THE LIDGERWOOD MANUFACTURING CO.'S HOISTING ENGINES AND BOILERS—THE GORTON HEATER.

In the illustrations on our first page we have endeavored to bring before the mind a correct idea of the plant, and the methods of prosecuting the work, in one of the largest and best equipped modern establishments especially devoted to the manufacture of hoisting engines and boilers.

The works of the Lidgerwood Manufacturing Company, which we take as a type, are near the Atlantic Basin, at the foot of Dikeman Street, Brooklyn. The main machine shop is 75 by 200 feet in size, and, with its gallery and two wings, affords a floor space of 28,750 square feet. The erecting shop covers a ground space of 50 by 228 feet, and with its gallery affords 17,500 square feet of floor room. The boiler shop is 50 by 290 feet, the blacksmith shop 45 by 90 feet, the Gorton heater shop 25 by 100 feet, and the storage shop 45 by 100 feet. Power is supplied by two engines, connected, but which may be readily disconnected, when either one will afford sufficient power for the entire establishment. All of the departments are completely fitted out with powerful traveling cranes, and the equipment in lathes and boring and turning machines of the latest patterns is designed to more than meet every possible demand. In every branch of the business, attention has been constantly directed to securing uniformity as well as perfection of work through the employment of machinery; and in milling machines there are several of novel construction, especially designed for the work of the company, who have made something of an innovation on ordinary machine practice in the extent to which they carry the work of machine milling.

The engines made by the company present too great a variety for us to mention them all in detail, but their single and double cylinder friction drum portable hoisting engines, with the latest improvements, constitute a representative type of a large part of their business. In the latest patterns of these engines, embodying the results of many years' experience, especial care has been taken to have them simple in design and construction, and well proportioned throughout in accordance with their cylinder power. The cylinders are of extra quality charcoal iron, the steam and exhaust ports being of ample size and designed for high speed, with D slide valve, the valve and valve seat having a scraped fit. The valve and piston rods are of steel, and the crosshead is of the locomotive hanging type, fitted with composition gibs having extra large wearing surfaces and easily adjusted to take up wear. The connecting rod is of best Ulster iron, and the drum and crank shafts are of the best quality of wrought iron, and calculated to be of ample strength for any possible requirement. The crank wheel is counterbalanced, and is forced on the crank shaft by a special press. The bearings are large, and fitted with anti-friction metal. A winch head is placed on the outer end of the drum shaft, and a band fly wheel on the crank shaft, for pumping, sawing, etc.

The friction drums of these engines have many improvements for which patents are held and owned by the company. The frictional hold is effected by the engagement of segments of hard wood, bolted on the inner surface of a spur wheel, to make a hollow inverted double cone, with corresponding cone-shaped flanges at one end of the drum. The spur wheel is actuated by a pinion on the crank shaft, and is ordinarily in constant motion. The drum is loose on its shaft, on which it has long bearings, and is free to revolve without sensible resistance, but the cone-shaped flange at one end of the drum is thrown into friction contact with the wood-lined spur wheel by a slight lateral motion of the drum, effected by means of a lever, screw, pin, cross key, and collar, and released by means of a spiral spring interposed between the friction surfaces. The great power afforded by this construction is obvious, being such that a very slight pressure will hold the drum against any load the engine can hoist. The end thrust caused by the lateral movement of the drum shaft is taken up by a thrust bearing and screw collar. The friction wood is secured to the inner surface of the spur wheel by bolts and nuts in such way that it can be always kept tight without trouble.

The drums are extremely durable, having been in constant use for years without requiring renewal, and the entire machine leaves nothing to desire in the quickness of its operation and the ease with which it can be managed. This is particularly exemplified in pile driving, when compared with the work done by any clutch and brake engine. The rope is made fast to the hammer, and passes up over the sheave and down around the drum. When the hammer is raised to the desired height, the drum is released, the rope then overhauling the freely revolving drum as the hammer falls, it being entirely within the discretion of the operator, without a moment's delay, to give either short, quick blows, or long and heavy ones, from the entire height of the pile-driving frame. This class of engine has now largely superseded all others for such work, hammers of twice the weight formerly employed being now commonly used, without damaging the heads or splitting the piles, and enabling the operator to give many more equally powerful blows in a minute. The quickness with which piles are driven thereby is generally very surprising to foreign workmen, and the export demand for these engines is large and growing.

In general hoisting work, as the weight is raised to the desired height, the moving of the lever and the operation of the spring loosens the hold of the friction drum, as required for ordinary lowering purposes, but foot brakes are preferably to be used therefor, as saving wear on the friction drum, and allowing the use of the engine for other purposes when a weight is to be held. These foot brakes can at any time be readily applied to an engine not having them, and some of the styles of engines are fitted with ratchets and pawls which may be thrown in and left with a load suspended.

The double cylinder engines are similar to those with single cylinders, except that they have the special feature of having no centers, the engines being connected at an angle of 90°, thus rendering them much easier to start and handle, single cylinder engines being sometimes caught on centers in handling heavy work. Double friction drum engines, with either single or double cylinders and reversible link motion, are supplied in various patterns specially adapted for quarrying, dock and bridge building, etc., whereby two derricks can be operated, or one drum can hoist a pile in pile driving, while the other handles the hammer. Double drum and double end hoisting engines are made in several varieties calculated to run at different speeds, and a style of portable hoisting and power engine is made to be housed, if desired, when, but for its larger wheels, it somewhat resembles a small dummy engine for street railway use.

Perhaps the most efficient machine ever built for mining operations is the large mining and tail rope hoisting engine made by the company, and specially adapted for double track inclines or double shafts in mines. It has double friction drum and brake and reversible link motion, both drums being loose and independent of each other, so that they may be thrown in and out of gear with the engines in motion, or one drum may be lowering while the other is hoisting, or both may be thrown into gear and the engine used as a regular reversible engine, one load being hoisted while the empty cage is being lowered. This is done with the minimum of friction and wear on the engines, and the great desirability of such independence of drum action, particularly on inclines or in mine shafts, will be at once obvious to all engineers and workmen experienced in mining operations.

Space will not admit, however, of such reference as would do justice to the great variety of engines made by the company. Work for which they have a regular demand they keep always in stock, their manufacture being carried on according to the duplicate part system, from complete sets of gauges and templets, which insures absolute accuracy. Instead, therefore, of building each engine separately, they are always ready, on receipt of an order, to send the parts to the erecting shop and set up the particular engine called for, after which the engine is thoroughly tested, being set up and run with steam on before being shipped. This system not only reduces the cost of production, while necessarily calling for the highest degree of accuracy, but it enables a user of these engines to obtain at any time, without delay, any special part of an engine which may give out, from wear or accident. The standard character of these engines has been recognized by different departments of the United States government, in their specifications for contractors, in which, in many cases, it is stipulated that engines furnished shall be equal to those of the Lidgerwood company. They have been on the market now some eight years, and there are over 4,500 of them in use, being employed in every part of the world.

The manufacture of boilers specially adapted for these various engines constitutes an important portion of the business of the company, as they make also marine boilers of all kinds, horizontal return tubular boilers, stationary and portable locomotive boilers, upright tubular boilers, and any kind of work in this class which may be called for. The shells, unless otherwise ordered, are made of CH No. 1 shell iron, of 50,000 lb. tensile strength, and the tube heads of the best flange iron, all of brands tested and known to be reliable, steel being used in place of iron when ordered. All of the boilers are hydraulic riveted, every rivet being subjected to exactly thirty-five tons pressure. The bracing and staying is of ample strength to allow a large factor of safety. The edges of sheets are planed off true and smooth, and the seams are thoroughly calked inside and outside. The tube heads are flanged on formers specially made for the purpose, the tube holes being drilled to size and the tubes carefully fitted, being usually driven in with a maul and then expanded. The fittings are complete, strong, and substantial, of good design, being made by special tools. The tests include a practical steam test to the guaranteed working pressure of 100 pounds, and a hydrostatic test to a pressure of 160 pounds, and every boiler must be found perfect under such pressure before being sent out.

As relating to a branch house of the Lidgerwood Manufacturing Company, we illustrate in one of our first page views the large Gorton heater shop of the Gorton & Lidgerwood Company. These heaters have been many years before the public, and have had a large sale, which, with the extensive facilities of the company for their manufacture, afford the best evidence of their high character. These house-heating boilers are for private residences, schools, public buildings, etc., and are unlike any other boiler for such purposes. They combine improvements attained through many years' practical experience in satisfying the demands of a large trade. They are side feed boilers, built on the plan of an upright tubular boiler, and are self-feeding as well as surface burning, being adapted for use either way. The coal reservoir is between the lower outside surface of the boiler and the water leg, and the tubes are directly above the fire, the heat passing up through them to the top and thence down on the outside between the boiler and jacket to the smoke pipe in the back. The boiler is designed to generate steam in the most economical and effective manner, the tubes being placed as thickly as will admit of proper circulation, and its evaporative efficiency is calculated as fully equal to that of the return tubular boiler. The coal reservoir is designed to hold sufficient coal to last from twelve to twenty-four hours without refilling, and the grate is low in the center, so that the coal will gradually feed down from the outer surface as it is needed, and distribute itself at a uniform depth over the surface of the grate, the fire being always directly under the tubes. The grate is of the shaking and dumping type, its outer or main part resting on ball bearings, so that it can be easily shaken, and the center part being independent and arranged to swing to one side for removing clinkers or dumping the fire. This boiler can be used with efficiency and economy for circulating hot water, as well as for making steam.

The general offices and salesrooms of the company are at No. 96 Liberty Street, New York, and No. 159 Friend Street, Boston.

Water as a Constituent of Organic Substances.

Water, says Dr. Whitelaw, forms three-fourths of the weight of living animals and plants, and covers about three-fourths of the earth's surface. Professor Chaussier dried the body of a man in an oven, like a brick in a kiln, and after desiccation the body weighed only twelve pounds. Rather more than a pound of water is exhaled daily by the breath, about 1¼ pounds by the skin, and 2¾ pounds by the kidneys, making the daily emissions of water by the body about 5½ pounds, or not quite 3 quarts. The following is the percentage of water in some well known articles:

Wheat	15	Mangel wurzel	85
Barley	15	Cabbage (leaves)	92
Oats	16	Cabbage (stem)	84
Rye	12	Mushroom	96
Rice	13	Fungi	86 to 95
Beans (field)	15	Potato	75
Beans (kidney)	23	Watermelon	94
Peas	14	Cucumber	96
Turnips	88	Vinegar plant	95
Carrots	83	Wheat flour	13 to 16
Rye flour	14	Cocoa	5
Barley flour	14	Manna	10
Maize flour	13	Figs	21
Indian corn flour	14	Plums	75
Oatmeal	14	Apples	80
Wheat bread	44 to 48	Gooseberries	80
Rye bread	44 to 49	Peaches	75
Cane sugar	5	Egg, entire	74
Linseed cake	10	Milk	87
Flesh	77	Blood	79 to 83
Skin	58	Gastric juice	97
Bones, variable	7 to 20	Trout	80
Beef	74	Pigeon	79
Veal	75	Cheese	40
Mutton	71	Hair, wool, horn	9 to 11
Haddock	82	Brandy	56
Sole	79	Whisky	47
Tea	5	Rum	30
Coffee	12	Beer	90

A New Frictional Machine.

At a recent meeting of the Liverpool Chemists' Association Dr. Symes exhibited and described Mr. Tudsbury's new double cylinder electric machine for the generation of frictional electricity. It is a modification of the Wimshurst influence machine. Wimshurst's machine, as our readers know, consists of two plates of glass, the surfaces of which are brought near together, but do not touch each other. They are caused to revolve rapidly in opposite directions. The modified machine of Mr. Tudsbury is made of ebonite, in the form of two cylinders, very much in appearance like two sieves revolving one inside the other, the sectors being placed transversely across the hoop. This machine, the smaller patterns of which would prove admirably adapted for medical use, is also fitted with a new double high tension discharge, whereby the length of spark obtainable is considerably increased. Glass machines all give positive electricity. The new ebonite apparatus will yield negative electricity in the same manner.

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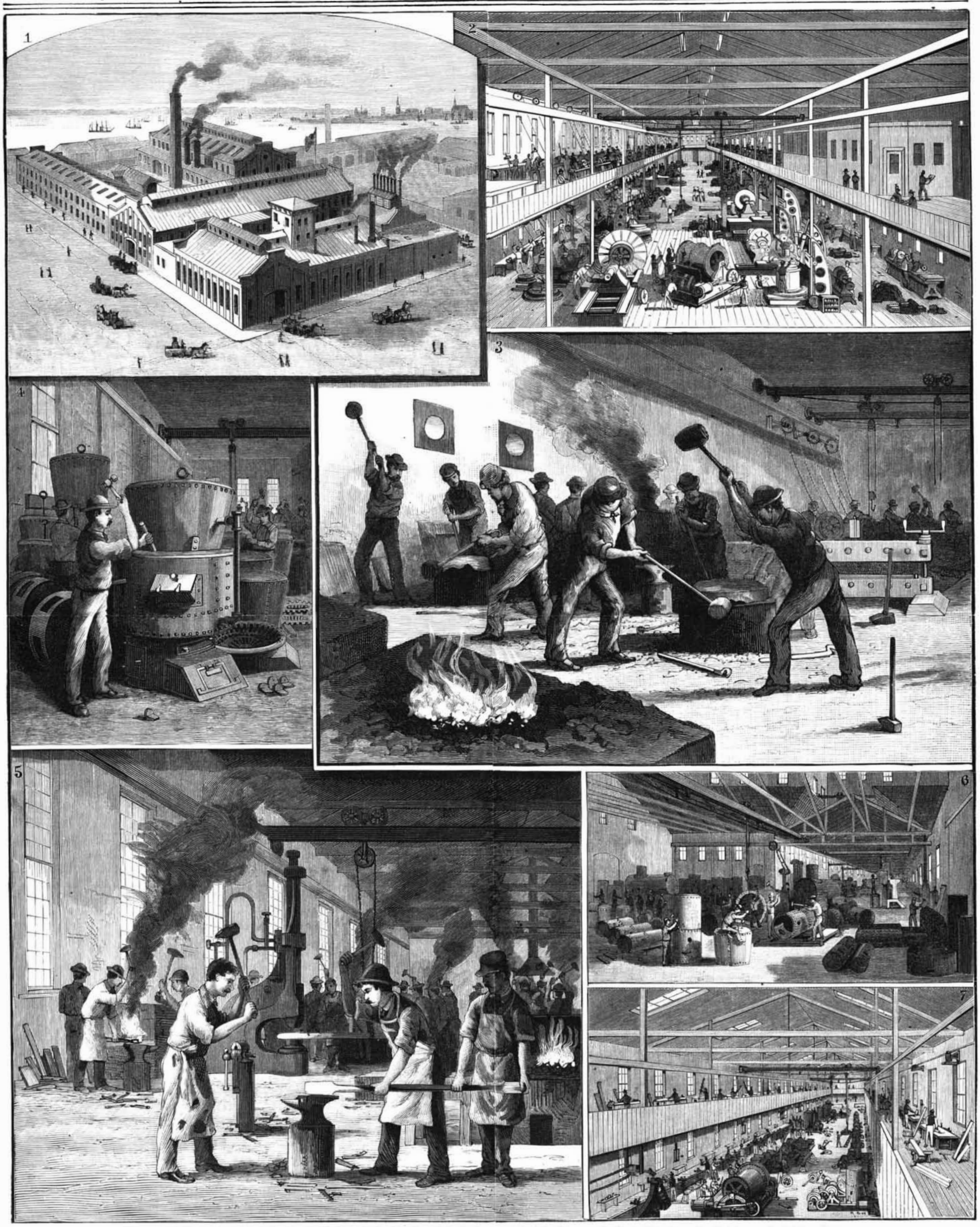


1. General View of Works. 2. Main Machine Shop. 3. Flanging Department. 4. Gorton Heater Shop. 5. Blacksmith Shop. 6. Boiler Shop. 7. Erecting Shop.

THE LIDGERWOOD MANUFACTURING COMPANY, NEW YORK—HOISTING ENGINES AND BOILERS—GORTON HEATERS.—[See page 341.]

Natural Gas in China.

The following abstract of an account given by Baron Von Richtofen of natural gas wells in China is given in the United States consular reports by Charles Denby, United States consul at Peking. These wells are found in Sz'chwan, near a town called Tsz-lin-tsing. In an area of twenty-seven li (9 miles) diameter salt wells are found. To make a well the Chinese use a long and elastic bamboo pole, supported in the middle by a cross piece, a rope made by coupling the ends of long (not twisted) slices of bamboo, and an iron instrument which weighs 120 catties (catty = 1⅓ lb.) The rope is fastened on the thin end of the pole, and the iron on the end of the rope. A slight up and down motion of the thick end of the pole makes the iron hop and bore a vertical hole with its broad, sharpened edge. The ground to be perforated consists chiefly of sandstone and clay. When a portion of the rock is mashed, clear water is poured into the hole, a long bamboo tube with a valve in the bottom is lowered, and the turbid water raised to the top. Pipes of cypress wood are rammed in to protect the sides of the bored hole and to prevent the water contained in the surrounding ground from getting access to the well; the pipes are attached to each other at the ends with nails, hemp, and tung oil. The inner width of the pipes is about 5 inches. As the work proceeds the pipes are rammed deeper, and a new one attached on the top; the rope, too, is made longer. At a depth varying from 70 to 100 chang (700 to 1,000 feet) the brine is struck, and the well is fit for use. The brine is raised to the top through long bamboo tubes and bamboo ropes, as described, by means of a horse whim, and then carried to large pans for evaporation, or led to them through bamboo pipes.

Besides these wells there are others, which are bored to the depth of from 1,800 to 2,000 feet. At that distance below the surface petroleum is struck. Immediately on reaching it an inflammatory gas escapes with great violence. Work is now stopped, and a wooden cap fastened over the mouth of the pit, perforated by several rows of round holes. In each of them a bamboo pipe is inserted, and through these the gas is led under the evaporation pans. The pipes ramify, and on each end a tapering mouthpiece, terminating in a small aperture, is attached. The gas is then used for evaporating the brine.

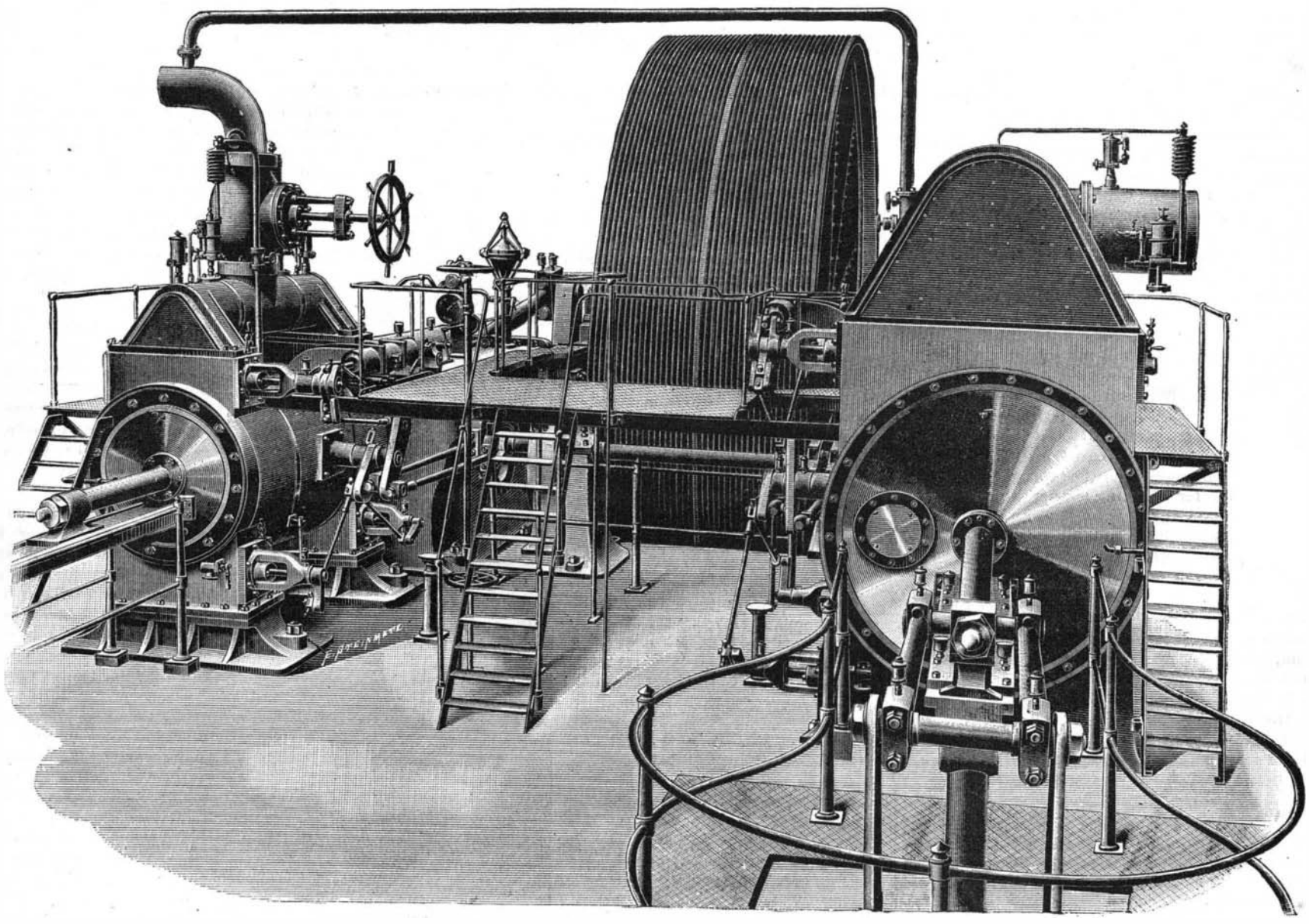
The enterprising spirit which induced the Chinese to examine the ground at so great a depth is said to have had its origin in the drying up of a brine pit. The proprietor was in hopes of meeting brine at a greater depth, but found instead the gas.

When the country was infested with rebels during the Taiping rebellion, they removed the cap from one of the gas pits and set fire to it. Since that time, or at least up to the time that Baron Richtofen wrote, a long column of fire rose from that pit, and it is considered nearly impossible to stop the flame.

The gas pits and brine pits are owned separately by corporations. The owners are subjected to the control of the government. The government monopoly is in the hands of the "taotai," who resides at the place. The salt works of Tsz-lin-tsing yield considerable revenue to the government, and have besides enriched numerous proprietors, and give occupation to a numerous population. The number of "fire pits" is twenty-four, and the salt pits are innumerable. Some of them do not enjoy the advantages of gas. The brine is evaporated with grass and wood.

2,500 H. P. CORLISS ENGINE.

As illustrative of the progress of the Corliss system of engines we give an engraving, from *Engineering*, showing a fine pair of compound Corliss engines lately constructed by Messrs. Douglas & Grant, of Kirkcaldy, for the Mazayon Spinning and Manufacturing Company. The cylinders are 40 in. and 70 in. in diameter respectively, and have a stroke of 6 ft. The power, which amounts to 2,500 indicated horse power, is transmitted to the various lines of shafting in the mills by ropes running off a fly wheel 30 ft. in diameter by 8 ft. 6 in. wide, and grooved for 38 ropes. This wheel weighs about 110 tons, and runs at 60 revolutions per minute, giving a speed to the ropes of considerably over a mile a minute. The crankshaft, made of Whitworth's fluid compressed steel, is 25 in. in diameter in the body and 20 in. in the bearings. The steam pressure will be 100 lb. per square inch.



IMPROVED CORLISS ENGINE OF 2,500 H. P.

Right to the Use of Water.

The *Legal Adviser*, published at Chicago, gives its readers some information respecting water rights, which has been a source of great trouble and much litigation between neighbor farmers.

It is a general principle, says the writer, that every owner of land upon a natural stream of water has a right to use the water for any reasonable purpose not inconsistent with a similar right in the owners of the land above, below, and opposite to him. He may take the water to supply his dwelling, to irrigate his land, or to quench the thirst of his cattle; to use it for manufacturing purposes, such as the supplying of steam boilers or the running of water wheels or other hydraulic works, so long as such use does not sensibly and injuriously affect its volume. But this is a mere privilege running with the land, not a property in the water itself.

Where the stream is small and does not supply water more than sufficient to answer the wants of the different proprietors living on the stream, none of the proprietors can use the water for either irrigation or manufacturing, but for domestic purposes and watering stock, one proprietor will be justified in consuming all the water.

Twenty years' use adverse to the right of another, will give the person so using the stream the right to continue the use, regardless of the other's rights.

And as to the division of water, every farmer who owns land situated upon a stream has the following rights:

1st. To the natural flow of the stream.

2d. That it shall continue to run in its accustomed channels.

3d. That it shall flow upon his land in its usual quantity, natural place, and usual height.

4th. That it shall flow off his land upon the land of his neighbor below, in accustomed place and at its usual level.

These rights he has as an incident to the property in his land, and he cannot be deprived of it by grant or description.

If any farmer shall make any change in the natural flow of a stream to the material injury of any other owner situated upon it, or by any interference shall prevent the stream from flowing as it was wont to flow, he is responsible for the damage he may occasion. These rights are subject to the privilege of each one of the farmers to make a reasonable use of the water upon his own land, while it is passing along the same. It matters not what the source of the water may be, whether it be backwater or the flowage of the same, or the water of another stream. Still, a division of a stream may be made by the farmer, if it be returned to its natural channel before it leaves his premises.

The United States Commissioner for Brussels.

The Hon. John Bigelow was recently appointed United States Commissioner to the Brussels exposition, and has sailed for Europe to take charge of the American exhibits at the Belgian capital and see that they are properly placed and classified. The exposition will open on June 2, and close in November. The buildings and grounds cover 100 acres, and are said to exceed in size and grandeur those of any previous exposition. Enormous temporary structures of brick and iron and a large permanent building of stone have been erected. A large portion of the exhibits are now in place. Owing to the delay of Congress in appropriating $30,000 to pay for the supervision and care of the exhibits from this country, fewer manufacturers have sent articles than was expected. Every prominent industry will be represented, however.