E. THOMAS.

BILLET MANIPULATOR FOR ROLLING MILLS.

APPLICATION FILED JAN. 31, 1918.

1,376,300.

Patented Apr. 26, 1921.

2 SHEETS—SHEET 1.

Fig. 1a

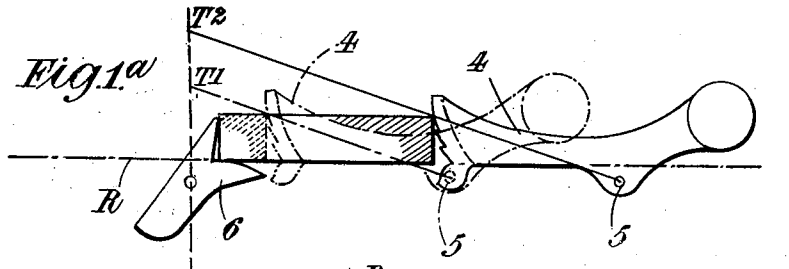


Fig. 1.

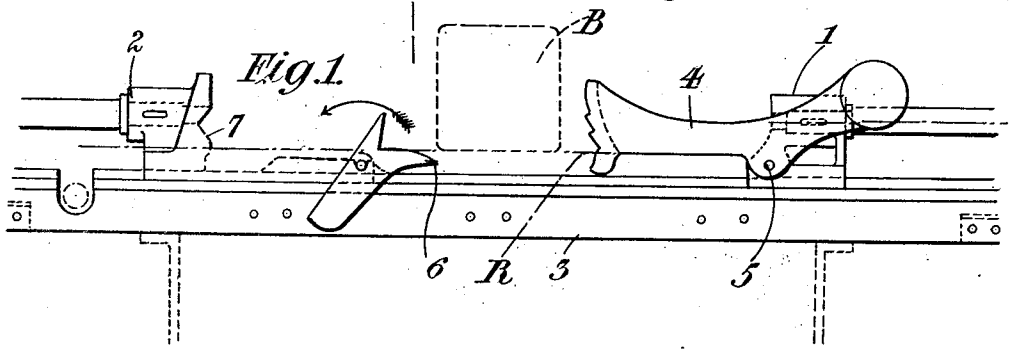


Fig. 2.

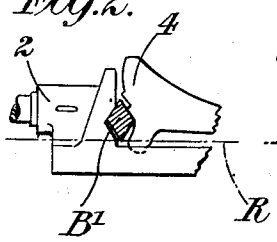


Fig. 3.

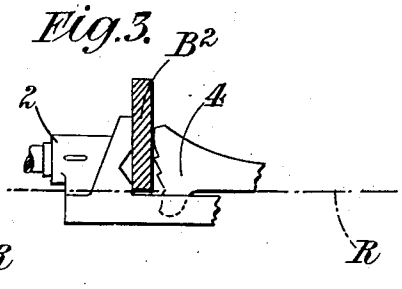


Fig. 4.

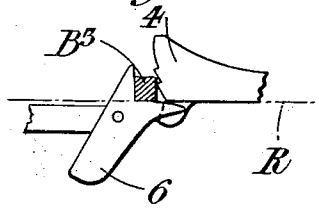
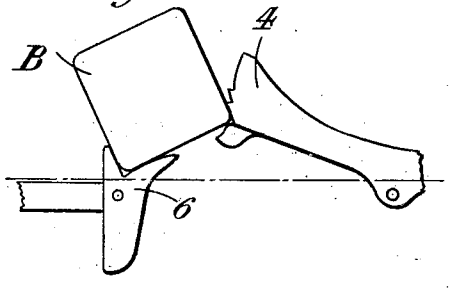


Fig. 5.



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2 SHEETS—SHEET 2.

Fig. 6.

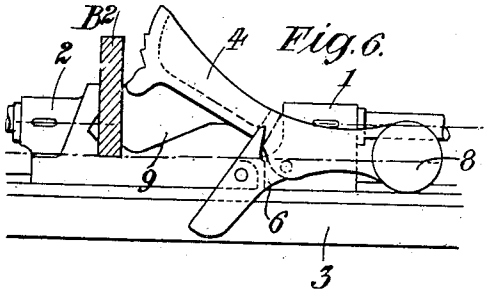


Fig. 7.

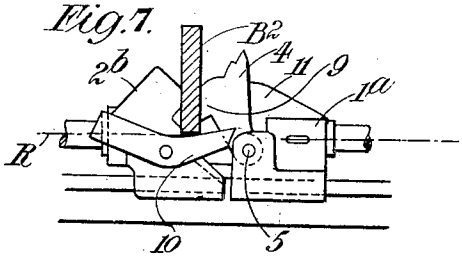


Fig. 8.

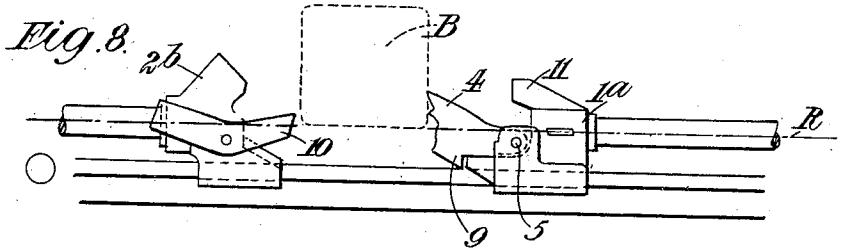


Fig. 9.

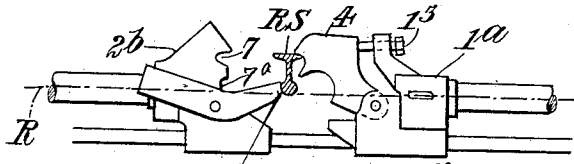


Fig. 9a.

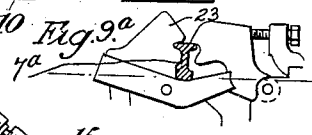


Fig. 10.

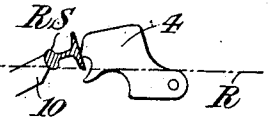


Fig. 11.

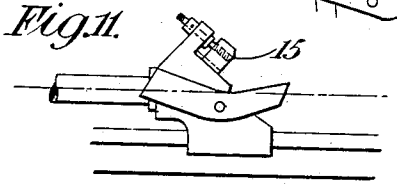


Fig. 12.

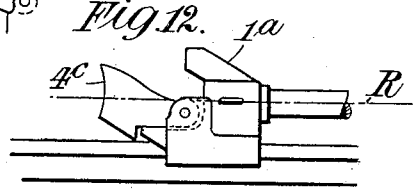


Fig. 14.

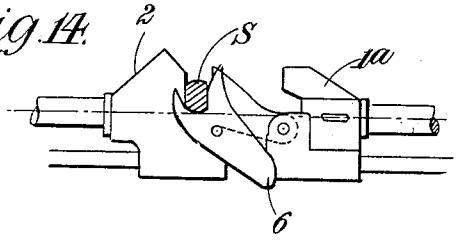
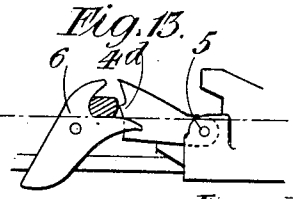


Fig. 13.



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UNITED STATES PATENT OFFICE.

EDGAR THOMAS, OF JARROW-ON-TYNE, ENGLAND.

BILLET-MANIPULATOR FOR ROLLING-MILLS.

1,376,300. Specification of Letters Patent. **Patented Apr. 26, 1921.**

Application filed January 31, 1918. Serial No. 214,747.

To all whom it may concern:

Be it known that I, EDGAR THOMAS, a subject of the King of England, residing at Jarrow-on-Tyne, in the county of Durham, England, have invented certain new and useful Improvements in Billet-Manipulators for Rolling Mills, of which the following is a specification.

This invention has for its object to provide improved apparatus for turning and otherwise moving ingots, blooms, slabs, billets and bars of various other cross-sections (hereinafter referred to as bars) in relation to the rolls of rolling mills.

The characteristic feature of apparatus constructed according to the present invention is that each "forehead" hereinafter referred to as being pivoted to the head of the machine is so shaped and so disposed that the turning movement of the forehead about its pivot, by which movement it effects the turning of the work, is effected automatically in the manner hereinafter described, solely by the reaction of the work against the thrust of the forehead against it.

The drawings herewith illustrate such apparatus as arranged for carrying out these operations. Like numbers and letters of reference indicate like parts in the various figures.

In these drawings—

Figure 1 is a side elevation of one construction of an apparatus according to the present invention;

Fig. 1ª is a diagram hereinafter referred to, to indicate the position of the line of thrust of the head in certain differing circumstances;

Figs. 2 and 3 are views of the head 2 which is a part of Fig. 1; they illustrate the manner in which the head is employed and are hereinafter more particularly referred to;

Figs. 4 and 5 are views of the tumbler 6 which is a part of Fig. 1; they illustrate the manner in which the tumbler 6 is employed and are hereinafter more particularly referred to;

Fig. 6 is a view similar to Fig. 1 to illustrate an alternative construction of forehead;

Fig. 7 is a view similar to Fig. 6 illustrating two other forms of head operating in conjunction;

Fig. 8 is a view of the parts shown in Fig. 7 but it shows them effecting a different operation as is hereinafter explained;

Fig. 9 shows in side elevation an apparatus comprising two heads modified to operate on a rail section;

Fig. 9ª shows the heads in engagement with the rail section.

Fig. 10 is a diagram showing parts of Fig. 9 about to begin to turn the rail;

Figs. 11, 12, 13 and 14 concern further alternative constructions of heads, hereinafter particularly described.

Apparatus according to this invention and exemplified by Fig. 1 comprises two heads 1 and 2, each head is slid along a guide plate 3 by hydraulic power or other suitable means, in a direction parallel with the rolls. A forehead 4 is pivoted to the head 1 at 5. The head 2 is provided with tumblers 6 which rotate through an angle of approximately 90 degrees in the direction of the curved arrow during the first movement of the turning operation. The head 2 and tumblers 6 tend to move the bar B in a horizontal direction (along side rails or tops of live rollers the level of which is indicated by the chain-line R) toward the head 1. The head 1 and forehead 4 tend to move the bar in a horizontal direction toward the head 2. When the bar is between and engaged by the tumblers 6 and forehead 4, and both heads act upon it simultaneously in opposite directions the bar is turned upon its own axis. Fig. 5 shows a large ingot (B) being thus turned. It is then moved horizontally by either head acting singly or both heads acting together as required, to the required position in relation to the rolls; or if a further turning movement is required and the bar has to be held so that the axes of its cross-section are in a certain position as with *e. g.* a bar of diamond, gothic, or rail section, the forehead 4 turns it up into the groove 7.

Fig. 2 shows a bar B^1 of diamond section held in this manner, the contact face of the forehead 4 being shaped to fit it. Fig. 3 shows a slab section B^2 held after it has been turned up on to its edge. Fig. 4 shows a small billet section B^3 in the situation it occupies in the tumbler 6 and in relation to the forehead 4 when the turning movement is about to begin.

The forehead 4, being pivoted at 5 at a level lower than that of the line of contact between the forehead and the smallest bar

to be turned, it follows that when the bar is pushed against the tumblers 6 or the fingers 10 hereinafter described, the bar is turned, the front of the forehead rising at the same time.

The construction and arrangement of the forehead in relation to the work on which it operates must be such according to this invention that (*a*) it can raise its head while pushing upon the work and (*b*) the line of its thrust when drawn from its pivot onward through the ingot, must not only pass above the fulcrum of 6 or whatever other fulcrum the work is to be turned about, whether the work is a large ingot or a small bar, but must also pass higher above the fulcrum or pivot when turning a wide bar than it would when turning a narrow bar of the same thickness, see Fig. 1^a, which indicates the position of two lines of thrust, T^1 for a narrow bar and T^2 for a wide bar, respectively, in relation to the pivot 5. To insure this result the pivot 5 must be placed at so low a level that the line of thrust will incline upwardly therefrom and from the level of the side rails or tops of the live rollers. through the point at which the forehead makes contact with the work.

The characteristic of this simple construction is that the action as between the forehead and the work operated upon (for instance an ingot) is, except for slip which may occur in the course of the operation, an action in which the contacting surfaces of the work and the forehead roll against one another with opposite senses of rotation, like the engaging surfaces of a pair of friction-gears, or like the two links of a toggle, *i. e.* the forehead does not clutch and follow the bar as in known types of manipulators, but rolling contact takes place between the forehead and the bar, the forehead rotating in a sense opposite to the sense in which the bar rotates.

The forehead 4 may have as in the construction illustrated in Fig. 6 an extension 9 which presents a vertical surface to the bar after the bar has been turned and the forehead is in its highest required position as shown in that figure; in this arrangement a balance weight 8 is employed which limits the upward movement of the forehead by coming into contact with the guide plate 3.

For certain bars, particularly long bars of small cross-section, fingers 10 (Fig. 7) of a known type may be used in addition to the tumblers 6 or the tumblers may be dispensed with and a known type of head used as shown at 2^b in Fig. 8.

Fig. 7 shows another modified form of head; it is numbered 1^a and is specially suitable to work in conjunction with a known type of head shown at 2^b in the same figure. In Fig. 7 also the forehead 4 is shown in its highest position after turning a bar B^2 but the balance weights of Fig. 6 are dispensed with, and the upward movement of the forehead is limited by an abutment-projection 11 on the head 1^a. Fig. 8 shows two opposing heads such as are illustrated in Fig. 7; in Fig. 8 they are seen in the position they occupy when they are about to begin to turn a bar. Figs. 9, 9^a and 10 show three positions of a construction wherein the heads are modified to suit a rail-section. In this modification the lift of the forehead 4 is limited by a set-pin 13, forming an abutment when the forehead is rocked into its upper position. In Fig. 10, the parts 4 and 10 are shown about to begin the operation of inverting a rail-section RS into the position in which it is seen in Fig. 9. During this operation the ends of the fingers 10 in contact with the head of the rail serve as abutments, so that when the heads are moved toward each other the rail is turned up on its head and held in the position shown in Fig. 9. The rail does not turn onward beyond this position for two reasons: first, because the heads 1^a and 2^b are stopped in their approach toward one another when they come sufficiently near to each other to have up-ended the rail; and, second, because the counterclockwise rotation of the cross section of the rail is then prevented by the nose of the part 4, which rests on the part of the rail RS, which is uppermost in Fig. 9, and which cannot rise beyond the position in which it is stopped by the pin 13, as it would have to do were the rail to be permitted to turn farther. If the rail is to be turned over from its position shown in Fig. 10 on its other side, however, then the motion of the heads will be continued until the fingers 10 push the head of the rail (that is that part of the rail which is lowermost in Fig. 9) so far toward the head 1^a out of its position shown in Fig. 9 that the rail will fall over on to its other side; in this case the screw 13 must be screwed a little to the right in Fig. 9 from the position it occupies in that figure, and thus it will permit a slight rise of the nose of the part 4 as the rail falls over.

If the fingers 10 become worn, or the rails vary in section, then, and only then, the fingers may be depressed by the thrust, which under the action of part 4 the rail will exert against them, in which event the heads must be moved to close together that the rail-head (that is the part of the cross section of the rail which is lowermost in Fig. 9^a) will not only be pushed into the lower part 7^a of the double groove in the head 2^b, but the final part of the movement of the forehead 4 to the left into the position it occupies in Fig. 9^a will then cause the rail-section RS to rotate counter-clockwise in this part 7^a of the groove about the

head of the rail as a pivot, and the forehead 4 will rise with the flanges of the rail by reason of the reaction of the rail against the forehead 4 until the rail stands on its head on the top of the side rails or live rolls R, with one side of its T-flange in the groove 7, as shown in Fig. 9ª. It will thus be appreciated that under normal working conditions the rail is held upended as shown in Fig. 9, with the heads 4 and 2ᵇ situated some distance apart, while should the fingers 10 be depressed by the rail, either by reason of the form of cross-section of the rail, that is thrust against them, or because they have become worn under excessive working conditions, then the rail may slide over the ends of the fingers in depressing them and will arrive into the position shown in Fig. 9ª, in which the heads clamp the rail between them, as above described.

The cavity in the head 2ᵇ may be adjustable in size and shape. Fig. 11 shows one arrangement for altering the cavity to suit various sizes of gothic or diamond sections, by means of a screw-adjusted sliding block 15.

Fig. 12 shows a forehead which is shaped as at 4ᵉ to be suitable for certain sections of material.

Fig. 13 shows a modified form of forehead face 4ᵈ and tumblers 6 for turning a section S used in rolling round bars, and

Fig. 14 shows how this section S is turned by the devices of Fig. 13.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a billet manipulator for rolling mills, the combination of sliding heads mounted for relative movement, means carried by one of said heads for engaging against the work and permitting the work to turn, and a pivoted forehead on the other head arranged to engage and be automatically reacted upon by its thrust against the work whereby said forehead may be oscillated and the work turned, substantially as described.

2. In a billet manipulator for rolling mills, the combination of two sliding heads, a forehead pivoted to one of said heads and adapted to engage and be reacted upon automatically by the work to swing said forehead and turn the work, and a tumbler for holding the work and upon which the work may be turned by said forehead, substantially as described.

3. In a billet manipulator for rolling mills, the combination of sliding heads, a tumbler associated with one head and about which the work may be turned, a forehead pivoted directly to the other head and arranged to come into contact with the work, the reaction produced by the thrust of said forehead against the work adapted to cause the forehead to be swung about its pivot and the work to be turned in said tumbler, substantially as described.

4. In a billet manipulator for rolling mills, the combination of heads capable of relative movement and adapted to hold a billet, and an oscillating forehead associated with one of said heads and adapted to engage against the work, the center of oscillation of said forehead being disposed below the lowest point of contact between the forehead and the work, substantially as described.

5. In a billet manipulator for rolling mills, the combination of slidable heads, means associated with one head and providing for the holding one side of the work while same is being turned, and a forehead associated and movable with the other head for engaging against the opposite side of the work and adapted to turn same, said forehead being pivoted below the line of contact between the forehead and work, the line of thrust produced on the work by said forehead passing above the center on which the work is turned, the contacting faces of forehead and work rolling against one another with opposite directions of rotation, substantially as described.

6. In a billet manipulator for rolling mills, the combination of heads, means on one head for engaging against one side of the work while permitting same to turn, a pivoted forehead carried by the other head and engaging against the opposite side of the work, the forehead pivot located below the point of contact between the work and forehead whereby to cause the swinging of both forehead and work, and faces on said forehead for receiving large and small work, substantially as described.

7. In a billet manipulator for rolling mills, the combination of heads movable toward and away from each other and adapted to hold the work therebetween, a forehead pivoted on one head for engaging with the work and adapted to be swung by the reaction of its thrust against the work whereby to also turn the latter, and an extension projecting beyond one end of the turning face of the forehead and having a vertical surface adapted to be presented to the work when the same has been turned on its edge, substantially as described.

8. In a billet manipulator for rolling mills, the combination of heads movable toward and away from one another, a forehead pivoted on one head and adapted to engage the work, the forehead arranged to be swung about its pivot by the reaction of its thrust against the work whereby to turn the work, and means whereby the swinging movement of said forehead may be limited, substantially as described.

9. In a billet manipulator for rolling mills, the combination of two sliding heads,

one head having a notch therein, and a forehead pivoted to the other head, which forehead is a single rigid unit pivoted near one of its ends directly to said other head and is adapted to be swung and turn the work when the heads are moved toward each other, said notch being arranged to receive one side of a bar of diamond or gothic section, said head being constructed to receive the other side of such bar, substantially as described.

In testimony whereof I affix my signature.

EDGAR THOMAS.

Witnesses:
N. RUSSELL,
A. CAMERON.