cuts the exact depth into the face of the wheel for a tooth, then stops by a self-acting movement, the blank wheel moving a certain distance for another tooth, and so on until all are cut. The teeth are thus formed by the metal being left standing between the spaces cut out by the burr wheel. Various sizes of wheels and racks, for printing presses, &c., are cut with equal facility in this machine.

The beds and platens of printing, hand and hydraulic presses are here planed smooth by machines, most of them having movable reciprocating cutters. Most of the improved iron planing and slotting machines and lathes employed in this manufactory were made by A. M. Freeland, of this city, who has obtained much celebrity as a tool-maker, but there are also some most excellent machines made by Whitworth & Co., of Manchester, England.

PRINTING PRESSES.

The apartments above the ground floor are devoted to various operations, but principally that of making and fitting-up printing presses. Here at all times may be witnessed single and double cylinder presses of various sizes, in different stages of construction. Power presses for every city, and every part of our wide spread country, are being continually fabricated; and such are the skill, the resources and abilities of those who have charge of, and who execute the different operations, that very many new and intricate machines—new inventions—are entrusted and submitted to them to be reduced to practicability. Several new machines, to order, maygenerally be witnessed in the course of construction in this department; one which we noticed, for printing railroad tickets, was of very intricate workmanship. A new printing press, for a Boston publisher, was also being fitted-up, together with severa others requiring great accuracy of operation.

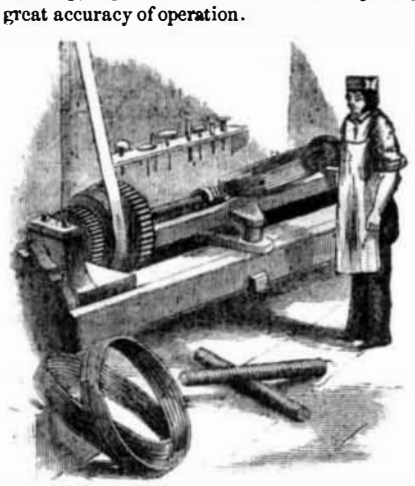

FIG. IX.—COILING SPRINGS.

It is in this department also where Hoe's great "Mammoth Rotary Presses" are fitted-up, and reduced to practical working order before they are sent out. The fame of these printing giants has led to their representation in a former volume of the SCIENTIFIC AMERICAN, and in several other illustrated periodicals, and the public is now somewhat well informed in regard to their powers and utility; we, therefore, have not deemed it necessary to present an engraved view of one at this time. The importance of the invention of this press cannot be over-estimated. The daily papers of our country would have been limited in their circulation had it not been produced to meet the wants of the public. The New York *Herald*, *Tribune* and *Times* have Hoe presses in which ten impressions are taken during every revolution of the type cylinder, and they can throw off 20,000 copies per hour with ease. Several other daily papers in New York, Philadelphia, and other cities have eight cylinder presses, which are nearly as rapid in action; and there are quite a large number having six and four cyliuders now running. The *Illustrated London News* is printed on one of six cylinders, which was sent from Hoe's establishment, and *Lloyd's Weekly Newspaper*, in London, on one of the same dimensions. The Manchester *Guardian* is printed on one of four cylinders—Messrs. Hoe's make—and the *Examiner* on one of similar size, by Whitworth, under Mr. Hoe's patent. In Europe, as well as in our own country, it is held to be *the press of the world*. The preceding figure (9) illustrates the mode of forming the large coil springs on which the journals of the inking rollers rest. It is made of the best iron rod and placed on the spindle of the lathe, which, as it revolves, coils the iron rod around it, and a guide directs the pitch necessary between each spiral or thread. A visit to one of the printing-rooms, when one of these large presses is in operation, is as great a treat to a stranger as is a visit to the Falls of Niagara. Improvements are continually being made in printing-presses, and we were shown a very important one recently attached to the flat bed cylinder press, for equalizing the pressure on the parts during the period an impression is taken, so as to render it more durable and correct in action. All the parts of these presses, from the most minute screw to the largest cylinder, wheel and rack, are, from their incipient stage to the last finishing touch, executed in this manufactory. This perfect control of all the materials and workmanship insures much greater perfection than could otherwise be secured.

A very large business is also carried on in the upper part of the building, situated in Columbia street, in making printers' furnishings, such as cases, &c. Large stacks of sawed cedar and white wood are here kept standing for long periods, in order that the timber may be perfectly seasoned before it is finally used, as such joiner's work must be exceedingly exact, to prevent warping and shrinkage. A Daniels' planer and several circular saws are in continual operation for preparing the stuff. The room is heated by steam pipes, and every means provided to insure safety and comfort.

In connection with this joiners' department there is also the pattern shop, where the most scrupulous attention must be paid to the most minute feature of the work to be completed, in order to insure accuracy through all the subsequent operations. Some patterns are very valuable, as they involve a great amount of patient labor and study, hence they are carefully protected from fire or other accidents, because, if lost, it would be very difficult to replace them.

On the opposite side of the establishment, in Sheriff street, is the office of the superintendent and clerks, the draughtmen's room, and a photograghic gallery in the attic story. Here, too, is the telegraphic station, in which are the key and recording instruments for transmitting and receiving lightning messages to and from the main office in Gold street. Working drawings are here executed by the draughtsmen for all new machines, and for new parts of different form to improve old machines. Correctness in proportion and arrangement of parts in the drawings are absolutely necessary for the future guidance of the pattern-makers and mechanics. In the photographic room copies are taken of objects, the likenesses of which are desired for distribution or preservation. This part is under the charge of the principal draughtsman, who appears able to handle a pencil of sunlight as facilely as one of camel's hair.

Throughout the whole of this manufactory, in which about four hundred mechanics are employed, a strict regard is paid to all details, and order reigns in every department. Under the gentlemanly attention of Mr. Bowen, the superintendent, we were afforded every facility for examination, and he furnished us with a lucid and ready explanation of every machine which, from its complex character, was difficult to understand without a very long period for observation.

Power to Drive Circular Saws.

The power required to drive circular saws depends on the character of the timber to be operated upon and the amount of work to be turned out in a given time. In sawing southern yellow pine, twelve horse power is required for a circular saw 52 inches in diameter, running at the rate of 4,600 feet per minute at the periphery, with half an inch feed per revolution. In sawing white wood, spruce or soft maple, nine horse power will suffice to run a saw at the same velocity. By using a variable feed in a saw-mill, the same steam engine or water wheel can saw all kinds of timber—the feed being slow for hard and knotty logs, and quicker for soft free timber. A five horse power water-wheel or steam-engine can drive a circular saw of 52 inches diameter by proportioning the feed of the log; of course, it should be less than one half that of the saw, running with half an inch feed.

Gang saws are superior to all others for sawing logs where ample power can be obtained. They can be run at the rate of 150 strokes per minute, with a feed of a half inch per stroke; and in some mills in Maine they cut 50,000 feet of boards in twelve hours with ease—five in a gang—with circular saws for edging. As gang saws are made thinner than those employed singly in a gate, they economise the timber in cutting, and they also cut more accurately, as the logs do not spring so much; they being held more steady to the cutting action. Lumber cut by gang saws is about 20 per cent superior to that cut by a single saw, and it sells at such an advance in price in the market.

There are differences of opinion regarding the merits of the common gate and the *muley* saw. The latter is much used in Ohio, but the other is still the greatest favorite in most other sections of our country.

Iron and Steel Improvements.

Considerable sensation was produced among iron manufacturers in 1856 by an invention called the "Bessemer process," which consisted in blowing air through the molten pig iron as it was run from the cupola furnace, by which action, it was stated, a portion of the carbon in the iron united with the oxygen of the air, and was thus disengaged in the form of carbonic acid, whereby the metal was purified at one continuous operation, and converted into good malleable iron and steel. This invention was illustrated in our columns on page 32, Vol. XII., and a patent afterwards taken out for it, in our country, by Mr. Bessemer; but it was subsequently set aside in a case of interference with Wm. Kelly, of Lyons county, Kentucky, who was held to be the first inventor.

Since that period reports have prevailed that the merits of the invention had been grossly exaggerated; in short, that it was a failure. Such reports seem to have recently met with a confutation from G. F. Goransson, a large iron manufacturer at Eskden, in Sweden. He uses a converting vessel situated near the taphole of the blast furnace, and into this he runs the fluid pig iron—one ton at a time—then lets in the blast to it, at seven pounds pressure, for about seven minutes, by which action the iron is converted into steel. The temperature of the pig iron rises, by this operation, to a degree which could not be attained in three hours in the common air furnaces containing the iron in crucibles, and using an amount of coke equal to three times the weight of the metal. A large iron ladle, lined with loam and similar to that used by molders, is suspended in a crane near the converting vessel; into this the fluid steel is discharged and stirred for two minutes with a steel rod. This action liberates carbonic acid, which rises in a high flame; after which the metal is allowed to repose one minute, then run in a vertical stream into ingot molds from a *jit* in the bottom of the ladle. The whole time occupied, from the moment the fluid pig iron leaves the furnace until it is cast into the mold, does not exceed twelve minutes. The loss in weight, including the impurities thrown off, does not exceed 15 per cent, which is only about one-half the waste incurred in the manufacture of bar iron by the old system in Sweden. By this improvement Mr. Goransson states, in a letter to the London *Engineer*, that more than 1,000 tons annually of cast steel can be made with the same quantity of fuel as is now required for making 500 tons of bar iron. He says:—"So completely have we accomplished the object, that we now make several tuns of large ingots of cast steel, in succession, without a single mishap or failure of any kind. The steel can be made either hard, medium, or soft at pleasure. It draws under the hammer perfectly sound and free from cracks or faults of any kind, and has the property of welding in a most remarkable degree."

These are important results well deserving the attention of our iron manufacturers, as the Swedish steel thus made has been tried in England and found to be of excellent quality for tools, &c. If such things have been done in Sweden they surely can be effected in America. In England we doubt if such success can be secured with the iron ores of that country, all of which contain either sulphur or phosphorous, of which impurities the Swedish ores are remarkably free. But in our country we have ores equal to those of Sweden, such as the magnetic ore of New York, Pennsylvania and the Lake Superior region, and with these such results can surely be attained. It would also appear that all varieties of pig iron can be greatly improved by this process, if good steel cannot be made from them, and for this reason alone it should be more generally applied.

Draining of Farm Lands.

It is said that the most successful farmer in New York—Mr. Johnstone, of Ontario county—is also a most thorough drainer of his lands. Draining is, no doubt, one of the most effective means of increasing the product of the soil, and any useful information on this question is of much value. At a recent meeting of the Farmer's Club, held in this city, Professor Mapes gave expression to some very useful and practical ideas on the subject. He said he preferred drains five feet deep and eighty feet apart, to those three feet deep and twenty feet apart. Generally his plan cost no more than the other. The land never puddles near the drain; the water enters from below—never from the sides. Between the drains the water of falling showers forms an arch in the earth, below which, for a short distance, the earth is saturated, but above it never. Until this arch is flattened to the lower level of the drain the water will continue to issue from the drains. The five-feet drain then secures two feet more of earth in depth than the three-feet drains. He urged the necessity of keeping both ends of the drain open to the admission of air—the upper end being secured so by a pile of large stones reaching to the surface—and the circulation of air through it should be sufficient to extinguish the light of a candle placed at the upper opening. Another use of the drain was, that it made a mulch in effect of the upper inch of soil over the whole field.

Books in Turkey.

MESSRS. EDITORS—It may be interesting for your readers to know that the first and last work on medicine, in the Turkish language, was printed in Scutari in 1820. It was called: "Mirror of the Bodies," a folio sheet, with 300 pages, containing 56 anatomical plates. The publication of this work was hailed in Europe as a great event, considering that the *Koran* forbids to make plates of the human body. It is never allowed to open a body, even if, as the Koran expresses it, "the dead person should have swallowed the most precious pearl, which did not belong to him." The author was Cham-Zadeh, Mehemmed-Ata-Ula, a member of the Ulemas. It is remarkable that a particular Hatte-sherif—an edict of the Sultan—was required to allow its publication.

Printing was first introduced in Constantinople in 1726. It was interrupted again from 1743 till 1784, and since its introduction until the late war broke out—that is in a period of over 100 years—only about sixty books have been published! What a stupendous fact to dwell upon, considering one year's issue in the United States!

GALEN.

TELESCOPES.—Good results need not be expected at the moment when a telescope is transported from a warm room into a cold atmosphere. If the mirror of a reflecting telescope is not of the same temperature of the surrounding air the vision will be imperfect.