

BORING OUT COLUMNS IN SOLID ROCK.

BY L. RAMAKERS.

The method of extracting stones by means of wedges driven into them at intervals, or by explosives, is beginning to be discarded in quarries in favor of new processes. The system of sawing by helicoidal cable is becoming more and more widely employed. Utilized at first for forming an entrance to the lower part of strata in working shafts where there existed no entrance with natural slope, it is employed at present for cutting out stone at the adit end of quarries and forming it into blocks. For guiding and carrying the cable, use is made of a tubular support provided with two channeled pulleys, one of them mounted upon a fixed support at the upper part, and the other upon a movable one sliding along the entire length of the tube. The displacement of the movable support is effected by a long screw parallel with the tube and which gives the wire the pressure necessary for the sawing of the stone. For the sawing of a detached block, the mounting of these tubes on both sides of the block is done very easily. But the case is entirely different when it is desired to saw in a stratum in which no break occurs. In such an event shafts about thirty-six inches in diameter designed for the reception of the tubes are formed at the extremity of the length that it is desired to saw. In hard stone (such as bluestone) the shafts are driven at distances varying from 35 to 50 feet, while if it is a question of soft stone they may be driven at a distance of 120 feet from each other.

The Société de Constructions Electriques de Charleroi (Belgium) is constructing for the sinking of shafts a special drill actuated by an electric motor. The essential part of this machine consists of an iron plate cylinder 140 inches in height and $36\frac{1}{2}$ in diameter, at the base of which is mounted a knife 12 inches in height. The knife also is cylindrical and upon its lower part are formed alternate teeth upon concentric circumferences. This arrangement of teeth in two rows permits the knife to attack the stone better, and to widen the space in which the cylinder moves. After the shaft is driven, the cylinder and the internal core of stone may be removed.

The cylinder and knife system receives a circular motion of 50 or 60 revolutions through the intermediary of a square rod to the upper end of which is keyed a helicoidal wheel, which engages with an endless screw upon the shaft of the electric motor.

The knife-carrying cylinder was formerly actuated by the helicoidal cable that saws the stone, or by any sort of electro-dynamic drive; but all such transmissions had certain faults, and their efficiency, moreover, was unsatisfactory. The endless screw is much more certain in its action, its operation noiseless, and its efficiency very high. Its axial reaction is produced upon accurately calibrated steel balls. The square rod, through a sleeve, carries along the cylinder, and permits it to descend in measure as the work advances. The weight of the iron plate alone causes the descent

of the knife. The sleeve is held in the axis by a movable guide sliding in three uprights of U-iron, forming the frame of the apparatus. In order to facilitate the boring of the stone, some fine granules of tempered steel and some water are thrown from time to time into the groove of the drill.

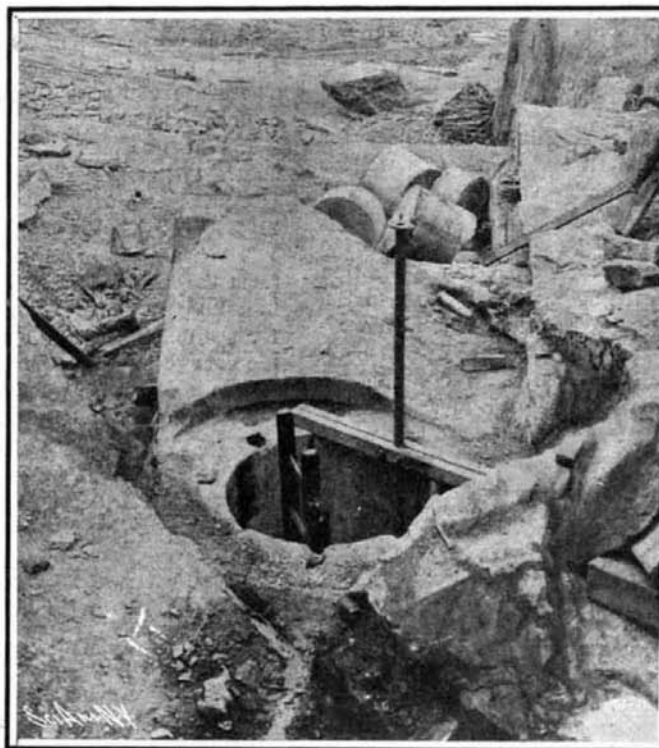
As the entire apparatus has to be often shifted, the motor is in no wise sheltered, and so it is of the hermetic type. It is from 20 to 25 horse-power.

When the operation of boring is finished and it is a question of removing the cylinder and the internal core, a hand windlass fixed to one of the uprights of the frame is employed. This windlass takes the cylinder by the upper part, while as for the core, a hook is first inserted therein, after which it is broken by driving wedges into the groove formed in the drill.

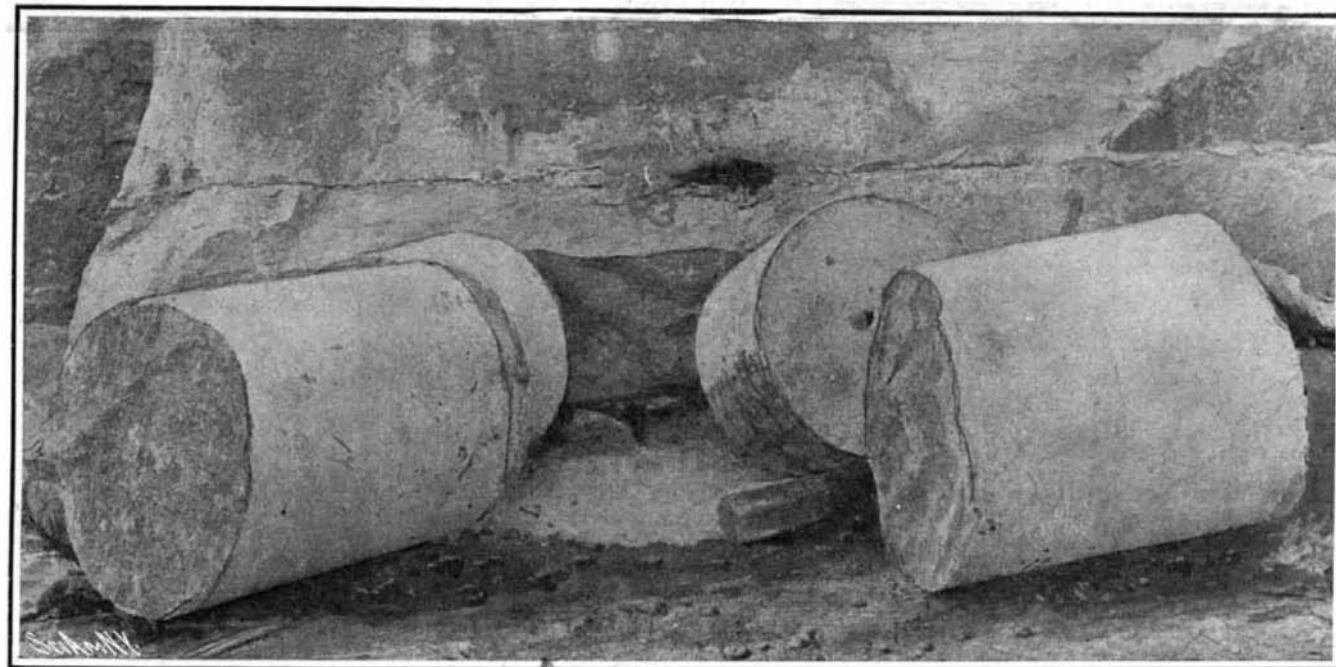
When it is desired to bore deep holes, a second cylinder of 140 inches diameter may be superposed; and sometimes even a third and fourth are added. In this way shafts of 50 feet in depth have been sunk. As a



The Circular Cutter at Work.



Pits Dug by the Circular Cutter.



Portions of a Granite Core Extracted by Circular Cutting.

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general thing, however, the boring is not done to a depth of more than 25 or 35 feet.

The advance of the work varies greatly with the hardness of the stone. At the Hainaut quarries (Belgium) where blue-stone is extracted, the above-named establishment has installed a type of drill capable of driving a 13-foot shaft in ten hours.

A Seven-Ton Pump as Evidence of Patentability.

Sometimes the rigors of Patent Office procedure are not without their humorous side. A New York attorney filed an application for improvements in a centrifugal pump. The Patent Office declared the invention inoperative and demanded a working model. The Patent Office was requested to send an examiner to Trenton to inspect the machine in actual operation. But this the Patent Office refused to do. The attorney, therefore, politely sent a seven-ton pump to the Patent Office—sent it, moreover, from Trenton to satisfy a skeptical examiner. Twenty-one men were required to get it into the examiner's office.

ARTISTIC FRENCH TAXIDERMISTRY.

BY JACQUES ROYER.

Time was when museums of natural history were filled with stuffed animals, mounted in stiff, unnatural attitudes, veritable caricatures of the creatures which they professed to represent. It was deemed sufficient to rub skins with arsenical soap and stuff them with hay or tow, and Agassiz was justified in writing: "Stuffing a skin is equivalent to destroying it."

The taxidermist of to-day, on the contrary, takes great care to preserve the appearance of life and to mount single animals and groups with all possible realism.

Artistic taxidermy had its beginning some twenty years ago when Jules Vernaux mounted a group of lions attacking an Arab courier, which created a great sensation. Soon afterward, Mr. William T. Hornaday, who had been sent by a great London firm to the East Indies to study the orang-outang in its native forests and to collect skins and skeletons, determined to re-

produce some of the curious scenes that his pencil had caught. On his return he composed a masterpiece which was purchased by the American Museum of Natural History in New York. It represents two male orangs fighting for the possession of a young female that is shown fleeing from her nest in a treetop, with her baby clasped to her breast. One of the rivals has overpowered the other and is biting his hand. The face of the vanquished combatant is distorted with rage and pain. Several simian spectators awakened by the fray, are viewing the scene from their arborescent homes. The group is a sculptural monument worthy of Barge or Frémiet.

French taxidermists soon followed the example of Vernaux and his successors, notably Hornaday, Ward, and Dyche.

The old absurdities were abandoned and the art has now reached a high degree of perfection in France.

The tools of the taxidermist are simple. They comprise sharp scalpels, dissect-

ing pincers, mallets, saws, files, scissors, awls or large needles for sewing, steel punches for perforating bones and claws, bristle brushes for applying antiseptics, badger brushes for arranging fur and feathers, and iron wires of various sizes for supporting the specimens and attaching them to their pedestals.

In preparing a large animal, like a tiger, for mounting, the flesh is carefully dissected away and the bones are cleaned. Next, the skin is freed from adhering fat by scraping with a thin-bladed knife and rubbing with plaster. It is then soaked in an antiseptic bath (usually a solution of alum and common salt) which prevents the falling of the hair and the development of injurious insects.

Skins of small animals, such as rats and squirrels, are coated inside with arsenical soap—a mixture of white soap with arsenic, camphor, and potassium bitartrate, which was invented by the pharmacist Becquer.

These manipulations, which vary somewhat according to the nature of the subject (mammal, bird, fish, or reptile) constitute, so to speak, the manual and me-

chanical part of taxidermy. The artistic part is the mounting.

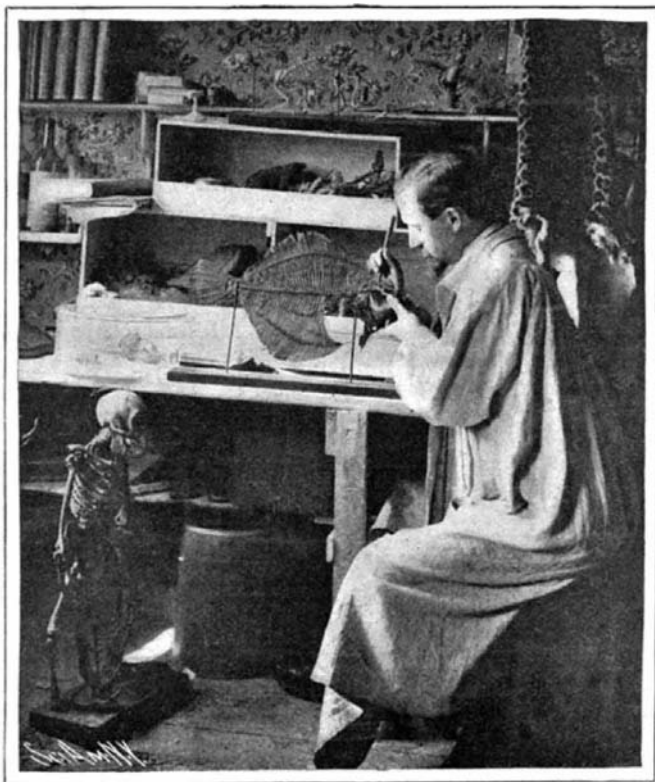
The taxidermist first selects the wires which are to form the framework and support of the specimen. These are passed along the bones, and the legs, thighs, trunk, and neck are then stuffed successively. Cotton is used for small birds; tow, hay, or straw, for wolves, deer, horses, and other large quadrupeds.

skull and jaws with forms made of paper, which make it possible to imitate nature to perfection and more expeditiously than could be done with tow, especially for heads of skins which are to be displayed flat, or used as rugs.

Such artificial heads for common animals, including dogs, cats, wolves, foxes, deer, bears, tigers, and lions, are made in great numbers in a factory at St. Maur,

species. Tongues are made in a similar way and are colored by young apprentices. The parts having been finished with the file, polished and assembled, a decorator gives the finishing touch by applying the proper colors to the nostrils and the tip of the muzzle.

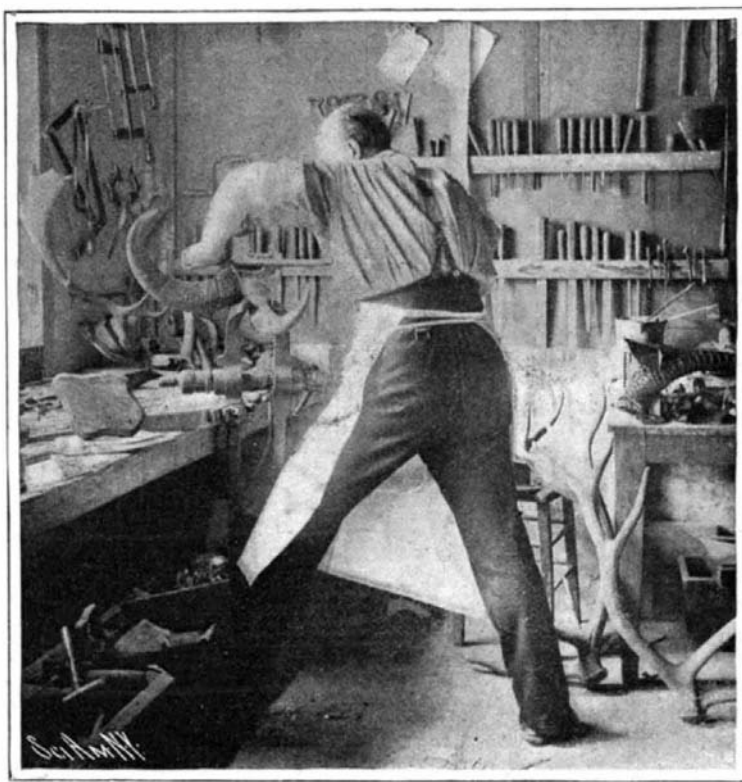
The taxidermist buys these factory-made heads and puts on each the proper sterilized and wetted skin which he secures by a row of small tacks extending



Dissection of a Flat-Fish.



A Stuffed Snake.



Preparing Horns for Mounting.



Making Teeth and Jaws.



Coloring Artificial Tongues.



Painting the Paper Heads.



A Naturalist "Pairing" Artificial Eyes.

ARTISTIC FRENCH TAXIDERMISTRY.

The openings in the skin are now sewn up with strong waxed thread and the hair is combed over the sutures. Parts which are too prominent are flattened with the mallet and sunken parts raised by inserting an awl and using it as a lever. After all this the animal must be arranged in a natural attitude.

Modern French taxidermists prefer to replace the

near Paris, in the following manner: A plaster mold of the natural skull is lined with several sheets of paper, applied one by one and fastened together with glue. This paper cast, after drying, is very hard and tough. This work is done by women, and other women cast, in leaden molds, composition jaws with teeth, which exactly imitate the dentition of the various

from the nose to the top of the head. Then he seizes the skin with pincers and stretches it over the cheeks, fastening it with more tacks. All these tacks are removed after the skin has become dry, but a row of nails inserted around the throat is allowed to remain. After drying, too, the head is combed and brushed and the painted parts are retouched, if necessary. Next,

the eye sockets are filled with wet tow in order to soften the lids. On the following day the tow is removed and the eyelids rounded. Glue is then applied to the interior of the eye sockets and glass eyes are inserted—yellow, blue, red, brown, or black, with round or oval pupils, according to the species. As commercial glass eyes made for the same species often vary in size, they must be carefully measured and assorted into pairs of eyes as nearly alike as possible.

The preparation of birds is less difficult than that of mammals, but the preservation of their brilliant colors necessitates certain precautions. If stained with blood they are first washed with soap and water, dried with a fine towel, and dusted with plaster. When this has hardened it is removed, and the operation is repeated until the feathers have regained their original luster. Bird lime is removed by rubbing with olive oil or fresh butter, scraping with the scalpel, washing successively with strong potash lye and pure water and drying with fine plaster. The removal of grease exuding from wounds demands still greater care. Several methods are given in technical works. The best, according to Boitard, consists in brushing the spot lightly with turpentine and washing it successively with potash, alcohol, and water. If all this fails, the damaged feathers must be replaced by feathers taken from another bird of the same species.

The cleaning finished, the bird must next be carefully measured before skinning, in order to preserve the correct proportions in the mounted specimens.

In France, the incision needed for skinning is made along the median line, from the gullet to the abdomen. The skin is detached with the scalpel, scraped to remove grease and bits of flesh, and brushed inside with arsenical preservative.

After it has received a skeleton, consisting of a wire running from the head to the tail, with branches for the wings and legs, the skin is stuffed, beginning with the neck. The bird is now said to be "*en peau*," or "in its skin." If not mounted at once it is wrapped in paper to protect it from insects, dampness, and, as far as possible, desiccation. If it is kept for several months it must be softened before mounting, in order that it may be posed effectively, with wings raised, tail spread, etc. Whatever the attitude chosen it is maintained by linen bandages until the specimen has become quite dry.

The bills of some birds, notably the immense bill of the great toucan, fade slightly after death and must be retouched. The same applies to the brightly colored feet of certain species.

Snakes are usually extracted from their entire skins through the throat, but first, if the species is venomous, the fangs are drawn and the poison glands are seized with pincers and cut off with scissors as close to the jaw as possible. Sometimes it is necessary to make an incision a few inches long in the belly in order to remove all the flesh and viscera. After the skin has been treated with preservative it receives a spine made of wire wrapped with tow and is then stuffed, sewn up, and bent into the form desired. It is next washed with water or alcohol, dried with a towel and freshened by brushing with turpentine. After receiving glass eyes, wax poison glands, artificial fangs, and a coat of varnish it is ready for exhibition. Lizards are prepared in a similar manner.

Large fishes, such as the shark and the dogfish, are also treated in nearly the same way. Few small fishes are mounted in France, because there is at present no known method of preserving the brilliancy of their metallic colors. French taxidermists, therefore, prefer to preserve such specimens in alcohol or to prepare and mount their skeletons, which they do with rare skill.

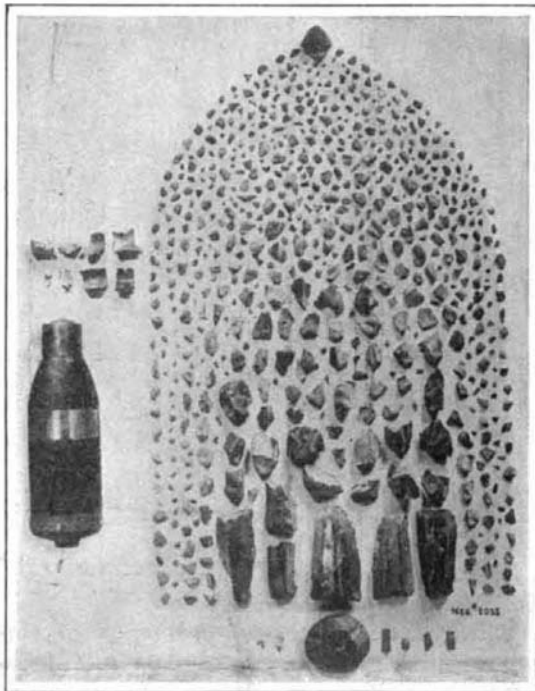
Such, in brief, are the methods now employed in French taxidermy, which tends more and more to become a highly artistic science.

What is said to be the highest dam in the world has been built on the Salt River, Arizona, and will submerge and completely obliterate the town of Roosevelt. The work is well under way, and it is expected, says the Iron Age, that by 1908 the town will be 172 feet below the surface of the water. It is expected that the head obtained will be the means of securing abundant power. A temporary power plant, a cement

mill, ice plant, lighting plant, and saw mill have been completed. A telephone line has been installed to the head works of the power canal, 18 miles above Roosevelt, and extended in the other direction to the site of the great dam, which is 30 miles from Phoenix.

NEW TYPE OF ARMOR-PIERCING SHELL.

We show illustrations of a new type of armor-piercing shell which was tried recently at the proving grounds of the Bethlehem Steel Company, makers of the shell, and gave remarkably good results. The problem confronting the manufacturer is to make a shell and fuse which will penetrate modern face-hardened armor, and burst after it has passed through the armor and is within the ship or fortification, as the case may be. Three elements enter into this problem. First, to protect the head of the shell while it is forcing its way through the intensely hard, carbonized surface of the plate, and prevent it being shattered into fragments; secondly, to provide sufficient strength in the walls of the body of the shell to prevent their collapsing or crumpling up under the momentum of the after body of the shell; thirdly, to provide a fuse which will automatically delay its action until the shell is just clear of the plate and explode the charge at the critical moment, scattering the fragments



The Capped 6-Inch Shell Penetrated a 6-Inch Hard-Faced Krupp Plate and Burst About Six Feet Behind It. About 650 Fragments, Including Shell, Cap, Copper Band, and Fuse, Were Recovered.



The 6-Inch Capped, Ribbed-Cavity Shell Which Was Loaded with Black Powder and Exploded Six Feet Behind a 6-Inch Kruppized Plate.

NEW TYPE OF ARMOR-PIERCING SHELL.

among the crew and upon the light interior structure and mechanism of the ship or fort.

The lower photograph shows longitudinal and transverse sections through a 6-inch armor-piercing shell of the new type above referred to. It will be seen that instead of a circular cross section the interior wall has a ribbed outline. The ribbed form is adopted because of the belief that these shells are stronger for penetration and better able to withstand deformation or complete breaking up. The upper photograph represents 650 fragments, including shell, cap, copper band, and fuse, which were recovered from a 6-inch capped armor-piercing ribbed cavity shell loaded with black powder after it had passed through a 6-inch Krupp plate and burst about 6 feet to the rear of it. The original weight of the shell empty was 102½ pounds. The total weight of recovered fragments was 943-16 pounds. The weight of the largest fragment recovered was 10¼ pounds, and the average weight of the fragments was 25-16 ounces. We are informed by Mr. John F. Meigs, to whom we are indebted for our information and photographs, that not only have the ribbed projectiles proved better able to withstand the heavy end-on pressure, but the number of fragments into which the shell is burst is greater than when the shell cavity is circular.

A PUZZLING BIT OF FOUNDRY WORK.

BY C. METCALF.

The job foundryman, whose work is usually of the most varied sort, occasionally meets with a particularly knotty problem. A case in point is illustrated in the accompanying engraving, which is a photograph of a double, grooved drum, recently made by the Metcalf Iron Works in South Brooklyn. It measures 5 feet 6 inches on the larger diameter, 4 feet on the smaller diameter, and is 4 feet 9 inches deep. The drawings and specifications for the drum were rather meager, but the work did not promise any special difficulties. However, the apparently simple drum proved to be much more troublesome than we had imagined it. This was due to the fact that a connecting groove was required between the two drum faces, also that a deep flange was necessary at each side of the groove to prevent the cable from slipping off when winding from one drum face to the other. No patterns for the drum were supplied, and the only thing we had to work from was a single blue-print. Our method of procedure is illustrated by the accompanying engraving, which is really a composite view showing at the left half a section of the mold after being struck up, and at the right half the sweeps used in forming the mold. The process of loam molding, while common among foundrymen, may not be familiar to many of the readers of the SCIENTIFIC AMERICAN, and may, therefore, need a somewhat detailed description.

First a spindle plate was laid and a "transient" or removable spindle mounted to turn in a bearing in this plate. A board or sweep was secured to the spindle by means of a strap, and the spindle was then revolved so as to sweep up a bed for the bottom plate. On this plate the brickwork was built. The sweep 1, shown by broken lines in the engraving, was now used for striking up a bearing for the lifting ring. This sweep was fastened to the board 2, which was later used to strike up the recess for the lower flange of the drum. A "crab-iron" was laid over this flange, and the brickwork was carried up to the height of the second flange of the drum. This brickwork was well plastered with

wet loam and then the board 3 was used to sweep up the belt face of the drum as well as the upper flange and the bearing of the next plate. The sweep 3 was now removed and sweep 4 was secured to the spindle. The outer edge of this sweep was cut, as shown in the engraving, to form the spiral groove called for in this portion of the drum. This edge was protected while building up the brickwork, by means of a strip of wood bolted to the sweep and overlapping it a fraction of an inch. The overlapping strip served as a gage for laying the bricks at the proper distance from the sweep. After the bricks had been well plastered with loam the protecting strip was removed, the set screws fastening the straps to the spindle were loosened to permit axial movement of the spindle, and the sweep was supported by a "finger" bolted thereto, and resting on a spiral thread or worm formed on a sleeve which was secured to the spindle. The sweep 4 was now revolved about the stationary spindle and was caused by the worm to follow a spiral course, forming in a single turn the entire spiral groove of the smaller drum face.

The process followed thus far is not unusual among foundrymen. It was the next step that called for originality. The connecting groove leading to the larger drum required not only a spiral thread, but a scroll or snail to carry it from the smaller diameter out to the larger one. A snail cam was therefore made of the form shown in the photograph. On the edge of this cam a thread was formed of the same pitch as that of the worm, namely, 2½ inches. The layout of this thread was in itself quite a difficult task. The cam was made of wood, and the thread was smoothed up with a little oil and lead. Board No. 5 was now set to engage this cam 6, which was secured at the desired position on the spindle. The board was attached to a pair of straps by means of bolts adapted to slide in slots in these straps. This permitted the outward movement of the board, while the straps were free to slide on the spindle to allow for the necessary axial movement. A single turn on the stationary cam carried the sweep up to the position shown by dotted lines, thus completing the connecting groove. To insure easy working of this sweep a rope was tied to the outer end of the upper strap and fastened to a collar at the top of the spindle so as to support the