PATTON'S IMPROVED MEAT CHOPPER.

The principal peculiarity in this meat chopper is the movement by which the knife is made to strike in a different position at each stroke. This movement is ingenious yet simple, and only operates when the knife is raised to its highest position.

The knife is caused to reciprocate by a pitman connecting the fly wheel with a collar, A, placed just below the ratchet wheel at the top of the shaft which carries the knife, this shaft turning freely in the collar when not otherwise held.

The pitman extends upward from the collar, A, its upper end carrying a pawl pivoted to the pitman at B, and caused to act positively and surely by the rubber spring, C. D is a spring pawl which works into teeth cut in the perimeter of the ratchet wheel, and holds it from turning except as it is actuated by the pawl pivoted at B.

The oscillation of the lower part of the pitman past the middle vertical axis running through the pivot, A, causes the upper part to oscillate in the opposite direction, and thus operates the pawl, causing the knife to make its stroke in different positions successively.

Patented December 19, 1871. For further information address Joseph R. Piper, Harrisburgh, Pa.

Machine Forged Horse Shoe Nails.

A correspondent of the *Commercial Bulletin* has paid a visit to S. S. Putnam & Co.'s nail works, at Dorchester, Mass., which he describes as follows:

Here was a busy scene, and the utmost life and activity prevailed in every department. Between 180 and 200 hands are employed on all the different kinds of work, and more than 1,000 tuns of horse shoe nails are annually made in this factory, from the best Norway and Swedish iron, which are sold all throughout the country. The business was established in 1855. The nail factory is 260x60 feet, of both stone and brick, and the machine shop is 100x50 feet. Two steam engines, one 200 horse and the other 20 horse power, propel the machinery, three Harrison boilers are kept in constant use, and the continual clang of 100 nail machines is sufficient to almost deafen the inexperienced visitor. The monthly pay roll reaches between $8,000 and $10,000. The men work "by the pound," and earn from $2 to $5 per day.

Horse nails, from time immemorial, have been made by hand, forged out on the anvil by blacksmiths. In many parts of Europe, whole villages are devoted to this branch of business. The bundle of iron rods is secured by the head of the family, who takes it to his home; and, with the assistance of his wife and children, it is made into horse nails, and the product returned to the capitalist, generally at a depreciation of 25 per cent for waste. For many years these nails found a ready market in this country, under various brands or marks, like "G" or "A" horse nails, as they could be imported at a less cost than our own blacksmiths could make them. Of late years, however, much attention and capital has been devoted to their manufacture by machinery, and Yankee ingenuity has devised various methods to produce a nail equally as good as those made by hand.

Machines have been made, from time to time, to cut the nail from sheets or plates of iron, either hot or cold, but it has been found impossible to produce a nail so compact, firm, tough and strong, as can be made by hammering out on the anvil, whereby the grain of the iron is compacted, refined, and made more ductile and tenacious; although many nails of the former description have come into general use. Some few years since, Mr. S. S. Putnam, of Neponset, conceived the idea of forging horse nails by machinery from the red hot rod, and devoted much time and money to perfecting a machine which would make a nail equal, if not superior, to those made by hand. This invention has proved a success; prejudice and difficulties have been overcome, and nails made by this machine are now in general use all over the country.

Fight between a Cobra and a Mongoose.

The snake was a large cobra, 4 ft. 10½ inches in length, the most formidable cobra I have seen. He was turned into an enclosed outer room, or verandah, about 20 ft. by 12 ft., and at once coiled himself up, with head erect, about ten or twelve inches from the ground, and began to hiss loudly. The mongoose was a small one of its kind, very tame and quiet, but exceedingly active.

When the mongoose was put into the rectangle, it seemed scarcely to notice the cobra; but the latter, on the contrary, and, putting down its head, tried hard to escape, and kept itself in a corner. The mongoose then went up to it and drew it out, by snapping at its tail, and when it was out, began to bite its body, while the cobra kept turning round and round, striking desperately at the mongoose, but in vain.

When this had continued for some time, the mongoose came at length right in front of the cobra and, after some dodging and fencing, when the cobra was in the act of striking, or rather, ready to strike out, the mongoose, to the surprise of all, made a sudden spring at the cobra, and bit it in the inside of the upper jaw, about the fang, and instantly jumped back again. Blood flowed in large drops from the mouth of the cobra, and it seemed much weakened. It was easy now to see how the fight would end, as the mongoose became more eager for the struggle. It continued to bite the body of the cobra, going round it as before, and soon came again in front, and bit it a second time in the upper jaw, when more blood flowed. This continued for some time, until at last, the cobra being very weak, the mongoose caught its upper jaw firmly, and holding down its head, began to crunch it. The cobra, however, being a very strong one, often got up again, and tried feebly to strike the mongoose; but the latter now bit its head and body as it pleased; and when the cobra became motionless and dead, the mongoose left it, and ran to the jungle.

appeared at once to recognize its enemy. It became excited, and no longer seemed to pay any attention to the bystanders, but kept constantly looking at the mongoose. The mongoose began to go round and round the enclosure, occasionally venturing up to the cobra, apparently quite unconcerned.

Some eggs being laid on the ground, it rolled them near the cobra, and began to suck them. Occasionally it left the eggs, and went up to the cobra, within an inch of its neck, as the latter reared up; but when the cobra struck out, the mongoose was away with extraordinary activity.

At length, the mongoose began to bite the cobra's tail, and it looked as if the fight would commence in earnest. Neither, however, seemed anxious for close quarters, so the enclosure was narrowed.

The mongoose then began to give the cobra some very severe bites; but the cobra, after some fencing, forced the mongoose into a corner, and struck it with full strength on the upper part of the hind leg. We were sorry for the mongoose, as but for the enclosure it would have escaped. It was clear that, on open ground, the cobra could not have bitten it at all; while it was the policy of the mongoose to exhaust the cobra before making a close attack. The bite of the cobra evidently caused the mongoose great pain, for it repeatedly stretched out its leg, and shook it, as if painful, for some minutes. The cobra seemed exhausted by its efforts,

The natives said that the mongoose went to the jungle to eat some leaves to cure itself. We did not wish to prevent it, and we expected it would die, as it was severely bitten.

In the evening, some hours after the fight, it returned, apparently quite well, and is now as well as ever. It follows either that the bite of a cobra is not fatal to a mongoose, or that a mongoose manages somehow to cure itself. I am not disposed to put aside altogether what so many intelligent natives positively assert.

This fight shows, at any rate, how these active little animals manage to kill poisonous snakes. On open ground a snake cannot strike them, whereas they can bite the body and tail of a snake, and wear it out before coming to close quarters. This mongoose did not seem to fear the cobra at all; whereas the cobra was evidently in great fear from the moment it saw the mongoose.—*R. Reid, in Nature.*

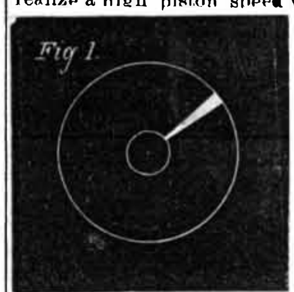
ROTARY ENGINES.

Rotative engines are those in which the energy of the steam produces the continuous rotation of a shaft through the medium of a crank and reciprocating piston. Rotary engines are those in which the continuous rotation of a shaft is caused by the action of steam on a piston or its equivalent continuously rotating within an annulus or steam tight casing. Reaction and impact engines—an example of the latter is furnished by Schiele's steam fan—are also sometimes classed as rotary engines. The rotary engine is a very old invention. One was designed, for example, by James Watt. The records of the Patent Office show that at least 200 separate schemes, for producing motion by the direct action of steam on a piston, have been patented at one time or another. We have no intention of describing any one of these engines, but we may refer such of our readers as are interested in the subject, to a very able and exhaustive review of the best of such inventions, which recently appeared in the shape of a series of papers in a French technical publication, "*La Propagation Industrielle.*" The object we have at present in view is simply to explain the principles which should guide inventors who direct their attention to the production of efficient rotary engines, and to point out the true nature of the advantages which would attend the use of such machines if perfectly successful.

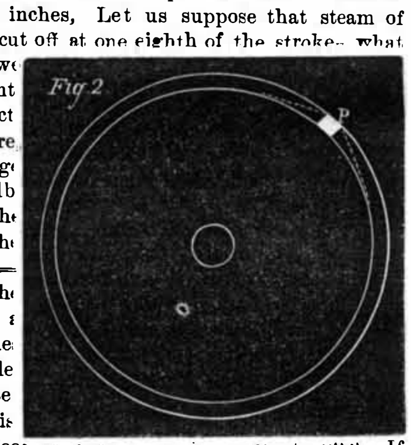
There are very few treatises on the steam engine in existence which do not contain an allusion to rotary engines, but the writers, one and all, take particular pains to warn inventors that nothing would be gained by the substitution of rotary for reciprocating rotative engines. This statement is perfectly true in one sense, but it is not wholly true. There is, practically, no loss of power as a consequence of reciprocation alone in the normal steam engine; and it is quite certain that no economical advantages would, within well defined limits, attend the use of rotary engines. But it can easily be demonstrated, on the other hand, that advantages could be derived from the use of a good rotary engine which would well repay the trouble, expense, and skill required to make it. The great point in favor of the rotary engine is that it will permit large measures of expansion to be used to the utmost possible advantage, simply because it places at our disposal a piston speed without any parallel in existing engines. This will become more apparent as we proceed. Strangely enough, it is a point which has hitherto been overlooked by all inventors.

To enter on a long exposition of the defects which exist in all the usual designs for rotary engines would only prove tedious; we therefore propose to explain here the principal features of a theoretically perfect engine, and to point out the difficulties which present themselves when we attempt to reduce this theory to practice. It remains to be seen whether the admirable workmanship of the present day will enable these difficulties to be overcome.

The principal feature in all rotary engines hitherto proposed consists of a piston or its equivalent rotating in a case, the piston being of a length equal or nearly equal to the radius of the circle which it describes in its revolution. The edges of this piston must be packed in some way to keep them tight. There are three edges to be packed; the fourth is made up by the shaft. But a moment's reflection is required to show that the nearer any portion of the packing is to the center the less rapid will be its wear. The consequence is that the packing nearest the edge suffers more than that nearest the shaft, and leakage very quickly ensues. Again, the piston area in such engines is very considerable. The center of effort is not far from the shaft, and any attempt to realize a high piston speed would entail a rapidity of rota-



ion which is inimical to the successful action of the abutment valve or its equivalent. A theoretically perfect rotary engine must have a very small piston, and the center of effort must be located as far as possible from the shaft. The two accompanying diagrams will make our meaning clear. Fig. 1 shows the old form of rotary engine; Fig. 2 shows that which we propose as being in theory infinitely superior. Let us suppose that the diameter of the outer ring in Fig. 2 is 10 feet, the diameter of the inner ring 9 feet 4 inches. The piston, P, will then be 4 inches deep, and let us further suppose that it is 2 feet wide, with semicircular ends. The area of such a piston will be in round numbers 86 square inches. Let us suppose that steam of 100 lb. pressure is cut off at one eighth of the stroke—what a stroke means we shall explain presently—and that, deducting back pressure the effective average pressure is 30 lb Then we have for the whole pressure on the piston 86 × 30 = 2,580 lb. Now, the circumference of a circle 9 feet 8 inches diameter—that described by the center of effort of the piston—measures 29 feet 3⅜ inches, or in decimals 29·3. If our engine makes sixty revolutions per minute, we shall have a piston speed of not less than 1,758 feet per minute, and



$$\frac{1758 \times 2580}{33000} = 137 \text{ H. P.}$$

Thus we have an engine occupying a little more space than the fly wheel alone of an ordinary 10 horse engine, which may nevertheless give out 140 indicated horse power with ease. Into questions connected with the arrangements required for packing such an engine and keeping the joints tight, we shall not now enter. We are dealing at present with principles, not with details. We shall, instead, proceed to examine a most important feature, namely, the means to be adopted in providing an abutment for the steam. In very many rotary engines of the old type, a simple flat-sided sliding valve is used as an abutment, and the consequence is a great loss of useful effort. Move this valve as quickly as we will, it is simply impossible to get it out of the way of the advancing piston and into position again behind the piston without leaving a very considerable space between the two. Even if we suppose the sliding abutment to have the same velocity as the piston, we find that it cannot, in such an engine as we have described, be completely closed until the piston has moved 4 inches away from it. This 4 inches represents clearance, and all clearance is waste in a rotary engine, because, unlike the reciprocating engine, there is in all rotary engines hitherto designed no compression. It is obvious that the abutment should not be withdrawn till the last moment, and that it should be replaced as quickly as possible. Suppose that the withdrawal and replacement are effected while the piston—including its own length—has moved over 2 feet; then as the piston is moving at the rate of, in round numbers, 30 feet per second, only the fifteenth part of a second will elapse while it is running over two feet; and it follows that a heavy mass of metal must be jerked out, brought to a dead stop, suffered to pause while the thickness of the piston is passing, and jerked in again through a distance of about 5 inches in the fifteenth part of one second, and this operation is to be repeated every second. We have no hesitation in saying that this is practically impossible.

But it is not impossible to contrive a form of abutment which shall be either a sliding valve or its equivalent, and