triple expansion engines, which are expected to develop 13,250 indicated horse power, with natural draught, driving twin screws, which will give her a sea speed of 18 knots. It is expected, however, that she will be able to exceed this speed when necessary. At her ordinary load draught she can carry sufficient coal to steam from Cronstadt to Vladivostock at her most economical rate, or about 18,000 knots without the necessity of calling at a coaling station to replenish her bunkers. She has been built at the yard of the Baltic Works Company on the river Neva.

THE POTSDAM RED SANDSTONE COMPANY'S WATER WHEEL.

In a recent issue of this paper we illustrated the Potsdam stone quarries of this State. In one of the cuts a water wheel was shown, to which we alluded as employed for developing power for running the machinery of the works. This wheel was designed by a member of the firm of the Potsdam Red Sandstone Company. Its simplicity and efficiency entitle it to consideration, independent of the fact that the position in which it is placed involves special difficulties in operation. The river on which it is located is subject to freshets and varies at times greatly in the level, in the spring sometimes rising 6 feet. The stream is also used for logging, 200,000 logs passing down it in a season. These sometimes jam, and quantities of the logs strike the wheel and pass under it, the wheel rising to let them pass. The wheel has been in operation for several years, yet in all this time it has never broken a paddle.

The wheel proper is an undershot wheel of the simplest possible construction. The hubs or flanges for carrying the arms are keyed to the shaft, as shown in the cut, Fig. 2. To further stiffen the shaft, three struts are placed equidistant around its center, over which tension rods with turn buckles are carried, as shown in this view and also in Fig. 3. The wheel is destitute of framing to take up twist. In place of such framing a wire rope is carried spirally half way around the wheel, just inside the paddles, to which it is fastened. This compels the end of the wheel next the gear to keep up with the other end. The rope is found to answer the purpose perfectly.

The shaft of the wheel is made of rock elm, and is 24 inches in diameter. At the ends it is trimmed down for journals, and over the portion thus reduced in thickness pieces of 15 inch iron pipe are driven. The outer portion thus treated forms a journal two feet long; the inner portion is 6½ feet long. The wheel is 18 feet in diameter and 41 feet long. The paddles are 20 inches wide and of the full length of the wheel, each being in one piece. The arms are of 4x7 inch water elm.

The wheel axle is carried on trunnion blocks made of timber 20 inches square. The trunnion blocks are suspended by ropes, which, passing over pulleys in a stationary frame rising above the top of the wheel, terminate in counterweights, thus supporting the weight of the wheel. Everything now is in condition to keep the wheel at the same level as regards the water, whether it rises or falls. In the large engraving the trunnion block and counterweighting arrangement for the outer end of the wheel shaft is shown. A similar mechanism is contained within the house for the other end of the shaft. In Fig. 4 of the sectional drawing the arrangement of counterweighting is shown more in detail.

The end of the shaft is carried into the house and on it a gear wheel 10 feet in diameter, with teeth of 2½ inches pitch, is placed. It is obvious that as the wheel rises and falls this gear wheel will, of course, do the same. The arrangement shown in Fig. 5 is for the purpose of enabling it, in spite of the changing of position, to operate a fixed countershaft. A wooden frame of heavy timber has one end journaled upon the shaft, so as to inclose within itself the 10 foot gear wheel. On the same frame a 10 inch gear wheel engaging with the larger one is journaled. This gear wheel turns a 5 foot band wheel attached to its own shaft. From the band wheel a belt goes to a fixed band wheel near the ceiling, which, by miter gearing, turns a grooved rope pulley for the power-transmission cable. On the further end of the frame a box is placed to receive material for proper counterweighting. This counterweight keeps the belt stretched. An examination of Fig. 5 of the cut will explain the entire arrangement. As the water wheel rises and falls, the counterweight executes the reverse movements. The 12 inch gear wheel and 5 foot band wheel change in position a little as these movements take place, but the counterweight keeps the belt always stretched, and the two gear wheels are always at a fixed distance from each other, as they are both attached to a rigid frame. The grooved sheave for the transmission rope is 10 feet in diameter, and normally runs at 200 revolutions per minute. The gear wheel on the end of the shaft is of wood with iron segments bolted on, and is of 8 inch face, as is also the 10 inch pinion with which it engages.

The fastest speed of the wheel is thirteen revolutions per minute, its lowest speed is six revolutions. It has developed as much as 200 horse power. The total expense, including pulleys, belting, shafting, and wire rope for transmission, was $2,500. The gear and all the parts have worked perfectly without noise or wear. It was built by regular employes of the Potsdam Red Sandstone Company.

Chemistry a Shrewd Detector of Forgery.

Some years ago a traveling salesman related to me a curious incident of detecting a forgery. He was a traveling salesman when emery wheels came into early use, and he sold a quite large wheel in Providence, R. I., and wrote them what speed it was warranted to run at safely. In a short time the party wrote to him that the wheel had burst and broken one man's arm and done other great damage. So when he went to their city he called at their place, and they sued him for some thousands of dollars' damage; and as he was out of his State it caused him no little trouble to secure bonds for appearance at court for trial of the case. This he did, however. Then he commenced to study how to get out of his trouble. He had been rather careless in not copying his letters, and this one in particular; but a happy thought struck him, and he went to their office and inquired what ink they used. They said Carter's exclusively. In looking at the letter he thought that the figure 1 in the 1,800 was of a slightly different shade than the 800, while the salesman used Arnold's only in his office. So in going home he went and saw a scientific chemist in New York City and paid him $25 to furnish a chemical solvent that would dissolve and remove either ink without affecting the other. So in about a month came to him, by express, two bottles, one marked to remove Carter's ink and the other to remove Arnold's, with directions how to apply and use it. He tested them, and both were a success.

The time for court came, and he appeared there with counsel. He heard the evidence of proprietor and bookkeeper. In cross-examination the bookkeeper swore that he used Carter's ink only. The salesman's letter was produced. The judge and foreman of the jury were called to a table to see an experiment in chemistry. Defendant had two bottles of ink and two bottles of solvent. The court was asked to write his name with the two inks on two pieces of paper and dry them thoroughly by the fire. Each solvent was tested; one removed the Carter ink and the other the Arnold. Then the letter was brought and the court asked to carefully examine the shades of ink, and thought it discovered a slight difference.

Then the solvents were applied, and the figure 1 completely removed without affecting the figures 800.

The court said, "It is not necessary to proceed in this case. The jury is instructed to bring in a verdict for defendant, with costs of prosecution." Said the salesman who related this to me, "I was not through with them then. I made them pay for that emery wheel, all of my costs and time, and my lawyer's fees, or risk a suit for forgery. They paid everything up and quit, and had a very costly emery wheel." J. E. EMERSON.

The Oil and Gas Region in Ohio.

Mr. John Gould, writing from Western Ohio to the *Country Gentleman*, gives the following interesting account of the oil and gas wells of that region:

That these black swamp lands of Ohio were the 1,200 feet covering of an oil stratum, and across the State from northeast to southwest was to be discovered a gas belt that would be a world's wonder, no one had ever dreamed of, and this discovery, a few years since, the mad rush of speculators, and the tide of adventurers who are also seeking their Eldorado, have had a wonderful effect upon the agriculture of the western counties of the State. The number of wells, both of gas and oil, that have been put down in Western Ohio is past computing, and as each one represents an outlay of from $2,000 to $5,000 for derrick, engine, housing, piping, and labor, some economists put the outlay at a figure actually above the income from the sale of the oil. It is also to be doubted if the farmers, except in individual instances, have had their actual wealth enhanced by the discovery of oil; not but that the farmers receive the money for the ground lease and royalty, but assuming that these wells would be a lasting source of income, hosts of these men have in turn become oil speculators and well developers, and the abandoned wells and dry holes tell why oil is not always a source of wealth or profitable investment.

A day of observation among the wells is not without interest, and may possibly awaken a moment's attention on the part of your readers. These wells are usually in clusters, varying in number from six to a hundred, and as a rule are not far from 1,200 feet in depth. The huge derricks above them are not far from 60 feet in height, resembling a windmill tower. The wells are cased below the water line with a 5 inch iron tubing; inside this are the 2 inch pump tubes. The well is provided with a small engine, although the steam is furnished from a central boiler house that supplies the power for from three to eight wells. The steam pipe to the wells, that may be 10 or 150 rods away, is put in a 6 inch square wooden conduit box, elevated about two feet from the ground. From each well a return half inch gaspipe is carried to the furnaces of the boilers, so that no fuel but gas is used. Nearly all the wells produce a little gas, which is thus utilized, making a steady, uniform fire; and besides, this plan enables the engineer not only to manage the boiler house, but also to look after all the wells connected with it.

The wells vary greatly in productiveness, and that a well is a good producer is no sign that another, six rods away, will be worth pumping, or that the lasting qualities of one well give any assurance that its neighbor will last beyond the time required to pump its "head" off. The oil in this region seems to be found in "pockets," that underlie tracts of land from a few acres to whole sections and the greater part of a township. The county has been all drilled over by the prospectors, and derrick ruins in every direction attest that it costs money to find money, and that fortunes are lost quite as often as found.

The oil product has greatly lessened, and, with few exceptions, a 30 barrel well is now counted a good one, though a well is pumped until it gets down to a one or two "barreler," when it is "shot," and then if the flow is not increased, the derrick is taken down, the pumps taken up, and the casing drawn with powerful "jacks," the hole plugged, and our farmer's source of royalty is at an end, unless he has a number of wells upon his farm. Many farmers will lease only a few acres to a company, and so may have two or even three oil companies producing upon his farm. When a good well is struck, the aim of other companies is to lease up as close to the well as possible, and put down wells all about it and thus assist in pumping out a territory as soon as steam pumps will elevate it, to prevent the other man or company from making a "mint." These rival wells are not always a success, and a poor well beside a good one is not a rare thing.

Farmers are paid a pretty uniform price of $2 per acre ground lease and one-sixth of all the oil pumped, and those who were thus content, and wisely used their royalties, and kept right on farming, have reason to congratulate themselves, while others are softly repeating the old refrain, "It might have been" otherwise.

Each and all of these wells are connected with the Buckeye pipe line, and the oil is first pumped into a tank at the well. At certain times the pipe line companies' agent visits the well, measures the oil in the tank, gives a "scrip" for it, and connection is made with the main line, for all wells have a small pipe to the main pipe, that is operated by large pumping engines, with compound pumps, that have a capacity of forcing from 5,000 to 15,000 barrels of oil through the lines in 24 hours, and these mains are connected with the lines of the Standard Oil Company, that extend to Chicago, Buffalo, Cleveland, and New York City, so that when the oil leaves a well tank there is no knowing where it may be four days after. The man who takes the pipe line oil receipt, or scrip, takes it to the pipe line company, who cash it at the going price of oil —now 43 cents—or sells it to an oil broker, and it quickly becomes a factor in the oil exchange, to bull and bear the oil market.

The "shooting" of a well is an interesting operation. The pumps are pulled up, long 3 inch tin cans of nitroglycerine are carefully let down to the bottom of the well, often 100 quarts in all, and then a little iron go-devil is dropped down into the well, which, striking the top can, explodes it, and all the rest for that matter. There is a faint explosion heard, the earth gives a pulsation, and oil and gas may as a result spurt into the air in a column or it may not, and the well may freshen up or it may prove permanently dry, in which event the derrick is torn down and the well pulled up.

The gas fields are dotted here and there through the oil territory, though both are often found in paying quantities close together, but great as was the amount of gas and so wasteful were its discoverers that probably not over one-fourth of the gas once found can be coaxed from the ground at present, and where gas was used not only to light and warm buildings and furnish fuel for all kinds of manufacturing purposes, so low has the pressure become that wood, coal, and coal oil are now in active demand by a majority of those who once used it almost exclusively.

The Magnesium Light.

The application of powdered magnesium as a source of light for photographic purposes is by no means such a modern invention as some seem to suppose. So far back as 1865 it was used; and in that year Mr. H. Larkin obtained a patent for a lamp for its combustion. The lamp answered well, and we were present when some very good portraits were taken by its aid. In this lamp the powder, mixed with a certain proportion of fine sand, was made to pass through the flame of a spirit lamp, or one of gas, which insured its combustion. The chief reason why the lamp was not much used was the then prohibitive price of magnesium.—*Br. Jour.*

A LASTING machine that enables one operator to last 3,000 pairs of shoes a week is one of the latest things in labor saving machinery. It tackles anything from light feminine foot gear to the heaviest brogans.

SCIENTIFIC AMERICAN

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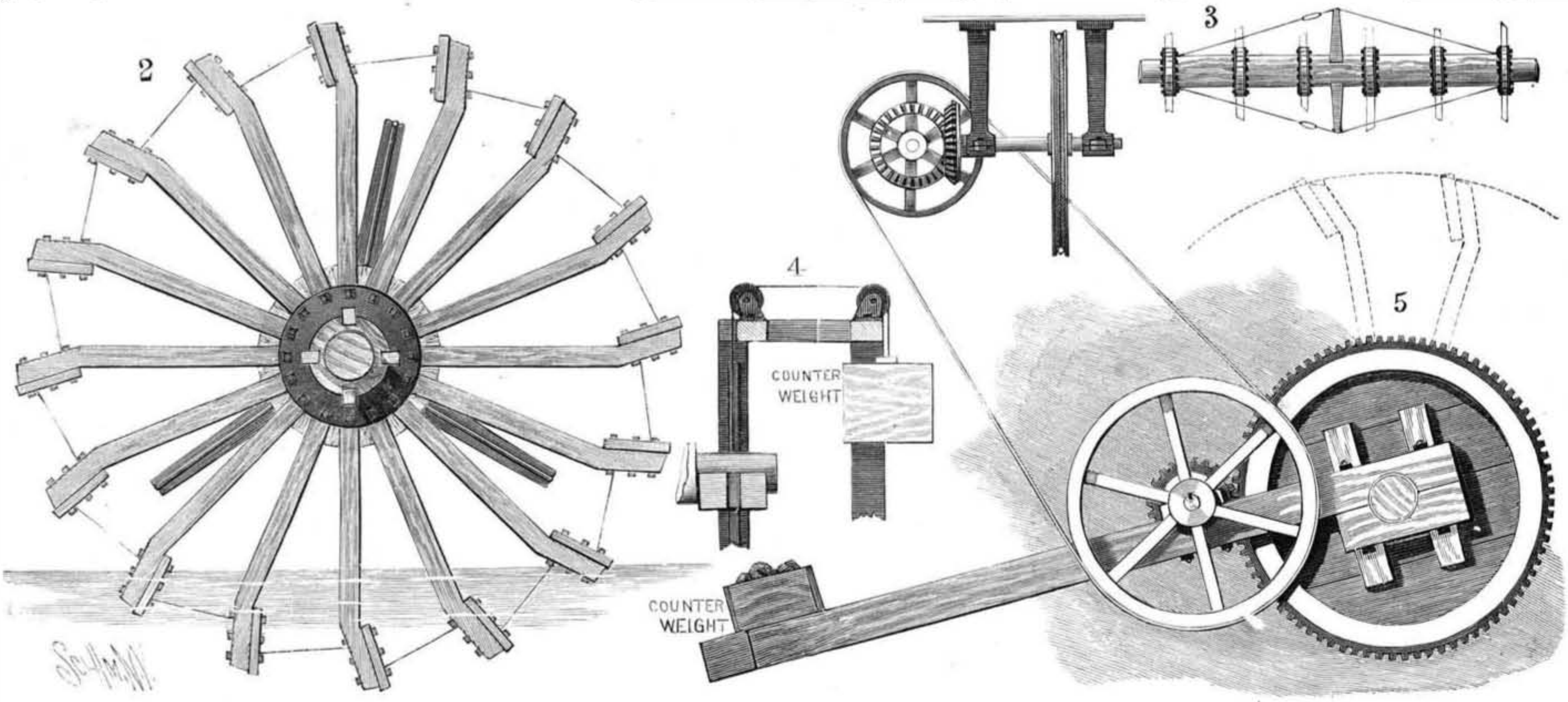

1. General view of wheel and outer counterpoising. 2. Side end view of wheel. 3. Bracing of wheel shaft. 4. Counterpoising. 5. Adjustment for varying water level.

ADJUSTABLE UNDERSHOT WATER WHEEL FOR VARYING WATER LEVEL, OF THE POTSDAM RED SANDSTONE CO.—[See page 38.]