquired in America to ascertain the methods that would be adopted in similar circumstances there. The Americans advised building a pontoon to float the machine intact across the broad stream, but the pontoon, besides costing a couple of thousand pounds or so, would have been of little use for anything except as a float for the excavator.

The question of shifting the huge machine long troubled Mr. McIntosh. Engineers in South Australia advised him that he would have to dismantle

it, carry it in sections, and erect it again on the new site. It was a fast worker and did not take long in fixing up the drains on Mypolonga and other swamps on the western side of the stream, finishing at Wall Swamp, not far from Mannum. Then it was required at Neeta Swamp, on the other side of the river, and the transportation question had to be settled. To dismantle the machine, carry it in sections, and reassemble it would have cost about £250, and as that expense would recur every time a water-shift was required, it would probably have counteracted the value of the machinery in comparison to manual labor. In addition the process would have occupied about six weeks, and the excavator would have been out of use all that time.

Therefore Mr. McIntosh decided upon a bold course, which many people said would end in disaster. He gave instructions for two barges to be built, which were required in the general operations of the department, and proposed to lash these vessels together, run the big machine onto them, and sail away with it on board. Competent engineers prophesied failure and facetiously asked Mr. McIntosh how he was going to fish the wreck out of the river, for the machine, with its long arms reaching up into the sky, was considered so top-heavy that the barges would not carry it. People who have seen the excavator realize the magnitude of the undertaking. Still, in spite of all opposition, Mr. McIntosh lashed the barges together and ran the

machine onto them along heavy bridge timbers. By an ingenious arrangement he balanced the vessels so that the great weight was equally divided between the two, and towed by a steamer, the strange vessel, with its stranger freight, steered across and along the river. The bulky machine crawled once more onto terra firma, and the transportation was complete. Mr. McIntosh believes this is one of the biggest undertakings of its kind ever handled in any part of the world. The transportation cost less than £50, and Mr. McIntosh says he can take the excavator anywhere he likes along the Murray.

DANGER OF THE PIT SILO

Editor IRRIGATION AGE:—I think Mr. Larsen should have pointed out in his excellent article on the pit silo, in your June number, the danger that is likely to be met with in its use. A silo should be so built that it is always ventilated to a point nearly opposite the top of its contents. This allows the carbonic acid gas, or carbon dioxide, to flow off without doing harm. If built in the side of a bank, a pit silo might be so ventilated. The carbonic acid, being heavier than air, lies in the silo if means for its escape are not provided.

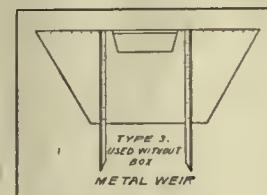
The pit silo is one of the earliest forms, but lives were lost by reason of the accumulation of carbonic acid, and it is probable that in this fact we may have the chief reason for its abandonment. The presence of carbonic acid may be detected by lowering a lighted candle into the silo, and common pru-

dence suggests that this always be done before going into any unventilated pit or mine where the decay of vegetation may have generated carbonic acid.

The pit silo may be made safe by proper precautions, but will everyone who uses it always have the forethought to take those precautions? "Safety First" suggests that pit silos be built only in the sides of banks, where they may have an opening clear to the bottom.

M. B.

Measure Your Water

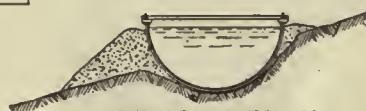


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AT THE HEADGATES

Washington

Work on the contract recently awarded A. Guthrie & Co., Inc., by the West Okanogan Valley Irrigation district of Washington, to reclaim 10,000 acres by canal irrigation has already begun and it will be pushed to completion before the end of this year. The contract price for the completed job is \$511,600, paid out of the proceeds of a bond issue of \$600,000, purchased as a personal investment by Charles Ffolliott of St. Paul, president of A. Guthrie & Co. Before financing this project for the West Okanogan Valley Irrigation district, Mr. Ffolliott insisted on the listing for sale at a low figure of practically all the land in the consolidated district, which the owners would be unable personally to bring into cultivation.

Even though a local improvement district has not money to pay the annual water charges, an irrigation company must furnish water, according to a recent decision against the Pasco (Wash.), Reclamation company.

Idaho

The Utah Construction Company will take over the construction work on the Blaine county irrigation project in Idaho, sold under the hammer to James Ennes of Kansas, for \$150,000, providing the settlers will accept less water per acre than the original contract calls for.

The Utah Construction company is ready to spend \$1,000,000 in further developing the Big Lost River project, which was bought at public auction, providing the settlers will agree to a two-acre foot contract. The Idaho irrigation commission, which inspected the project, reached the conclusion, it said, that the best settlers could expect would be the two acre-feet and its members are inclined to the belief that two acre-feet under the present conditions is all that the settlers can expect.

M. H. Woods of Kansas City, Mo., has bid in the Blaine county (Idaho) irrigation project for \$150,000. With other capitalists, he expects to spend \$100,000 in putting the project in good working shape.

Colorado

Two companies, one capitalized for \$250,000 and one for \$200,000, have been organized to take over the assets of the Pueblo-Rocky Ford Irrigation Company. Forty thousand acres of land will be thrown open for settlement.

Utah

F. B. Hammond of Moab, Utah, is urging a government irrigation project along the Green river, which would

water 1,000,000 acres. It is claimed the dam and headworks can be built for \$5,000,000 and would solve control of the Colorado river floods.

Oregon

Three thousand acres will be irrigated around Keno, Ore., by an electric pumping plant.



(650-43R)

"Crop Insurance"

is a term fittingly applied to irrigation. Economy urges the application of such insurance with centrifugal pumps driven by oil engines or electric motors.

We furnish the pump and the machine to drive it.

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International Harvester Tractors: Mogul—Titan

THERE is work on your farm for a Mogul or Titan oil tractor—work that's too heavy for horses and for which horses are too expensive to use.

Did you ever have power enough at plowing time to plow the way you wanted to? Did you ever allow a needed fallowing, disking, or harrowing to go undone just to save the horses?

There is no profit in that. Use the horses for the work they are fitted for and give the killing work to a Mogul or Titan oil tractor.

Mogul and Titan tractors all use low grade oil fuel, the cheapest fuel in the world. They are all field tested and proved; all easy to understand and handle. In size they range from 8-16 to 30-50-H. P., a range wide enough to meet the needs of practically every farm.

The oil tractor is here to stay, because it increases the net profit from the farm. It costs you nothing to write us and get facts and figures that will help you to determine just what saving a Mogul or Titan oil tractor will make on your farm.

International Harvester Company of America

(Incorporated)

CHICAGO

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U.S.A.



The Goose Lake Valley Irrigation Project in Lake county, Oregon, and Modoc county, California, has been completed. The district includes 50,000 acres. The storage reservoir is thirty miles in circumference.

Montana

A suit has been brought in Hamilton, Mont., asking the district court to declare the Bitter Root Valley Irrigation Company insolvent.

Boomer & Hughes of Spokane, Wash., have obtained the contract for the construction of the Glen Lake irrigation project in the Tobacco Valley of Montana. The main works will cost about \$100,000.

How to Make Farming Pay

Agriculture

The Best Handbook for the Farm

By OSCAR H. BENSON
of the United States Department of Agriculture and

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284 Photographic Illustrations, 444 Pages

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* This rate applies to renewal subscription orders also.

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California

Flat water rates of \$2 per acre annually for general crops and a special annual rate of \$7 for rice lands were decreed by the California state railroad commission in its revision of the water rates of the Sacramento Valley West Side Canal Company.

Farmers in the Hot Creek Valley of California had their irrigation project practically wrecked by the hot mud

poured forth from Mt. Lassen, a volcano, which became active recently. Plans are under way to repair the damage.

Plans for a huge irrigation project, covering 200,000 acres in Amador county, Calif., have been formulated by the Ione Valley Development Association. A petition for the organization of the irrigation district is being circulated.

Alfalfa for profit

"One-Half the Alfalfa Seed Sown is Wasted Every Year"

This statement has been made by many recognized Alfalfa experts—men who know what they are talking about.

They say that they see cured better stands of Alfalfa with 10 lbs. of seed, Superior Special than with 20 lbs. Alfalfa and of seed sown broadcast.



THE SUPERIOR 20 X 4 SPECIAL ALFALFA AND GRASS SEED DRILL

There are 20 discs on this machine set 4 inches apart. The construction is such that all the seed is sown at an even depth, and an equal amount of seed in every furrow.

None of the seed is wasted, when drilled in the ground with a Superior Alfalfa and Grass Seed Drill

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Saves More Than Two Dollars an Acre on
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FREE—A copy of "Boyd's Farmers' Alfalfa Guide," price 10c, will be mailed free to any reader of Irrigation Age who will write for the book and mention Irrigation Age.

WATER MEASURING DEVICES

(Continued from page 295)

very large quantities. The cost of the structure for holding the 12-inch meter will vary from \$10 to \$15. It is stated by those who have developed this meter that any kind of an orifice in which the meter can be inserted so that its axis is vertical will do very nicely after the meter has been calibrated to suit that type of orifice.

From a test of a 12-inch Hill meter at Davis it appears that this size of the meter will register the quantity passed within 1.5 per cent for discharges of from 1 to 3.5 cubic feet per second. For discharges of less than 1 cubic foot per second, more water passes the meter than is registered. For discharges of 3.5 cubic feet per second the water boiled up through the opening so as to submerge the counter of the meter tested. By increasing the length of shaft of the meter higher discharges than this can be crowded through the 12-inch meter, but the greater loss of head required makes the use of larger meters preferable.

The loss of head or fall in the water required for this meter varied from 1 inch, when carrying 1 cubic foot per second, to 6½ inches, when carrying 3.5 cubic feet per second.

The Hill meter seems adapted to use under the usual conditions of irrigation practice. It is simple and has few wearing parts. The head required for the different sizes is less than that needed for the use of weirs. The record of the total quantity of water passed can be read in units of .001 acre-foot.

The Hanna meter has not yet been tested in the Davis laboratory. This meter has been designed by F.

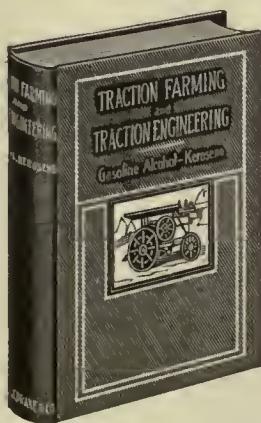
W. Hanna, supervising engineer of the U. S. Reclamation Service. The present retail price is \$50. Figure 25 is taken from a photograph of one of these meters; figure 13 shows one installed with a Cipolletti weir.

The Hanna meter differs from the Dethridge, Grant-Michell, and Hill meters in being a device that registers the quantity passing through some other device rather than itself making the measurement. It differs from an ordinary water register in that it registers the quantity of water passing rather than merely the height of the water in some device. It can be installed in connection with a weir, a rating flume, an open channel or a submerged orifice, or an orifice with free discharge, and will indicate on a counter, directly in acre-feet, the quantity of water passing. The mechanism of the meter is inclosed in a dust-proof metal box, shown in figure 13, and when installed this metal box rests on the top of a stilling box, also shown in the illustration, which communicates through a pipe with the stream being measured. A float resting on the water of the stilling box and an 8-day clock together operate the meter.

The next article will discuss Water Registers and Current Meters and also will include the story of how some of the Meters mentioned above were tested.

Idaho is after the water wasters. Several have been fined. As in other western states, there is a shortage of water this year in Idaho. Water wasters not only rob fellow settlers of water and injure their own lands, but they frequently ruin roads, thereby hurting whole communities.

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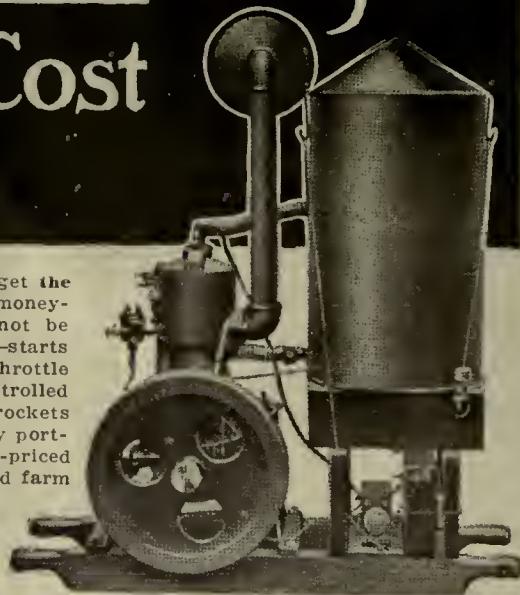
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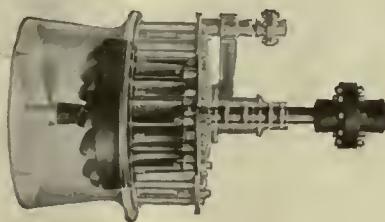
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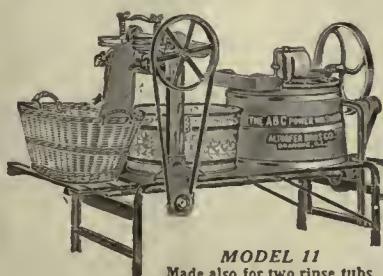
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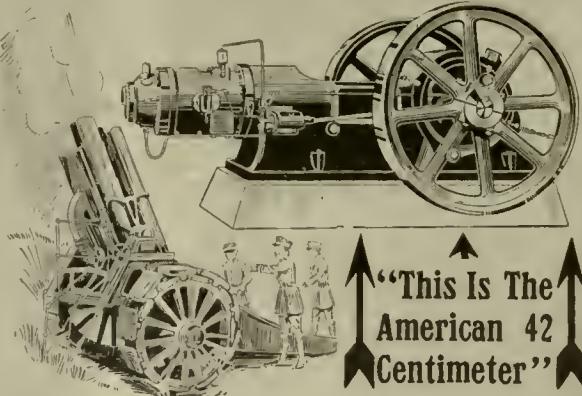
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Work all night—work all day—
Still no corn, no wheat, no hay.

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Tired of farming—tired of life;
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Rich old farmer says to his "better half,"
With a tender smile that turns to a laugh—
"The Litchfield Spreader on this here farm
Has given us a bank account long as my arm."

"ALL'S WELL THAT ENDS WELL."

Thirtieth Year

THE IRRIGATION AGE

VOL. XXX

CHICAGO, SEPTEMBER, 1915.

No. 11

THE IRRIGATION AGE

With which is Merged

The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARID AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

D. H. ANDERSON
PUBLISHER,

Published Monthly at 30 No. Dearborn Street,
CHICAGO

Entered as second-class matter October 3, 1897, at the Postoffice
at Chicago, Ill., under Act of March 3, 1879.

D. H. ANDERSON, Editor

ANNOUNCEMENT.

The "Primer of Hydraulics" is now ready; Price \$2.00.
If ordered in connection with subscription \$2.50.

Beware
of the
Glittering
Bait

"At the next session of Congress we
should work to get what we want
for this project."

Project Manager Camp of the
Klamath (Ore.) Federal project
made the above statement recently
to the settlers in his project.

His words are filled with dynamite. He asks
one project to array itself against others, to battle
in Congress for funds—to pull wires, to lobby.

This is no time for the Federal Water Users
to be arrayed against each other. Only united action
will bring from Congress the reforms yet needed to
make life on the projects worth while. These re-
forms are far more important than the dollars needed
to enlarge any project.

And yet Federal project managers are sending
up similar cries in Montana, in Washington, and in
other states. No doubt the old Reclamation Service
crowd would be glad to see the Water Users fighting
among themselves. Do not take their bait!

The revaluation reports will probably go before
the next Congress, if Secretary Lane's "Supreme
Court" completes its work. Every Federal Water
User who has studied the work of the local boards
realizes the necessity of concerted action by the
settlers in all the projects, if any results beneficial

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Official organ Federation of Tree Growing Clubs of
America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation
of Water Users' Associations has taken action whereby
THE IRRIGATION AGE is created the official organ of this
vast organization, representing 1,000,000 persons on the
government irrigation projects.

Interesting to Advertisers

It may interest advertisers to know that The Irrigation Age
is the only publication in the world having an actual paid in
advance circulation among individual irrigators and large
irrigation corporations. It is read regularly by all interested
in this subject and has readers in all parts of the
world. The Irrigation Age is 30 years old and is the
pioneer publication of its class in the world.

to the Water Users are to be obtained. Otherwise,
all this show, which the settlers must pay for, will
bring only a nice coat of whitewash for the Reclama-
tion Service.

And how easy it will be to smear on the white-
wash, if the Water Users are busy scrambling for
stray pennies to build more of their projects.

Let your Congressmen pull the "money wires."
The Federal Water Users cannot afford to be-
come petty lobbyists.

Mix a Little
Play With
the Work on
the Farm

Rural communities need play—in
fact, no place needs play more. Liv-
ing becomes a hard, iron-clad propo-
sition with no surety of anything
save the deadly monotony of the
daily grind, unless it be relieved by
some form of occasional recreation.

Play was considered by our forefathers to be
a creation of the "evil one," and to really stop work
and to play was a long step on the road to eternal
punishment. The trend of ideas is changing, and
today we are finding in play much that is not only
good, but absolutely essential to the physical, men-
tal and moral development of the country.

To the rural community the economic value of
recreation is of great importance. It is not only of
value to the farmer to keep his sons and daughters

on the farm, but it is of great value to the country at large. From the rural districts comes the citizenship of our country, and if we are to keep the ideals of our nation inviolate, we must keep our country youth content on the farm. In any place life must be made attractive to make it worth living, and to save young people from gaining the false standards of value and false ambitions which the city offers, life at home, in the country community in which each farmer and his family live must be made attractive and possible through some form of home and community recreation.

Prosperity! It is spelled for the **Harvest Worth** United States this year in these figures: Wheat, 1,000,000,000 bushels; corn, 3,000,000,000 bushels; oats, 1,500,000,000 bushels. Total for the three grains 5,500,000,000 bushels. In round numbers, those figures are the government estimates.

Such figures are almost too great for comprehension. What does this mean in dollars and cents? Figuring wheat at a dollar a bushel (it's more than that now), corn at seventy cents, and oats at forty cents a bushel, the result:

Wheat	\$1,000,000,000
Corn	2,100,000,000
Oats	600,000,000
 Total three grains.....	\$3,700,000,000

Crops of that stupendous total are now being harvested. That huge total is being put in circulation in this country. It goes not into the pockets of a few very rich men; it goes into the pockets of the farmers of every state—from there to reach every channel of trade.

It needs no prophetic soul to foretell early and certain prosperity. The billions from the harvest furnish guaranty.

There has been no overcapitalization, no over-production, recently, in this country. On the contrary, for two or three years there has been an extraordinary period of retrenchment and severe economy. Stocks are low whether in big business or in the tens of thousands of little stores. The great railroads and the small factories need rehabilitation. All business is waiting for the word to start the greatest buying movement in this country's history. The billions from the bushels will start the wheels.

Even though we are facing an international crisis, there can be no question but that we are on the verge of prosperity far greater than ever before experienced, even in this nation of great plenty. The far-seeing business men already are shaping for the

booming times. Quietly they have been buying goods, laying in new stocks, all the while talking hard times so that no one would boost the prices on them.

The time to buy is when every one wants to sell; the time to sell is when everyone wants to buy.

There never was a better time to buy than now.

The country is just coming out of the cloud, into the financial golden sunlight. The wise men know it. Every one should wake up to the real condition.

The big money will be made by those who begin their buying now, before the prices soar; by those who have new, fresh goods to tempt some of the farmers' unprecedented wealth.

There are none so blind as those who will not see.

Opportunity knocks!

Do it today! It will be a harder job tomorrow.

It's nice to talk about war, but—are you ready to enlist?

Old-fashioned annuals and perennials are more in use this year than ever.

Let's not knock a chip off anybody's shoulder unless we are prepared to fight.

Take better care of the farm machinery this winter. You cannot make money any easier.

It will soon be time to take up geraniums and annuals to be grown in the house for winter flowers.

A good strain of hollyhock makes an excellent plant for a late summer screen at the rear of the house.

The seas must be free, even though it hurts England's pride a bit. The Kaiser has bowed to the U. S. King George is next.

Great Britain's bargain with J. P. Morgan may hold down grain prices but the record crop will not go to waste. Perhaps it may mean cheaper bread.

The lazy man generally wears a hang-dog look, because down in his heart he is ashamed of himself and knows that he deserves the contempt of his fellows.

URGES U. S. BACKING FOR IRRIGATION BONDS

By L. M. RICE,
of Seattle, Wash.

THE majority report of the Revaluation Board of the Carlsbad project, as published in the July IRRIGATION AGE, is a remarkable document. If the testimony upon which those conclusions were reached is true, and fairly representative of the situation in general relating to Reclamation project affairs, then the work of revision has not begun too soon. The revaluations in this report very pertinently raise the question, "How can the Reclamation fund be administered without waste?"

In an address delivered by Judge Carroll B. Graves before the Washington Irrigation Institute at North Yakima, Wash., on December 17, 1914, it was pointed out that a portion of the Reclamation fund might wisely be used for the purpose of guaranteeing interest on the bonds of such districts as have been approved by Reclamation engineers. An amendment to the Jones Bill embracing the plan as suggested by Judge Graves, would greatly relieve the Reclamation Service of the vast financial and construction detail incident to present methods; and the settler, accustomed to participate in local affairs, would thereby be brought into harmony with a development that is in accord with American democracy.

In THE IRRIGATION AGE of May, 1914, Assistant Secretary of the Interior A. A. Jones is reported to have said at the Denver Conference: "We might do this: provide a fund to start and finish a project; put the farmer on the land; give him water; look after his wants and earnings, and then turn the whole thing over to a local association. With the project completed and with liens upon your land you ought to be able to dispose of your bonds. But there should be nothing payable for the first ten years, and the bonds should be long-term and guaranteed. There is \$100,000,000 in the Reclamation fund, and Congress might be persuaded to use this to care for the defaults in interest payment. In that way, the interest might be made as low as 3% or 4%,

with the government practically behind the bonds."

Proposed federal aid to Reclamation work took definite shape in S. 6827, at the last session of Congress, which is known as the Jones Bill, and is still pending. It was introduced by Senator Wesley L. Jones of Washington. This bill authorizes federal guarantee of interest on bonds of such district projects as may be pronounced feasible by Reclamation Service engineers. The passage of the Jones Bill, whether amended along the lines above suggested or not, would greatly stimulate development by means of district organization in which the administration of affairs rests with those who pay the bills. Most of the state laws governing district operation require the creation of a sinking fund for retiring bonds at maturity.

The federal guaranty contemplated by the Jones Bill would impose very slight risk upon the government. District bonds, the principal of which is covered by a cumulative sinking fund backed by the land of the district, and the interest thereon guaranteed by Uncle Sam, would form a very attractive security and find ready sale in the market practically at par.

A district has every incentive to manage its affairs in a business manner, eliminating all unnecessary outlay, and confining overhead

"Practically worthless land" now paying big profits in crops of wheat, oats, corn, potatoes and alfalfa. This 1,000 acres of volcanic ash soil, the Phillips Estate at Fort Pierre, S. D., was made a profit earner by the installation of a 100-horsepower oil engine and a 10-inch centrifugal pump on the banks of the Missouri River. The pump discharges 3,000 gallons of water per minute. The engine is housed in the brick building and is belted to the pump in the smaller building. Photographs by courtesy of Fairbanks, Morse & Co.

charges to the least sum consistent with efficient service. District organization is a growth. It has been evolved out of the failures of other plans of development, and given tangibility by the necessities and difficulties surrounding the initiation of every new project. It is a concrete exponent of modern practice, and the deliberate conclusions of the most profound present-day thought.

With a view of ascertaining what has been accomplished by district organizations where they are now in operation, a circular letter of inquiry was recently addressed to a number of projects.

Seventeen out of twenty districts making re-



ports, have been organized since 1907. Of eighteen reporting, ten succeeded previous organizations, five initiated construction, and three have not commenced construction. The maximum period of operation before changing to district organization was twenty years.

The total area of the twenty districts reported is 736,735 acres, or an average of 36,336 acres per district. The maximum and minimum district areas, respectively, are 176,210 and 3,000 acres.

The total bond issue is \$13,442,300, or an average of practically \$18.50 per acre. The maximum and minimum bond issue per district are, respectively, \$2,572,800 and \$15,000. The maximum and minimum bond issue per acre are, respectively, \$82.50 and \$3.00.

The average rate of interest on bonds is 6%. Of the eighteen reporting on bond sales, seven sold at par, one at 97, one at 96.1, four at 95, and three at 90. Of the fifteen reporting upon ability to meet obligations promptly, fourteen answer "yes" and one "no." The average size per farm is 76 acres.

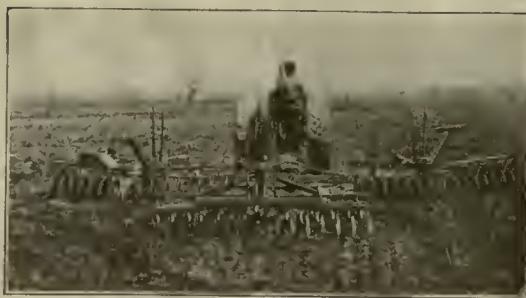
The reports uniformly show satisfaction of the Water Users, and their contentment is, in itself a large factor of success. Illustrative of the landman's point of view we quote from one report: "Organized 1909; issued and sold \$530,000 bonds at 95. Two years later issued and sold \$170,000 more at 96.1. These amounts were net to the district..... The bonds bear 6%, and all coupons have been promptly paid when due, and the district..... is entirely out of debt, with the exception of the bond issue, and has \$10,000 to \$15,000 in the treasury at the present time."

Quoting from another report: "We have met all of our interest and principal payments promptly when due..... without any difficulty, and we expect to meet our future obligations as they mature. The irrigation district law as it stands on the Idaho State Statute books today is good enough for us." Similar optimism pervades the entire series of reports.

Irrigation history, outside of government construction and operation, shows no parallel to the financial stability found in the practical working of the district. A remedy for irrigation distress has really been found.

Let law makers enlarge the remedy. Pass the Jones bill or a kindred measure and thereby give new life to the present halting, lagging, drooping and doubting work of reclaiming the desert.

Pass the Jones bill or a kindred measure and all over this broad land, wherever there is reclamation territory of merit, whether desert, swamp, or over-



One-man tractors earning their keep on a western farm.
Courtesy of the International Harvester Company.

flow in character, and with enough settlers to organize a district, the wilderness will be subdued.

CO-OPERATIVE SELLING

Suggestions by Messrs. Bassett, Moar and Keer,
Specialists in the Office of Markets and Rural
Organization in the U. S. Department of
Agriculture

A new faith has developed on the part of the farmers themselves that the co-operative plan of doing farm business is the most satisfactory method. Like the European farmer, the American farmer is being driven to cooperation by necessity. In the United States the necessity arises chiefly from the costly, clumsy and unbusinesslike methods of distributing food products, resulting in an abnormal discrepancy between the price paid to the producer and the cost to the consumer.

American farmers are beginning to realize by selling cooperatively they not only will be able to offer a standardized product and reduce the cost of marketing, but they will be able to furnish this better article to the consumer at the same or even lower price, thus stimulating consumption. In fact, any system of marketing that does not hope to give better service or better prices to the consumer, and, at the same time, secure for the producer a greater net return, is founded on improper principles.

Farmers must be willing to furnish their products, invest their share of the necessary capital, and at all times give their enthusiasm and most loyal support to the cooperative enterprise undertaken. Frequently a member offers to "let" the association handle a part of his products, forgetting that the favor is to himself rather than to the organization and that the part of his crops which he holds back furnishes the most difficult competition for the co-operative effort to face. The person who lacks sufficient faith in the cooperative plan to "go in all over" will prove an element of weakness rather than of strength.

Farming communities co-operate to secure better churches, better local government, and better schools. If they are willing to leave their religion, their politics, and the education of their children to co-operation, why should they hesitate to leave the marketing of their farm crops to a co-operative system that has passed the experimental stage? It seems to be largely due to their training along individual lines—to their spirit of "going it alone."

The position of manager in a co-operative marketing organization is difficult to fill properly, because it is undesirable. It requires the soul of patience and self-sacrifice to stand by the job in the face of the nagging to which the man who occupies

(Continued on Page 315)

IRRIGATION WATER MEASURING DEVICES

*By California Agents of Irrigation Investigations, Office of Experiment Stations, U. S. Department of Agriculture

THIS is the sixth of a series of articles prepared from a bulletin issued by the College of Agriculture of the University of California, at Berkeley. The articles are illustrated with photographs and drawings of the various structures and devices used in compiling the data.—THE EDITOR.

Reference has been made in the preceding pages to water registers for recording the height of water flowing over a weir or in a ditch or flume. In the main a water register is composed of a cylinder on which a record sheet is fastened, a float which causes this cylinder to rotate as the water being registered raises and lowers, and an eight-day clock which causes a pencil to travel horizontally the length of the cylinder each week, marking on the record sheet the height of the water as it travels. Water registers are usually set at the side of the ditch or weir carrying the water being measured, the float and counter-weight hanging in a stilling well. The register sheets fastened on the cylinder are ruled horizontally to show feet and fractions of feet and vertically to show days and fractions of days. These sheets are changed once each week. To make use of the record they furnish it is necessary to use discharge tables giving the flow with different depths of water for the weir or flume in connection with which the register is set. As a rule water registers are not adapted to farm use. They require constant care and attention and, as indicated, considerable computation is necessary to determine from the register sheets and the discharge tables the quantity of water that has passed.

The standard instrument used for measuring the velocity of water in ditches and other open channels is the current meter. Current meters are not used by farmers, but one should be a part of the equipment of every canal superintendent or irrigation manager. They are mentioned here merely with the hope of en-



A current meter and its equipment.

couraging their wider use by canal companies which have not been accustomed to use them and to make them generally familiar to farmers. Ordinarily it is not feasible to measure the water carried in main canals and main laterals by means of the devices that have been described in these articles. Instead current-meter ratings are made at selected portions of the main canals and main laterals and from these tables are computed showing the quantity of water flowing at various depths. Standard types of current meters cost from about \$75 to about \$90, depending upon the style and equipment.

AUTO-IRRIGATOR

The auto-irrigator is a new instrument for measuring the water-attracting power of the soil, devised in connection with experiments by Professor B. E. Livingston and Dr. L. A. Hawkins at Johns Hopkins University. It is essentially similar to Livingston's porous-cup atmometer, but the cup is buried in the soil instead of being exposed to the air. The experimentors have made a series of measurements

upon potted plants irrigated automatically with this device. The rate of water-loss from the irrigator is found to be highest somewhat later in the day than the time of maximum transpiration from the plants. The rate of loss from the irrigator then falls slowly, reaching its minimum in the early morning.

U. S. STARTS POWER COMPETITION

Competition makes the wheels turn. The Reclamation Service offered to sell power for pumping water onto the dry lands around the Klamath (Ore.) project. The California-Oregon Power Company immediately offered a low rate, and as a result a large number of pumping plants will be installed.

*The installation of the measuring devices described in this series of articles has been carried out chiefly by S. H. Beckett and R. D. Robertson, irrigation engineers, assisted by Roy Wray. The tests of the devices have been made under the immediate direction of S. T. Harding, irrigation engineer, in charge of irrigation investigations in Montana, temporarily on duty in California, who has also prepared the reports of the tests. The weir tables have been prepared by Wells A. Hotchkiss. The drawings and diagrams have been prepared by Stephen C. Whipple, scientific assistant. F. L. Bixby, irrigation engineer, in charge of irrigation investigations in New Mexico, temporarily on duty in California, assisted in designing the general plan of installation. The full study has been

planned and, in general, supervised, and the data has been arranged for publication by Frank Adams, irrigation manager.

The installation of the Davis field laboratory, and the testing of the devices have been jointly paid for from funds contributed by the state engineering department of California, the office of experiment stations of the United States department of agriculture, and the California agricultural experiment station. Co-operation with the state engineering department of California has been effected through agreement between that department and the office of experiment stations, the irrigation investigations at Davis having formerly been carried on by those two agencies without financial aid from the California agricultural experiment station.

The Federal Water Users



A Department Devoted to the
Interests of the Farmers on the
Government Irrigation Projects

EDITED BY GEORGE J. SCHARSCHUG

COMMISSION BLOCKS WATER USERS' SOCIETY

THE Reclamation Service has blocked the organization of a Water Users' Association on the Shoshone project in Wyoming. This action has been taken despite the Reclamation Act, which provides that all settlers must join their project Water Users' Association.

"The Reclamation Commission apparently has executed a genuine about-face on the question of organizing a Water Users' Association, and after the large amount of trouble incurred and time expended in getting the matter in shape by the local men, not little vexation is felt over this unexpected change of front on the part of the Washington authorities," says the Powell (Wyo.) Tribune.

The facts are that the Reclamation Commission had approved a constitution and by-laws for the association; these had been printed and distributed among the water users, and a meeting to adopt them had been called.

"Definitely, the official board refuses to enter

into contract with the association, but does not look with disfavor on the formation of such a body," continues the Powell Tribune. "Its preference is for an 'irrigation district' as provided for in the laws of several states, notably Montana, Colorado, Nebraska, Oregon, California, Idaho.

"We believe the main cause of dissatisfaction locally with the Commission's attitude is the fact that without this official status it will not be possible to secure the membership of every settler in the association, a thing that has long been desired and one which most of us were beginning to think was impossible of fulfillment.

"What we want is an all-embracing organization which may treat officially with the government with the feeling that every settler is standing back of its actions and that the Reclamation officials will consider it as officially representing the will of the majority of those settlers."

WATER USERS TO VOTE ON CO-OPERATION

WATER USERS on the Klamath (Ore.) Federal project will vote in October on a proposition to begin a co-operative movement which may be far-reaching.

Co-operation has for years been a special study of Abel Ady, president of the Water Users' Association, who has always declared the time would come when the farmers of this country would have their own banks, stores, telephone and power systems, elevators and, in fact, everything that goes to make improved conditions in a rural community. The farmers will be asked to vote bonds to cover whatever is saved to them from the present cost basis of \$30 an acre as the result of the revaluation of the project. These bonds are to be sold to provide funds to establish co-operative stores and various other things, including even the publishing of a newspaper, by the association.

Co-operative buying alone would save an enormous sum to the farmers if the whole local membership of the association secured their supplies through a general store. A still greater gain would accrue in co-operative marketing of products, and in the matter of a co-operative bank many financial diffi-

culties under which the farmers have struggled in the past would disappear.

SOME KENTUCKY IRRIGATION

Only a Kentuckian could have devised the "tin can" irrigation system. The inventor is Harry Mitchell, of Bourbon, Ky.

At each tomato plant he places a tin can filled with water, into which he puts one end of a twine string and ties the other end around the plant close to the ground. The water seeping through the length of the string keeps the ground moist for several inches around the vine. At each cabbage plant Mr. Mitchell buries a tin can with the top even with the ground. A small hole is punched in the bottom of the can, which is filled with water, and the ground is kept damp around the plant.

Every Federal water user should read The Irrigation Age.

It is fighting for their rights. If your neighbors do not take the Age, tell them about it.

BORLAND BLAMES THE SPECULATORS

REPRESENTATIVE W. P. BORLAND of Kansas City, Mo., takes an odd view of the Federal Reclamation financial difficulties, following his trip over the projects. He is quoted in a newspaper as follows:

"The United States will be fortunate if it gets back \$75,000,000 of the \$113,000,000 expended in the irrigation projects. Speculators gobbled up the best irrigation projects and financed them themselves, leaving the United States to finance those which the speculators knew wouldn't prove profitable to them without the assistance of the money of the United States government.

"The speculator so provided for his protection that he is paid first and the United States is left to hold the bag if things go wrong, as they have in some projects. The speculator either must have his money or the settler is put off the land. Delegations of citizens from the irrigated regions visit Washington annually in behalf of the 'poor settler' being fleeced by the speculators, a plea being made to defer payments due the Federal government for the water rights.

"Those extensions have been given with great liberality, and while the speculators have got their money and are safe, the United States government has received only a few millions of its \$113,000,000 invested."

GOULDS CO. CHANGES

The Goulds Manufacturing Company, of Seneca Falls, N. Y., manufacturers of pumps, announces that its sales organization is now being directed by R. E. Hall, former manager of the Boston office, and W. E. Dickey, former manager of the New York office, both of whom are vice-presidents of the company. A. H. Whiteside, former sales manager, has resigned.

Mr. Hall, who is now located at Seneca Falls, has charge of the general work of the department, and in addition looks after the business in all the Northern, Central West and North Pacific Coast states, including the territories of the Boston, Seneca Falls and Chicago offices. The export business is also under Mr. Hall's supervision.

Mr. Dickey has charge of all business in Southern, Southwestern and Southern Pacific Coast states, including the territories of the New York, Pittsburgh, Atlanta and Houston offices. He will continue to make his headquarters in New York.

W. H. Hopper, who has been with the company for more than twenty years, succeeds Mr. Dickey as New York manager. C. W. Fulton, formerly works manager, has been appointed manager of the Boston office.

A Pittsburgh office, under the management of H. H. Henderson, who has been representing the company in Northern West Virginia and Southeastern Ohio, has been opened. E. C. Wayne, from the main office at Seneca Falls, has been appointed assistant manager.

SINGLE TAX AIDS DISTRICTS

Starting with the Modesto district, four California irrigation districts have been conducting an experiment in single tax as applied to district revenues.

The latest to adopt this method was the Turlock district, in which the farmers voted for the new system in a proportion of nine to one. Oakdale and South San Joaquin had already taken the step.

Modesto started in 1887 to tax improvements as well as land, but found that this penalized the farmer who improved his land, planted orchards and erected buildings. At the same time, absentee land owners who held large tracts out of use, were lightly taxed and made large amounts in speculation.

TAKES CARE OF HORSES' FEET

The care of a horse's feet should commence when he is a colt; that is, before he is weaned. Untrimmed hoofs usually grow long and uneven, and a crooked foot, or worse, a crooked leg, is the result. Failure to regulate the length and bearing of the foot may make a straight leg crooked or a crooked leg worse, while intelligent care during the growing period can gradually improve a leg that is crooked at birth. When picking up a colt's foot, teach him to stand on three legs and not depend on the one holding up his foot for the fourth point of support. The handling of a colt's feet begins with the near front foot. Tie a rope around the pastern, grasp the rope close to the foot, push gently against the shoulder, and quickly lift the foot. The lifting of the foot must be simultaneous with the weight shifting to the other feet. Gentle the foot and leg and let it down. Repeat several times and then trim and level the hoof.

To raise a hind foot, put on a rope as on the front foot and draw the foot forward. To put a rope on the hind foot of a wild horse, tie up a front foot, have the assistant hold his hand over the eye on the same side as the foot to be lifted, or take the headstall in one hand, the tail in the other, and whirl the horse until he becomes dizzy. While in this condition he may be handled with safety. Lift the foot forward two or three times and gentle it. As soon as the horse gives in carry the foot backward into a shoeing position and trim the hoof.

To handle the feet of a horse that will not stand still, or that kicks, a halter twitch is a great aid. This twitch is easily applied and needs only the ordinary halter and tie rope. Pass the rope over the horse's head just behind the ears; raise the upper lip and put the rope across the gums above the teeth; run the rope through the loop made by passing the rope over the horse's head. The rope should be tight from the halter ring, over the head under the loop, and through the loop. A few good pulls on this rope should make the horse stand quietly.

SEES PROSPERITY FOR BOISE FARMERS

F. E. WEYMOUTH, supervising engineer and manager of the Boise (Idaho) Federal project, cannot see anything but prosperity in store for the project settlers this year.

"I talked with one farmer," said Mr. Weymouth, "who is clearing \$75 an acre on a 21-acre field of potatoes. A profit of more than \$1,500 from a field of that size is certainly a record that is not often duplicated in an agricultural section such as this. This man has his potato crop half harvested now, and it is yielding close to 150 sacks an acre. He is getting 75 cents a hundred, so you see he is allowing more

than \$50 dollars an acre as the cost for growing the potatoes. I don't think anyone will dispute that this is a liberal allowance for production costs."

Speaking of grain crops, Mr. Weymouth said: "They told me of one farmer who has threshed wheat that yielded 68 bushels to the acre. Several others are getting yields of more than 60 bushels. Farmers in this section told me they are getting from \$1.20 to \$1.30 a hundred for their wheat now, and if this is so, here is another instance of big returns from comparatively low priced land."

REFUSES TO CARRY WATER; FINED \$500

A DECISION which will attract the attention of water users and irrigation companies all over the West was handed down by Judge W. D. Wright of Denver, at Fort Collins, Colo., recently, when he fined the Water Supply & Storage Company \$500 for contempt of court in failing to comply with an order requiring the company to carry water for the Weld Farms Company in one of its laterals.

The Weld Farms Company's land lies east of Pierce, Colo. The company had purchased some 24,000,000 feet of water from the Greeley-Poudre Irrigation District, this water being stored in Douglas reservoir, some six miles north of Fort Collins. The Weld Farms Company desired to transmit this water to their land through the Pierce lateral, a ditch belonging to the Water Supply and Storage Company, but the latter company refused to carry the water on the ground that it was not a common carrier.

The Weld company then went into court and, pleading as a basis a statute which provides that any private ditch or canal may be enlarged or used for the carrying of the water of another, provided the expenses of such enlargement or use are defrayed by the party benefiting from same, got an order requiring the Water Supply and Storage Company to carry their water.

The contempt proceedings resulted when the Water Supply Company still refused to carry the water.

MAKES FARMER INDEPENDENT

In former years the county or state fair was the big day of the year in farming communities, but in this day those events pale into insignificance in comparison with tractor demonstration day that is becoming quite popular throughout the country. On these occasions tens of thousands of people come, not only from the state in which the demonstration is held, but also from adjoining states.

At first the farmer was loath to see the faithful

old horse supplanted, but as he comes to understand more fully the real value of the tractor, he regards it as a friend and assistant to the horse, which it relieves of that monotonous and slavish work which can be performed by an inanimate object even better than it can be done by the proud horse, which can be utilized in a far more profitable way.

The chief advantage of the tractor is that it gives more power when you want it and where you want it. It enables the farmer, during the short period that the soil is in good condition, to get his plowing done at the right season, before the ground gets too hard. It also enables him to plow his ground at a greater depth than he otherwise could, and this feature often adds several bushels per acre to the yield.

Another important feature is the fact that the farmer, with the small tractor, is enabled to do practically all his own plowing, and is not dependent upon hired men.

BUY \$3,500,000 PROJECT

One of the largest private irrigation systems in the United States has just passed into the hands of John T. Beamer of Chicago and associates. The transaction involved the sale by the American-Rio Grande Land Irrigation Company, near Mercedes, Tex., of its large pumping plant, canal and ditch system and 100,000 acres of land. The consideration was \$3,500,000.

It is reported that a cash payment of \$1,000,000 was made by Mr. Beamer. The American-Rio Grande Land & Irrigation Company was organized about ten years ago by B. F. Yoakum of New York, head of the Frisco Railroad, and a number of wealthy St. Louis men.

It is the purpose of Mr. Beamer to greatly extend the canal and ditch system and to make the property a producer of various kinds of crops. The whole 100,000 acres will be brought under irrigation and cultivation.

COOPERATIVE MARKETING

(Continued from Page 310)

such a position is usually subjected by the membership. In some quarters it really seems the farmers think to secure better results by discouraging the manager. Frequently they make him the proverbial goat—the recipient of kicks and knocks which apparently are administered for the purpose of forcing him to jerk along the co-operative machine more effectively. The fact that the manager can not possibly do his best under such treatment does not, as a rule, seem to occur to the members.

The most capable of officers, managers, and agents can not be expected to succeed in handling the affairs of organization unless they receive the full strength of the members' patronage and their complete moral support. The disloyal member is the chief element of failure in co-operative circles.

It would appear that owing to the very fine principle of mutual help involved, those forming a co-operative organization would be consistently loyal in their mutual relationship. But, on the other hand, unless exceptional care be exercised by the leaders, an organization from the beginning will be burdened with drones, cheats, deadbeats, and traitors.

When a grower joins a co-operative organization and then refuses to patronize it, he is a drone. He can not excuse himself even on the ground of bad management, for it is his duty to help secure proper conduct of the business.

If in selling through his organization a producer endeavors to pass off shoddy, poor-grade products, which injure the reputation of the body of which he is a member, he is a cheat.

The member who uses the special and private information of the association in making sales outside, without contributing to its support, is a dead-beat.

The man who joins a co-operative enterprise and then through subtle ways endeavors to obstruct its progress and defeat its purpose, is a traitor.

In starting a co-operative marketing enterprise one of the most serious problems is that of financing its operations. Organization and promotion work is costly, and comparatively large sums of money are needed to meet the expenses of marketing the members' products, and in many cases for

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making advances to the growers. Much of the work each year must be done before the shipping season begins, and until that time no revenue is available. Very few of these organizations have a paid in capital stock and surplus, or other assets which are liquid, sufficient to meet the expenses of the business during the heavy marketing season. It is therefore necessary to secure funds from outside sources for these purposes. Practically none have the security which is generally required by bankers in making loans to business enterprises, and as a result until recently it has been practically impossible for co-operative marketing associations to secure loans without certain of the directors and members assuming a personal liability.

Several associations meet the expenses incident to marketing by borrowing money from their own membership. Under this plan demand notes are issued bearing a rate of interest higher than that paid by the local savings bank. Sums ranging from \$10 to as high as \$4,000 have been secured from individual members in this way. This also encourages the habit of saving and fosters the feeling of individual interest in the organization among the members.

There is no factor of greater importance to an association in securing credit than that of capable management. Credit based upon character, ability, and a record of past successes is an element which a capable management gives an association. One

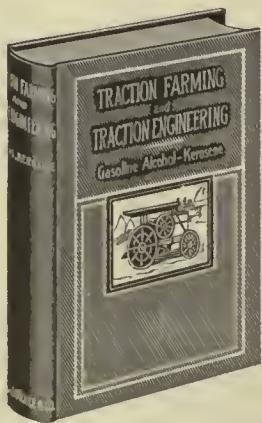
of the biggest bankers in this country made a statement as to credit for co-operative marketing agencies that "The management of an organization has more to do with the securing of money from outside sources than any other one feature. Where you have the right kind of management you generally have a strong organization."

Co-operation as an economic principle is receiving the serious consideration of practically all industrial classes. Its application to special lines of agricultural distribution and marketing is entirely feasible and offers a solution of problems and difficulties that are practically hopeless in so far as the individual is concerned. In the United States Department of Agriculture, co-operative organization is considered to be a primary and fundamental project, for it is believed that co-operation in agriculture is a corrective measure that will place the industry upon a solid basis and do much to insure the future happiness and prosperity of the nation.

Do not let any weeds ripen in the garden. One weed may produce seed enough to cover a large part of the garden.

As soon as the harvest is finished, begin figuring on next year's crop. Systematize your work during the fall and winter. Be ready for an early start in the spring.

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AT THE HEAD GATES

California

Surveys of the Southern Lassen Irrigation Project of California have been completed. The civil engineer in charge, William L. Wales, has submitted a full report, showing that the project is feasible and that the cost of bringing the water to the land and irrigating it will be between \$33 and \$35 an acre.

The district will include 22,500 acres.

Farmers in the West Side Irrigation District, near Stockton, Cal., will vote on a proposed irrigation system Oct. 16. The cost of the works is estimated at a total of \$285,000, amounting to \$24.78 an acre on the gross area of the district.

Without dissenting votes the property owners of the Deer Creek district near Porterville, Cal., have approved of the plans for the organization of a district, to water about 15,000 acres of the finest foothill citrus lands, at a cost of more than \$1,000,000. Stephen E. Kieffer of San Francisco is the consulting engineer.

Announcement has been made by the Great Western Power Company of Oroville, Cal., that the construction of the second unit of its canal will be started this fall. The rights of way have been secured. With the completion of the second unit over 150,000 acres of land will be placed under water. A large part of the land lies in the heart of the rice belt. The third unit will take the canal to the Sacramento river. Rights of way are being secured for a canal 150 feet in width.

Contract for construction of a concrete flume across Dry Creek on the main canal of the Modesto Irrigation District of California, 730 feet long with a capacity of 1,200 second feet of water, has been let to Ernest Green of Modesto at a bid of \$60,602.95.

Colorado

The Mutual Carey Irrigation Company, in which every settler will be a stockholder, has taken over the Smith Canon project in Colorado, which the Valley Investment Company was forced to abandon after holding the tract seven years and doing much work on it.

A Mountain rat put the Federal project around Grand Junction, Colo., out of business for several hours recently. He tangled himself up in the machinery at the dam.

Utah

Contracts totaling \$76,000 and covering the construction of a dam, reservoir, power plant and main irrigation ditch for a big 10,000-acre project on the Idaho-Wyoming line have been let by a party of Salt Lake and Ogden capitalists. The com-

pany is known as the Grand Canyon Canal and Power Company. It has been working on plans for the project for the last two years. Work will be begun in this month and rushed to an early completion.

Nebraska

One land owner has no right to appropriate the acreage of a neighbor under the law of eminent domain, where the purpose in view is purely a private one, according to the decision

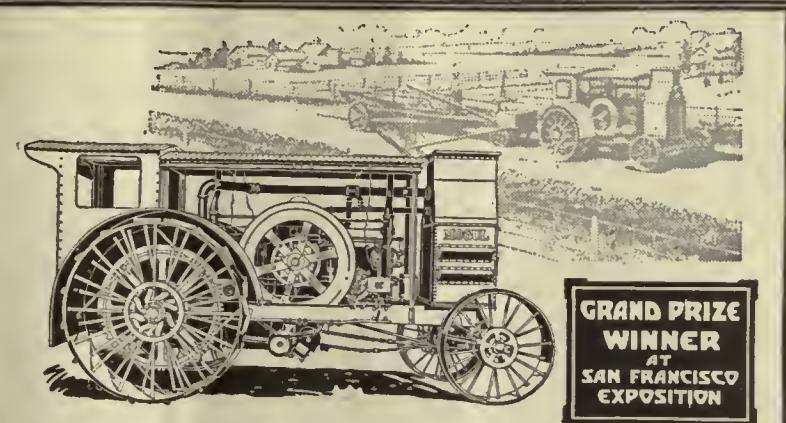
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Farm power must be cheap—cheaper than horses—or it won't pay. The fuel and oil bill, the biggest item of tractor expense, is far less than the cost of feed for horses to do the same work. You can get a **Mogul** or **Titan** tractor in sizes ranging from 8-16 to 30-60-H. P. They all burn low-grade oil fuel.

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of Judge W. H. Westover of Nebraska. The case has gone to the state supreme court on appeal by Nathan Broadhurst, against Andrew and Eva Vetter.

Broadhurst and the Vetters own neighboring farms in Dawes county, and a stream known as West Ash creek runs through the land of both.

Some time ago Broadhurst formed a plan to irrigate a part of his farm by building a dam across West Ash creek about seven feet high and 100 feet long, which would create a reservoir of twenty-five acres in extent. Five acres of this would have to be taken out of the lower portion of the Vetter farm, as the dam would back water up upon that tract.

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Broadhurst sought to condemn this land, his project having been approved by the state board, and the suit followed.

Reeves County (Tex.) Irrigation District No. 1 has voted bonds to construct an irrigation system.

An amendment was filed to the charter of the La Feria Land & Irrigation Company of Brownsville, Tex.,

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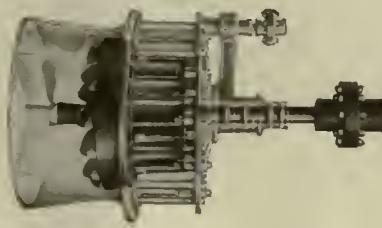
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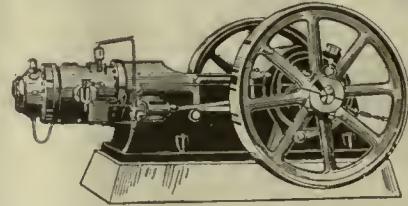
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THE IRRIGATION AGE

VOL. XXX

CHICAGO, OCTOBER, 1915.

No. 12

THE IRRIGATION AGE

With which is Merged
The National Land and Irrigation Journal

MODERN IRRIGATION

THE IRRIGATION ERA

ARID AMERICA

THE WATER USERS' BULLETIN

THE DRAINAGE JOURNAL

MID-WEST

THE FARM HERALD

THE IRRIGATOR

D. H. ANDERSON
PUBLISHER,

Published Monthly at 30 No. Dearborn Street,
CHICAGO

Entered as second-class matter October 3, 1897, at the Postoffice
at Chicago, Ill., under Act of March 3, 1879.

D. H. ANDERSON, Editor

ANNOUNCEMENT.

The "Primer of Hydraulics" is now ready; Price \$2.00.
If ordered in connection with subscription \$2.50.

Perhaps It's
Because He
Spells It
"Thot"

When T. Roosevelt became a general in the phonetic spelling brigade, he seems also to have acquired a lot of "phoney" ideas. One of these is that the people forget.

And on this theory, T. Roosevelt agents are reported scouting in the West for delegates to nominate the colonel for president on the Republican ticket.

We doubt very much if this kind of "phoney" politics will work.

Mr. Roosevelt may succeed in knocking some "ugh's" out of thought, but we doubt if the Federal Water Users will let him knock out of their thoughts the fact that he permitted his name to be used in an attempt to restore F. H. Newell to power in the Reclamation Service. And the water users, if they want to do so, can pretty nearly control eleven of the Western states, in which Mr. Roosevelt is reported seeking aid.

We doubt also whether the West will forget that Mr. Roosevelt has been very friendly to the impracticable conservation ideas of Millionaire Gifford Pinchot. The West does not want to waste her resources. She wants to use them, and she should do so. No conservation program which retards legitimate development is or will be satisfactory to the West.

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Official organ Federation of Tree Growing Clubs of America. D. H. Anderson, Secretary.

The Executive Committee of the National Federation of Water Users' Associations has taken action whereby THE IRRIGATION AGE is created the official organ of this vast organization, representing 1,000,000 persons on the government irrigation projects.

Interesting to Advertisers

It may interest advertisers to know that The Irrigation Age is the only publication in the world having an actual paid in advance circulation among individual irrigators and large irrigation corporations. It is read regularly by all interested in this subject and has readers in all parts of the world. The Irrigation Age is 30 years old and is the pioneer publication of its class in the world.

Mr. Lane and the Service Should Obey the Law Congressman W. E. Humphrey, of Seattle, Wash., has written a remarkable letter to Assistant Secretary of the Interior Sweeney. The letter referred to an Indian reservation opening, but one paragraph of it might apply equally well to the respect shown to the Reclamation Act by Mr. Lane, his body servant, Comptroller Ryan and the balance of the Reclamation Service. Here it is:

"When the 'soap box orator' counsels his deluded admirers not to obey the law, we excuse him in pity on the ground of ignorance, but what excuse shall we give for government officials of intelligence, specially charged to obey and carry out the will of the people as expressed by law? A former distinguished secretary of the interior taxed credulity and shocked common sense by solemnly declaring that the head of an executive department of the government had the right to do anything that the statutes did not specifically prohibit. But now it seems, from the tone of your letter, that one more step is to be taken and the doctrine announced that a department is under no obligations to obey a law that does not meet with its approval even if it is expressly written upon the statutes. I know that you agree with me that such doctrine is dangerous and open to strongest condemnation."

We urge Mr. Lane and his man servant to read the Water Users' section of the Reclamation Act and then study over their own acts concerning these

organizations. No doubt Congress intended that the law should be obeyed and enforced. Are the interior department and the Reclamation Service mightier than Congress?

**And Now
the Settlers
Must Buy
Drafts**

The Federal project farmer's check is no good—at least, not to the government. This is the latest edict of the Reclamation Service, and to us it seems about the most foolish.

There are fiscal agents, paid by the settlers in each project, who must, as a matter of business, bank their funds before turning them over to the proper authorities, but still, to add to the farmer's troubles, this order has been issued on the various projects:

"Effective August 1, 1915, all payments in settlement of charges due the United States Reclamation Service should be paid in currency, post office money order or by draft on New York or Denver."

"From above it will be seen that the project office will not be permitted to accept personal checks or drafts payable at points other than New York or Denver."

It certainly takes an expert bureaucrat to figure out all the various forms of torture for the unfortunate, struggling Federal Water User.

**Use the
Money of
the West
in the West**

Eighty millions of dollars are deposited in the banks of Denver.

All the banks of the West are glutted with money.

Instead of sending these funds to New York for Wall Street to play with or for Mr. Morgan to loan to the allies, why not spend this money in the West?

Let's have more initiative and confidence at home. The West is filled with opportunities for investment that will bring legitimate returns and help develop the resources of the nation. There are still millions of acres of arid lands that should be reclaimed.

Put the money of the West to work in the West. Never mind the war.

One good irrigation project means more to the nation than the "thank yous" of a dozen warring nations.

The star chamber methods injected by Secretary Lane into the so-called revaluation proceedings are un-American. Is the secretary trying to drive the settlers to repudiation?

The only way to be certain of peace is to be prepared to fight.

**\$4,750,000
Worth of
Education
for the
Farmer**

According to government figures, \$4,750,000 will be spent during the fiscal year 1915-1916 in bringing practical and helpful instruction to the farmer and his family.

The Smith-Lever agricultural extension act of May 8, 1914, provides for a permanent national system of agricultural extension work to be carried on with Federal and State funds through the State agricultural colleges in co-operation with the United States Department of Agriculture, by means of instruction and practical demonstrations in agriculture and home economics to persons not attending the colleges.

The Smith-Lever Act appropriates money as follows:

(1) \$10,000 of Federal funds annually to each of the 48 States.

(2) In addition to the \$480,000 the act appropriates for 1915-16 \$600,000 of Federal Smith-Lever funds. This sum will be increased annually by \$500,000 of Federal Smith-Lever funds until 1923, when the annual Government appropriation will be set at \$4,580,000. The additional appropriation is divided among the States in the proportion that the rural population of each State bears to the total rural population of the States. Any State, however, to share in this extra Federal Smith-Lever fund must appropriate and spend in extension work at least an equal amount of money from sources within the State. The money from the States will bring the joint demonstration fund to \$1,680,000 in 1915-16.

In addition to the Smith-Lever funds, however, the Department of Agriculture during 1916 will expend from its own appropriations for farmers' co-operative demonstration work and for other direct field instruction in special subjects over \$1,025,000. The States will raise from sources within the State and spend for demonstration work a total of \$2,650,000. This will make a grand total of \$4,750,000.

There isn't any of us who cannot learn something every day. The farmer is no exception. Every farmer should take advantage of the opportunities offered by this immense expenditure. The knowledge he can thus gain will net many dollars if put into practical use.

The Federal Water Users have or can control a million votes in a national election. A mighty club. Swing it.

Somebody in the Reclamation Service is still bunking Secretary Lane.

The Federal Water Users



A Department Devoted to the
Interests of the Farmers on the
Government Irrigation Projects

EDITED BY GEORGE J. SCHARSCHUG

MAKE THE WATER USERS FULL MEN AGAIN

THE Federal Water Users must go into politics.

The great national parties must be made to take an interest in the welfare of the brave men and women who are battling the desert and the most drastic government bureaucracy.

The water users must present their problems before the national conventions to be held next spring, and insist that the big parties, if they are to have the support of the Federal project states, must pledge themselves in their platforms to effect such reforms in the treatment of the water users as will make it possible for them to live and prosper as American citizens should. The Federal water users hold the balance of power in several of these states.

The water users should support no candidate for president who is not willing to have included in his platform a pledge for reforms in their behalf.

The settlers on the Federal projects want to keep their contracts with the Government. There is no thought of repudiation in their minds. Their families, their homes, their all is at stake. They are laboring under government burdens, which threaten to destroy all their hopes. These burdens must be lifted. These brave men must be made full men again. In order to correct the terrible conditions on the projects the leading political parties should seek to obtain these reforms:

1. The Government should keep inviolate its contracts with the water users. The settlers accepted certain representations of the Reclamation



An Oklahoma peanut crop, raised by irrigation. Courtesy of The Southwest Trail.

Service, a branch of government, and in a contract with the Secretary of the Interior agreed to pay certain amounts per acre for water rights on a completed irrigation project. This contract was drawn in accordance with the Reclamation Act of June 17, 1902, and based on estimated cost for the completed project. There is no excuse, therefore, for "extras." The Government, not the settlers, should pay for the mistakes and incompetency of its servants.

2. The Secretary of the Interior and the Reclamation Service should be made to recognize the laws of this nation. The Reclamation Act provides for the formation of Water Users' Associations to take over control of the projects, when the settlers have paid one-half the cost, and to administer the enterprise. The law says:

Sec. 6. That the Secretary of the Interior is hereby authorized and directed to use the reclamation fund for the operation and maintenance of all reservoirs and irrigation works constructed under the provision of this Act: PROVIDED, That when the payments required by this Act are made for the major portion of the lands irrigated from the waters of any of the works herein provided for, then the management and operation of such irrigation works shall pass to the owners of the lands irrigated thereby, to be maintained at their expense under such form of organization and under such rules and regulations as may be acceptable to the Secretary of the Interior: PROVIDED, That the title to and the management and operation of the reservoirs and the works necessary for their protection and operation shall remain in the Government until otherwise provided by Congress.

Despite this, Secretary Lane's personal appointee, Comptroller Ryan of the Reclamation Service, and in fact the entire Commission, are either

delaying by technicalities or absolutely refusing to permit the organization of Water Users' Associations on the Shoshone (Wyo.) and Truckee-Carson (Nev.) projects. The contracts between the Government and the settlers provide that the settler must join a Water Users' Association. The original plan for these associations was designed by a Secretary of the Interior. Now the Secretary of the Interior and Mr. Ryan are advocating the organization of irrigation district organizations, which would include many who are not bona fide settlers and therefore not eligible under Section 6, quoted above. Only by organizations with such comprehensive powers as provided for under the Water Users' section of the Reclamation Act, can the settlers hope to work out their multiple problems of project control, marketing, transportation and the like.

3. The vast army of employes of the Reclamation Service, whose salaries the settlers now pay, should be removed as soon as the projects are completed. They cause a tremendous and needless expense to the settlers, as well as no doubt greatly hampering that initiative of the water users which is necessary to their success.

4. In accordance with the Reclamation Act, title to main works on these irrigation projects remains in the Government, until Congress provides otherwise. Nevertheless, the settlers are being charged now on a basis which is figured on the total cost of the project. This is wrong and illegal. The cost of the main works should be charged to a separate fund, and bonds or some other means provided to carry out the "revolving fund" intent of the law as regards the cost of these works. The settlers should be charged only for that property to which under the law they can obtain title. The main works are public benefit improvements, like harbors or canals, and there is no reason why the Government should not retain them. If this policy is followed, the cost per acre to the settlers will probably be brought down to about the charges fixed in their contracts with the Government. The settlers cannot succeed removed, as they are, from markets and with long freight hauls and in a new country, if they must bear the tremendous burdens which the charges which Secretary Lane now seeks to impose upon them by insisting that they must pay the full cost of the projects, regardless of "engineering errors."

5. The contracts of the settlers with the Government now constitute a cut-throat first mortgage on their lands for the cost of the water. This can be and should be so revised that the Government will still have full security, and yet the settler will have use of at least part of his land as security for loans, which every farmer needs at certain times of the year in order to improve his farm, develop or market his crops.

The Reclamation Service was organized as a benevolent governmental institution. It developed into a civil service, red-tape-bound bureaucracy under previous administrations. Under the guise of reform, it has been turned into a political machine of the most Tammanyized variety by the present administration.

The Government has spent more than \$110,000,000 on these projects. It is generally estimated that more than \$40,000,000 of this sum represents work, out of which neither the settlers nor the Government will ever get any value. Surely the settlers should not pay this bill.

TO WATER 400,000 ACRES

According to H. M. Street, president of the Horse Heaven Landowners' Association, returns from the voting in Yakima, Benton and Klickitat counties indicate that the plan to create a \$10,000,000 irrigation district carried by a large majority. The directors of the district elected were Ira Carter of Prosser, John Sumner of Patterson and W. A. Kelso of Kiona. Work on the project, which will embrace 400,000 acres, part of which is already under cultivation, will begin as soon as money is raised by a bond issue.

SUN TEMPERS THE IRRIGATION WATER

The experiment of sun-tempering water to be used for irrigation purposes is to be tried by H. O. Douglass on his sixty-acre tract near Chico, Cal. Douglass recently bored a ninety-foot well on the place, but the water from the well was found to be too cold for successful irrigation. A three-inch centrifugal pump will pump the water into a reservoir six feet deep and to cover a quarter of an acre. The reservoir will be uncovered, which will allow the sun to warm the water before it is used for irrigation.

ANOTHER GOULDS OFFICE

The Goulds Manufacturing Company of Seneca Falls, N. Y., has opened a Philadelphia office at 111 N. Third street. E. S. Jenison has been appointed manager and F. G. Kramer will be assistant manager. Mr. J. B. Trotman will continue with the Goulds Manufacturing Company. This is the third office opened within the past few months by the big pump building company, offices having been opened in Pittsburgh and Atlanta.

TWO NEW ARMCO BOOKLETS

The American Rolling Mill Co. has issued an attractive booklet entitled, "Armco Iron Rust Resisting Products," in which are illustrated and described most of the important Armco products as made at the Middletown, O., factory, and quite a number of those produced by other manufacturers. The company has also published a new edition of "Defeating Rust," which booklet covers the inception, development, qualities and uses of Armco (American Ingot) Iron. These books contain much useful information with regard to this material, which is now assuming a very important place in construction which is intended to be lasting.

Let's spend that billion J. P. Morgan, the British fiscal agent, wants to loan to the allies in building battleships and increasing our army.

BLAMES HAPHAZARD U. S. IRRIGATION FINANCE

By MYRON T. HERRICK, Former Governor of Ohio and Former U. S. Ambassador to France

Excerpts from an Address Delivered Before the International Irrigation Congress, at San Francisco, Cal.

RECLAMATION of land by drainage, embankment, or irrigation in the United States has been going on since George Washington's days by private individuals and by the state and national governments. The coastal swamps, the Mississippi Valley, and lastly the arid and semi-arid regions engaged the attention of financiers, engineers, and settlers as population spread over and across the continent. The tillable acreage created or protected is enormous, yet results were not always satisfactory. Less has been done than promised, while methods (especially those of finance) have been so variant and experimental that the record of this kind of work is full of flaws.

The best chapter of this record is the irrigation projects. Private and public endeavor has done wonders for these during the past generation. Nevertheless, the Secretary of the Interior, speaking of the private enterprises, says: "Few, if any, of the investments have ever returned to the Eastern or European shareholder or bondholder the amount of the original expenditure." As to the government projects he says: "It must be admitted that the slowness of development and the use of reclaimed lands has been a source of disappointment."

The U. S. Reclamation Service has undertaken twenty-six irrigation projects. Some land is already irrigated in each of the projects, but most of the settlement lies on sixteen of them.

Through these irrigation systems the Service diverts a stream greater than the Hudson River at the Mohawk. The estimated area is 2,918,600 acres of which 1,343,193 acres, or 27,115 farms, can now be watered. The investment in capital and labor of the owners of these farms when fully developed will be about \$175,000,000, and the value is constantly increasing. One hundred fifty-three towns have sprung up, making the total population 310,514.

This splendid development, however, has been reached through trials and tribulations largely arising, in my opinion, from faulty methods of finance. The 1902 Act provides that all moneys (except the five per cent set aside for educational purposes) received from the sale and disposal of public lands in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming, shall be used in irrigation projects in those states. What that would amount to each year nobody, of course, could predict. The framers of the Act did not concern themselves about the possible dangers of this uncertainty, because they thought that irrigation was an easy



Irrigation strawberries with a Lauson pumping plant in the San Joaquin valley of California.

matter, and all that was necessary to do was simply to build reservoirs for impounding and main canals for distributing water step by step as the money was received.

But irrigation turned out to be a very difficult matter, complicated by serious and unforeseen problems that have upset original plans and estimates. Drainage systems had to be constructed in order to prevent lands from becoming water-logged or covered with alkali deposits through seepage and waste.

The receipts from the sale of public lands amount to \$81,813,772.71, which have now, of course, all disappeared. The Act provides that the cost of the construction work shall be assessed against the lands improved and be repaid by ten annual installments; furthermore, that annual charges shall be made for the water supplied and for maintaining the systems. A considerable percentage of these installments and charges is in default, but all repayments and accruals received have been thrown into the reclamation fund and indiscriminately used with the proceeds from the sale of public lands for development work without any regard as to whether it was on old or new projects. The fund was expended as fast as it accumulated. The Service has never had much more cash on hand than was needed for the current year. Expenses have outrun receipts, and so it was authorized to make loans amounting to \$21,000,000.

The gross expenditures for construction work amount to \$91,644,628.73. With all repayments and various receipts deducted from this, the net investment of the U. S. Government remains at \$82,918,801.83. This investment yields no profit because, under the Act, interest cannot be charged against the land owners. So the true financial situation of the Service can be determined only by taking into account the yearly loss of this interest, the debt it has incurred, the liability it has assumed on uncompleted work, and the adverse pressure exerted against it by constant demands of water users for easier terms from the Government.

Consequently, as the Secretary of the Interior declares: "The resources of the reclamation fund are now overburdened and the projects now under way cannot be completed within a reasonable length of time, unless there shall be large accessions to the fund."

This is a timely warning. The public lands are being sold off, and receipts from this source will eventually cease. Repayment of expenditures has not been as regular as expected. Moreover, Congress in 1914 extended the period of repayment by landowners to twenty years, with the first install-

ment to date from the fifth year after entry. Congress did this in full realization that great projects were under way or ought to be under way; it poured out the baby with the bath, and yet made no other provision to replace the means of finance that is disappearing.

The Reclamation Service employs a force of 7,998 persons; it has invested enormous funds in power plants, machinery, implements, and in equipment and improvements for carrying on its work. Its expenses run on whether this lies idle or is kept busy, while if it should do its work by piecemeal the operations of the Service—organized as it is for large undertakings—will become so costly that the investments of the Government will end in a loss.

No great enterprise, public or private, except these government irrigation projects, has ever been begun in the United States without at least trying in advance to find the funds needed to carry it to a finish. The troubles that now confront the Reclamation Service were foredoomed from the start because of the faulty method of finance by which it was inaugurated—because of this trusting upon an uncertain source of funds and revenue for conducting its operations. The correct way (if I may be bold enough to say it) is the simple, ordinary way of issuing debentures. Each project should have been required to stand good for its own debentures, and these debentures should have been issued in representation of the officially appraised value of the land as improved and been redeemed out of a sinking fund created by the installment payments of the landowners.

The debentures could have been issued in series against separate units in each project and placed on the market as occasion arose. In this way funds could have been obtained in advance to the full amount of the estimated cost of any work planned and undertaken. They would have had a ready sale at three per cent. In Europe such debentures have no fixed maturity, but are retired upon contingencies specified for the series at the issue.

In the case of railroads and municipalities in the United States, they mature at very distant dates, but are subject to immediate recall by the maker. Either of the two forms would have been satisfactory, provided it gave to each project ample time to refund and meet its obligations. The time should have been at least seventy-five years. This would have enabled the Government to grant a corresponding long term to landowners to repay their respective shares of the cost of the construction work. Calculated at three per cent for that period, the annuities which the landowners would have been required to pay into the sinking fund would not have been as large as normal interest charges at present.

Thus, besides creating an adequate supply of capital, this method of finance would have made the investment of the Government profitable and

also have lightened the burden of the landowners. The sooner this or some other method is adopted the better it will be. Indeed, a change is absolutely necessary, because the Secretary of the Interior warns that a cessation of all work is imminent, while the Director of the Service reports that landowners are falling in arrears and must be granted renewals even after the expiration of the recent twenty-year extension.

The U. S. Government may possibly worry along under present arrangements—but the landowners cannot. Last year they paid sixteen per cent of the returns of their crops to the Government. In addition, they had to pay water rights and taxes. Unfortunately, too, most of them had to pay six to twelve per cent interest on the mortgages which they gave for the purchase price of their property.

Such a burden would be difficult to bear in old, established communities. In these irrigation projects it becomes insupportable, because it leaves practically nothing to the entryman or assignee for the keep of himself and family, if he does not happen to have in cash at the start the \$2,000 or \$4,000 needed to improve and equip his farm. Five years are required to bring an irrigated farm to full development, while an orchard is a heavy expense and yields not a cent of profit during all that time.

It is clear out of the question to expect a settler in a new country to pay back or to recover the investment of capital and labor in his homestead faster than he can refund it from his savings from the annual returns of the soil. An attempt to force homesteaders to do so brought on the crash in 1893 of the farm-mortgage craze and, I believe, it is the chief cause of the financial difficulties of the farmers on the irrigation projects.

Short term for loans or for installment payments on construction work should be abolished. The charges against landowners and the financial operations of the Reclamation Service should be converted into long term—fifty or seventy-five years—through some carefully prepared plan of bond or debenture issues. I offer this suggestion after a more or less lengthy study of the subject in Europe and in the United States. If it be found acceptable, perhaps it would be best to reorganize the Reclamation Service so as to restrict its scope to making plans and estimates and doing the construction work, and then to place the financial operations in charge of the Secretary of the Treasury, and intrust the collection of dues from landowners to the Water Users' Associations.

This arrangement, if carried out to completion, would turn the Water Users' Associations into landschafts. I called the Government's attention to the feasibility of the landschaft idea in a report that I sent to the State Department from Paris in 1912. Further study has more thoroughly convinced me of the worth of this idea. If the irrigation projects



A one-man tractor doing work of several horses. Courtesy International Harvester Co.

were established as land districts, with authority to issue debentures and extend credit to settlers through a management similar to that of the Water Users' Associations and under the supervision of the Government, they would become pure landschafst; and they would be able to find capital on easy terms for other purposes than for the payment of construction charges. The arrangement, moreover, would weld the settlers in each project into a unity, arouse in them an intenser feeling of mutual responsibility, and create a solidarity of interests. With its financial duties thus eliminated, the Reclamation Service would be more efficient, because then it would assume its proper role as a body of expert engineers and contractors, with the Government acting as an impartial umpire to assure equal justice to all.

So the first trouble with the Reclamation Act and amendments is, as I understand it, that they did not provide for an adequate supply of long-term capital in advance of the projects which the Service has undertaken. As a result the Secretary of the Interior tells you that new or secondary projects cannot be considered, while there is danger that work on the projects under way may have to be discontinued. This trouble is purely financial. A remedy lies in the issue of debentures and the creation of a sinking fund out of the receipts from settlers for the payment of these debentures. This would open for the Service a dependable source of funds and also convert the financial operations from the unsatisfactory short term into the much needed long term.

In this way the Government could mobilize its entire investment and make it a revolving fund for carrying on and enlarging its work. There is no reason why the Government should not realize on the credit available from this investment. Indeed, good business and financial practice dictates the constant re-use of the \$100,000,000 that will soon be tied up, instead of letting it lie idle without drawing interest, as is now the case. It would be to the advantage of the Government to keep all this money active, except a fair margin set aside for safety. This it could do by issuing bonds or debentures against its investment. The future of the arid and semi-arid regions rests upon irrigation enterprises most of which are on the public domain and too large to be undertaken by private individuals. Whatever be the method of finance adopted, progress on this splendid and highly important work should not be left to hazard or impeded by lack of funds.

The landschafst principle is so old and thoroughly tested that it is well worth a trial. Its practice on the irrigation projects (where it could be easily introduced) would set an excellent example for farmers in all other parts of the country.

Mutual self-help, or co-operation, is the next greatest necessity of the occupants of the irrigation projects. The failure to recognize this fact is, in my opinion, another shortcoming of the Reclamation Act. Water Users' Associations were organized and are managed to protect the mutual interests of the settlers, and under the 1914 law they may be constituted fiscal agents to collect the charges due to the United States. It is regrettable that the Government did not take them more largely into its con-

fidence from the start—and that they have not more fully appreciated and utilized their influence to organize the farmers co-operatively in all their industrial, commercial, and financial affairs relating to agriculture.

Rural co-operation, in order to attain its best results, must consist of a system of inter-related associations based on local co-operative banks. The chief purpose of a rural co-operative bank is not to make individual loans to members, but to organize and strengthen their purchasing and selling power. It is one of the basic units for creating and supporting a system through which collective resources may be utilized to enable members to buy supplies and sell their products at the best prices. This, of course, saves so much money that members eventually have a surplus to lend to one another, but the common good must always be the main object, because only through that can the spirit of co-operation be preserved and the individual good of members brought about.

The Water Users' Associations are in a position to take a leading part in introducing and systematizing co-operative organization based on co-operative credit, and it is to be hoped that they will give more attention to this important matter.

The settlers on the projects would be all-sufficient in themselves if only they were thoroughly organized in such a way that they could utilize the wealth they create for financing their own business. The irrigation projects are distinctively agricultural. The ease with which co-operation could be introduced on them, and the great good it would do, call aloud for continued and persistent agitation for it, until the farmers on each project are completely organized into a co-operative system for taking care of their commercial, industrial, and financial necessities and affairs.

If this were done; and furthermore, if the mortgages were converted into long term through landschafst, and the Reclamation Service improved through a reform of financial methods, I predict that the irrigator farmers would have peace, plenty and prosperity, and that they would become the advance guard of a modernized agriculture that would awaken better ideas of life and action among farmers throughout the United States.

REMOVE THE RUBBISH

In the war against farm and garden pests a fall clean-up is a good means of attack. Fall plowing is generally recognized as a good method for the prevention of insect injury, but rubbish left in piles along fences, or in fence corners, or in the orchard, or kitchen garden, make the best kind of winter quarters for insect pests in various stages. Trash of this kind should be cleared away, preferably by burning, as such burning destroys any insects among the rubbish.

Every Federal water user should read The Irrigation Age. It is fighting for their rights. If your neighbors do not take the Age, tell them about it.

TEXAN HEADS IRRIGATION CONGRESS

THE International Irrigation Congress, which held a week's convention "on wheels" during the past month, with sessions at Stockton, Fresno, Sacramento and San Francisco, Calif., elected the following officers: Richard F. Burgess, El Paso, Texas, president; J. S. Dennis, Calgary, Alberta, first vice-president; George A. Smith, Salt Lake City, second vice-president; L. A. Nares, Fresno, third vice-president; Kurt Greenwald, Denver, fourth vice-president; Lafayette Clapp, Hatch, N. M., fifth vice-president; Arthur Hooker, Spokane, secretary.

President Burgess, Retiring President Case, Secretary Hooker and R. Insinger, Spokane; L. A. Nares, Fresno, and Richard W. Young, Salt Lake City, were elected members of the board of governors, which will select the next annual meeting place within the next few weeks.

The Congress adopted a series of resolutions, chief of which are the following:

Urging a system of rural credits and aid to settlement as the paramount need of irrigation development in western America.

Development of a better marketing system.

Completing of existing irrigation projects.

Better legislative control and supervision of irrigation districts.

Revision of reclamation costs through assistance of the United States Department of the Interior.

Federal, state and provincial liberal appropriations for continuing the gauging of streams, hydrographic surveys, irrigation investigations and studies.

Federal and state co-operation for river regulation and control.

A committee on legislation was appointed, composed of one or more members from each Western state, to present to Congress and to the different legislatures matters indorsed by the Congress or its executive committee as proper subjects for legislative action.

Country life is dying in America because of the drudgery of the farmer and the lonesomeness of his wife, according to William E. Smythe, of San Francisco, one of the speakers.

To substantiate his statement that "America is dying on the land," he cited statistics to show that between 1900 and 1910, country population increased but 4 per cent, while the increase of population in the cities was 40 per cent. Also, he said, the demand for farm produce increased 22 per cent, while the increase of the supplies of the farm was but 2 per cent.

"This Congress must deal with these problems until they are solved," said Mr. Smythe. As a remedy against the farmer becoming discouraged, he suggested intensified farming on small acreage.

President Wilson sent the following telegram to the convention:

"It is a matter of much regret to me that it is not possible to greet you personally and to express to you my interest in your work and my best wishes that success may attend the efforts you are making. Your work, while apparently limited to the arid Western regions, actually affects the interests of the nation as a whole, and the closest and most cordial co-operation possible should obtain between the Federal Government and the States in the furtherance of real conservation and utilization of our natural resources. I sincerely hope that you may have a very successful and fruitful session."

W. R. Williams, State Superintendent of Banks of California, said that a State commission appointed to pass upon bonds offered by irrigation districts for purchase by savings banks had approved issues aggregating \$11,163,511 since its creation in 1913.

"A State can do nothing better," he said, "than to furnish means whereby particularly safe securities, based on land at conservative values, may be issued and offered for sale in the places where there is a greater amount of money than there is a local demand for it, and where, consequently, a lower rate of interest prevails."

President D. W. Carmichael of the Sacramento Chamber of Commerce, said:

"Personally I am thoroughly convinced that colonization on a large scale will not again be a possibility in any portion of the United States or Canada until there shall have been devised and put into effect upon the Western continent an economic and scientific method of distribution of farm products.

"Some method of national or international distribution of farm products must be devised to bring the producer closer to the consumer and make impossible the centralization of food products and the creation of food trusts.

"Some time in the not distant future, some man, or some men, or some corporation will suddenly awaken to the possibilities of absolute verity in colonization work and will put upon the market some tract of land and settle it under such conditions. Having done so, they will, thereafter be able, so to speak, to sell land anywhere in the United States by 'mail order.'"

HOW TO DIG BIG WELLS

The American Well Works, of Aurora, Ill., has just issued a very ably prepared booklet on "Methods of Constructing Large Capacity Deep Wells for Irrigation Pumping in the Great Plains." It tells a remarkable story of the development by pump irrigation in the Panhandle of Texas and Eastern New Mexico.

KANSAS IRRIGATORS MEET

The fourth annual meeting of the Kansas Irrigation Congress will be held at Garden City, Kan., October 13 and 14. A large part of the program will be devoted to a discussing of irrigation by pumping.

Statement of the ownership, management, circulation, etc., required by the act of August 24, 1912, of THE IRRIGATION AGE, published monthly at Chicago, Ill., for October 1, 1915:

Editor, D. H. Anderson, 212, 30 North Dearborn street, Chicago.
Managing editor, George J. Scharschug, 212, 30 North Dearborn street, Chicago.

Business managers, none.

Publisher, D. H. Anderson, 30 North Dearborn street.

Owners: (If a corporation, give its name and the names and addresses of stockholders holding 1 per cent or more of total amount of stock. If not a corporation, give names and addresses of individual owners.) D. H. Anderson, 30 North Dearborn street, Chicago, Ill.

Known bondholders, mortgagees and other security holders, holding 1 per cent or more of total amount of bonds, mortgages or other securities: (If there are none, so state.) None.

D. H. ANDERSON.

Editor.

Sworn to and subscribed before me this 29th day of September, 1915.

HIRAM Y. SMITH.

(My commission expires July 21, 1919.)

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NEWS NUGGETS ABOUT IRRIGATION PROJECTS

New Mexico

The New Mexico supreme court has ruled that an irrigation company cannot be compelled to carry water for hire to a person who has not contracted with it for a water right and who demands the carriage of water from another source. The opinion was rendered in the case of J. M. Miller vs. the Hagermann Irrigation Company.

Work has been resumed on the Lake Charette irrigation project southwest of Springer, N. M. It is expected the reservoir construction will be finished during the winter.

Wyoming

The Big Horn Canyon Irrigation and Power Company of Wyoming has completed its preliminary investigations for the construction of a dam at the mouth of Big Horn canyon. A solid limestone bed rock was found.

Thirty thousand acres of land near Lyman, Wyo., will be reclaimed through a new irrigation project to be established near that place and which is to be fed from Black's fork, a tributary to Green river.

Water rights have been granted for the third unit of the irrigation system on the Wind River reservation in Fremont county, Wyoming. The proposed ditch will be 25 to 30 miles long and will water 40,000 acres of deeded land and 35,000 acres of Carey act land.

The Reclamation Service is asking for proposals for the construction of canals and structures on the Shoshone project, Wyoming, involving 560,000 cubic yards of excavation, 1,400 cubic yards of reinforced concrete, 9,000 square yards of grouted paving and the placing in wooden structures of about 130,000 feet, B. M., of lumber. The bids will be opened at the office of the Reclamation Service at Powell, Wyo., October 29. The work is located near the stations of Garland, Mantus, Frannie and Denver, on the C. B. & Q. Railway.

Idaho

Surveys for the irrigation of 10,000 acres in the Succor Creek irrigation district of Idaho have been completed. An interesting fact about this district is that it is proposed to take water which comes entirely from Oregon territory and run far the greater part of it upon Idaho land. Of the 10,000 acres, only about 2,400 are in Oregon. The project will cost about \$20 an acre.

Farmers around Carey, Idaho, are organizing a company to irrigate 15,000 acres from a storage reservoir in the Little Wood river. The dam will cost \$50,000.

Two engineers of the Federal Reclamation Service have been detailed by Secretary Lane to survey the Black Canyon lands in the Payette-Boise Valley, Idaho, and report

upon the feasibility of an irrigation project there. Counsel for 1,000 settlers on 90,000 acres of land in the Black Canyon asked for the survey. The settlers, many of whom went to the valley believing the lands would be reclaimed under the original Payette-Boise project, part of which was abandoned by the Reclamation Service, hope to have congress appropriate for an irrigation system.

Montana

David Hilger, heading the Flat Willow irrigation project, near Lewiston, Mont., has announced that his company will spend \$100,000 in completing the project by the fall of 1916. The company has already expended \$50,000.

Contracts have been let for the \$110,000 Glenlake (Mont.) irrigation project. It embodies the construction of about 20 miles of main canal and some 15 miles of smaller laterals, including over four miles of varied sizes of pipe line.

Oregon

Farmers around Prineville, Ore., are planning the organization of an irrigation district. They expect to issue \$500,000 in bonds to irrigate about 25,000 acres. Reservoirs are to be built on the Ochoco and Crooked rivers.

State Engineer Lewis of Oregon has approved the plans of the Suttles lake irrigation district for the issuance of \$600,000 in bonds for the irrigation of 12,000 acres. This project is situated in Jefferson county, Ore. A dam 58 feet high is to be constructed. It will be of sufficient capacity to store 21,500 acre feet of water in Blue and Suttles lakes, which are situated at the head of the Metolius river.

The majority of the water users under the first unit of the Klamath (federal) irrigation project, Oregon-California, who are subject to the provisions of the Reclamation Extension act, having made agreements provid-

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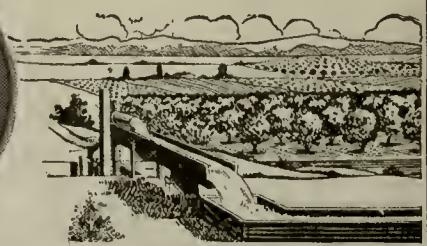
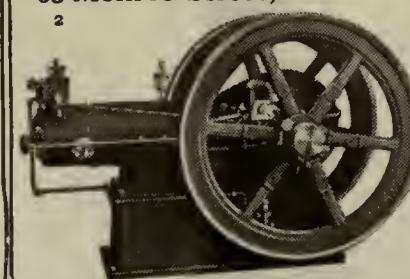
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ing for an increase in the cost of construction for the construction of drainage works, the secretary of the interior has issued a public notice ratifying the agreement and increasing the construction charge in the sum of \$12.50 per acre. In the case of all water right applicants and entrymen under this unit who have accepted the terms of the Reclamation Extension act the increase of \$12.50 per acre will be paid in additional annual installments after the expiration of the 20 installments payable under the act.

Utah

Seeking artesian water to irrigate several thousand acres in Weber county, Utah, a test well is being put down under the auspices of L. M. Windsor, a government engineer.

The Utah state land board will drill a 600-foot well in Cedar valley to tap the underground water supply.

Messrs. Houser, Sim & Vorkink, Salt Lake City, Utah, have received the contract for the construction of Division 9 of the High Line Canal, Strawberry Valley (Federal) irrigation project, Utah. The work involves 25,000 cubic yards of excavation and the placing of 2,600 cubic yards of reinforced concrete, and will cost \$35,504.10.

South Dakota

Final details are being worked out for the irrigation of 25,000 acres south of Rapid City, S. D., by the Spring Creek Irrigation Company. The proposed reservoir will cover 430 acres.

Curtis Bros., of Columbus, Neb., have been awarded the contract for earth work on the north canal extension and laterals, Belle Fourche (Federal) irrigation project, South Dakota. The work involves 56,000 cubic yards of excavation and 13,000 cubic yards of overhaul, costing \$8,771.

Washington

Water users under the Wenatchee Canal Company system, irrigating the heart of the Wenatchee district in Washington, have authorized a bond issue of \$500,000 for the Wenatchee reclamation district to be used in acquiring title to and improving the canal. The vote was practically unanimous, being 407 in favor and 6 against. The result of the election places the district in a position to effect immediately any settlement the receiver of the company may direct.

Dunn & Hogan of North Yakima, Wash., have received the contract to furnish sand and gravel along the canals of the Outlook Irrigation district, Sunnyside Unit, Yakima (Federal) Irrigation project, Washington. The price is \$5,601.50.

California

All California irrigation bonds are finding a better market, it is claimed,

since the state took over the control of the irrigation districts insofar as the approval of bonds went. Now, it is no longer possible for a

fake company to issue wildcat irrigation securities, and there is an accordingly better market for bonds of the existing districts.

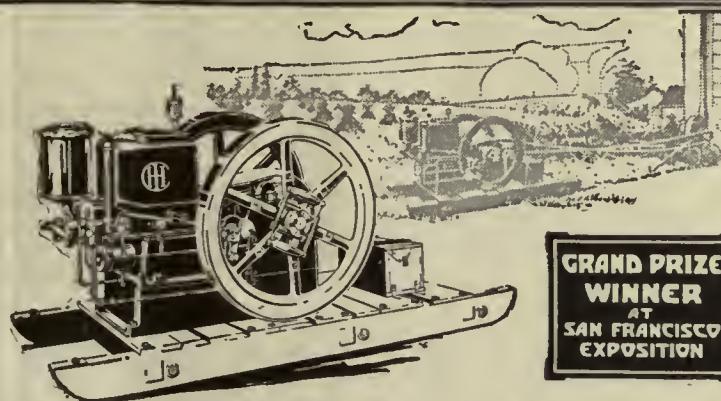
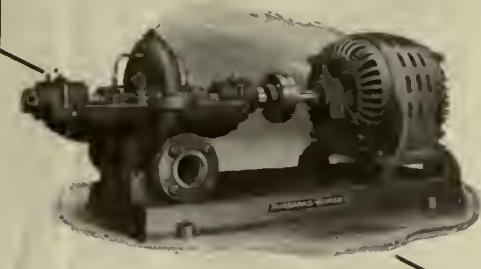
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Elwood Mead and Frank B. Adams, irrigation experts, have completed their survey of the great Ayer holdings in Nevada and Yuba counties, Cal., and soon will proceed to Boston to lay their report before C. F. Ayer, the owner. It is authoritatively stated that both Adams and Mead are enthusiastic over the project and will strongly recommend that the project be taken up. It is also stated that Ayer is waiting only a favorable report to order the beginning of operations, which will involve the expenditure of over a million dollars.

Work on the Lake Cowhead irrigation and power project in California, will be commenced this month, according to an announcement by Charles A. Gardner and Engineer Durst, who claim the company has about \$600,000 with which to begin work on the project that will furnish water to a large area in Surprise Valley, Modoc county.

Settlers in the Sacramento Valley Irrigation Company's project in Glenn and Colusa counties, California, have organized to protect their interests in a suit brought by the Equitable Trust Company of New York, to foreclose a mortgage on the project of \$7,000,000. The settlers claim that the company charged them \$75 an acre when they bought their land for a water right. Later the Supreme Court decided the company was a public service corporation and could not legally sell a water right, but must furnish water to all comers. The settlers now want this money returned, or its amount stricken from their contracts. They believe they must act before the great mortgage is foreclosed, or they will be too late.

Texas

Asking foreclosure of \$350,000 bonds out of an original issue of \$1,050,000, the St. Louis Union Trust Company and Thomas N. Dysart, trustee, have filed an amended petition in the United States court at Houston, Texas, in the receivership case of the San Benito Land and Water Company. If Judge Waller T. Burns orders the foreclosure the plaintiffs will come into possession of the great irrigating system at San Benito, which includes 37 miles of canals and 100 miles of laterals. On the application of these plaintiffs the San Benito Land and Water Company was thrown into the hands of receivers July 31, 1913. At the time of the receivership the company's affairs involved more than \$2,000,000. Failure of crops was given as the cause of the receivership. Assets exceeded liabilities by \$1,000,000, it was said. So extensive are the irrigation facilities of the company at San Benito, that a number of persons owning adjoining property are circulating petitions to form an irrigation district under the laws of Texas. By foreclosing on the mortgages and getting possession of the irrigation facilities the plaintiffs expect to sell their rights to the proposed irrigation district and thereby realize on their

bonds. There are 52,000 acres involved in the irrigation enterprise, besides 16,000 acres of the San Benito Irrigation Company.

The Grand Falls (Texas) Irrigation district, is preparing to issue \$150,000 in bonds for development work.

Nevada

A splendid work has been taken up by the University of Nevada,

which will prove of invaluable service to ranchers and prospective irrigators in all parts of the state. A department has been organized to develop and test out water wells in different localities and to assist ranchers in producing water in the cheapest and most efficient manner. The University has just ordered two new centrifugal turbine pumps from the Layne & Bowler Corporation.

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