W. H. WARD.

Machine for Rolling Metal.

No. 103,397. Patented May 24, 1870.

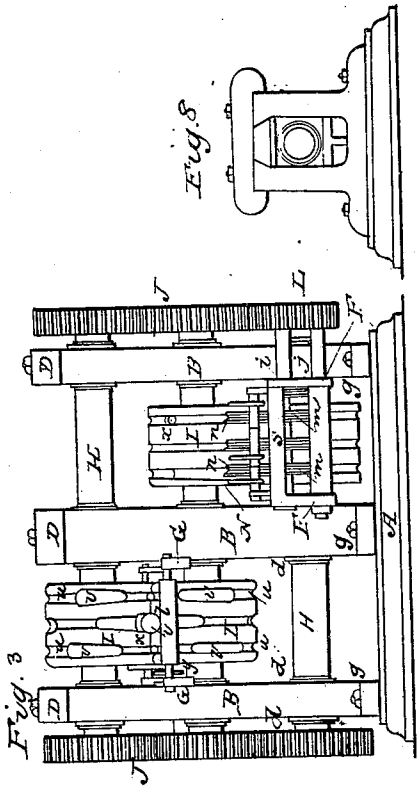

Fig. 3

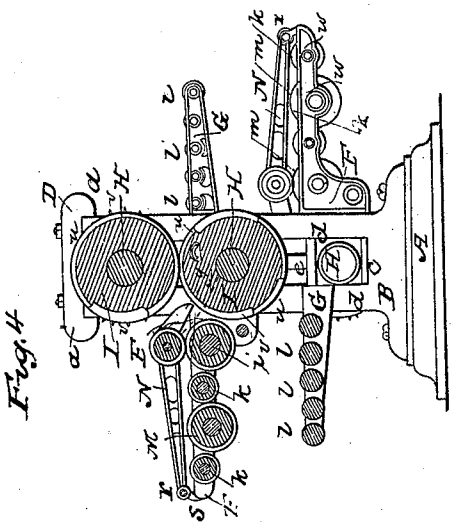

Fig. 4

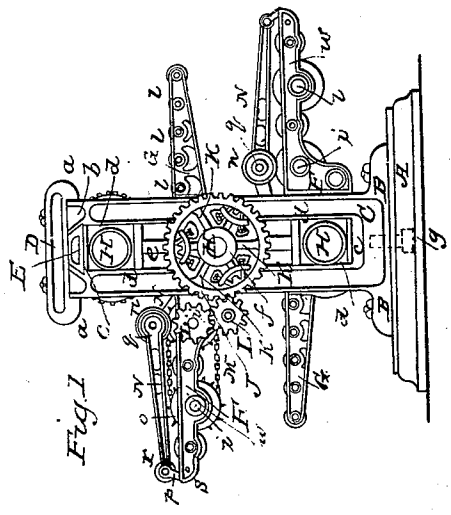

Fig. 1

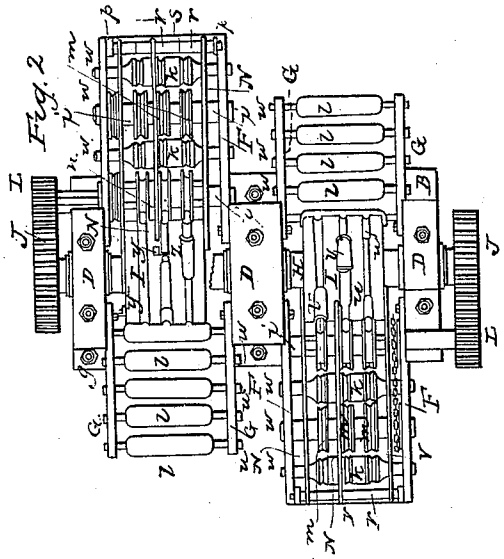

Fig. 2

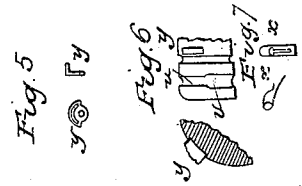

Fig. 5

Fig. 6

Fig. 7

Witnesses

A. L. Palmer

S. F. Adams

Inventor.

W. H. Ward.

UNITED STATES PATENT OFFICE.

WILLIAM H. WARD, OF AUBURN, NEW YORK.

IMPROVED MACHINE FOR ROLLING METALS.

Specification forming part of Letters Patent No. **103,397**, dated May 24, 1870; antedated May 14, 1870.

To all whom it may concern:

Be it known that I, WILLIAM H. WARD, of Auburn, in the county of Cayuga and State of New York, have invented certain new and useful Improvements in Automatic Feeding and Registering Rolling-Mills, for rolling axles, horseshoes, and other articles; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the accompanying drawings, which make part of this specification, and in which—

Figure 1 represents an elevation of a machine embracing my improvements, with the gear-wheels of the upper and lower rotary dies removed. Fig. 2 represents a plan or top view of the same. Fig. 3 represents a front elevation of the same. Fig. 4 represents a vertical transverse section through one pair of the rolling-dies, with their feeding and delivering rolls. Fig. 5 represents a side and edge view of one of the adjustable feed-lever lifters. Fig. 6 represents a portion of one of the rotary dies, showing the cut-off in the cavity thereof. Fig. 7 represents views of the adjustable stop, arranged in the groove of the die-roll. Fig. 8 represents an elevation of a pillow-block lock.

In the accompanying drawings, A represents the bed-plate; B, the side pieces or uprights of the frame, and D the tie-cap or pillow-block lock which constitutes the frame of the machine. The standards of the frame are provided with vertical openings to receive the division-stanchions *e*, between which the bearing-blocks *d*, for the journals of the rotary die-shafts H, are secured. The rotary dies I are arranged upon three horizontal parallel shafts, H, consisting of an intermediate, an upper, and a lower one. The intermediate shaft is provided with two or more die-rolls, I, while the upper and lower ones are provided with a single die-roll on opposite ends, excepting when more than two die-rolls are on the intermediate shaft; then these upper and lower shafts will require corresponding additional ones, so as to match in pairs with the rolls of the intermediate shaft in such a manner as will constitute pairs of die rolls upon the shafts, applicable for rotary compress rolling any article they may be constructed to produce.

The die-rolls thus arranged are of sufficient size to have formed upon their circumferences a number of cavities, *v*, sunk or cut therein, of different sizes and forms. The central one is considered the most suitable for the larger or bloom cavity, while the outer ones are more convenient for the different decreasing sizes.

The rollers are so adjusted that the dies of each pair will exactly coincide, as represented in Fig. 3.

The cavities *v* of each pair of rolls must, of course, be the exact shape of those of the other, and they are provided with separating-cutters *z*, Fig. 2, to cut off the articles under formation at the proper length.

Each end of the several shafts H projects beyond the frame, and is fitted with a gear-wheel, J, of uniform diameter, and matching one within the other, so as to impart to the die-rolls I an equal and uniform speed.

The die-rolls, arranged as before described, form duplicate and distinct sets, and enable the machine to have two operating or feeding front sides, and as many delivering-sides—that is to say, a receiving and a delivering side alike on opposite sides; because it will be seen that one pair of die-rolls turn in one direction on one side of the machine to receive the article to be formed, and in the opposite direction on the other side of the machine, thus constituting a double front.

In carrying out my invention, I arrange a feeding-table, F, upon a level, or thereabout, with the upper periphery of the intermediate die-rolls I, as represented in Fig. 4, on one side of the machine, and a delivering-table, G, on the same horizontal plane therewith, at the opposite side of the machine; and beneath this delivering-table G, I arrange another feeding-table, F, on a level, or thereabout, with the upper periphery of the lower die-rolls, and on the opposite side of the machine is placed a delivering-table, G, on the same horizontal plane therewith, beneath the feeding-table first described. These feeding-tables consist of horizontal side plates, F, bolted or otherwise secured to the upright side pieces, B, of the frame, extending parallel to each other therefrom, and united at their outer ends by a cross-bar, *s*. Between these side pieces I arrange a series of grooved feeding-rolls, *m*, secured upon horizontal shafts *i*, mounted in bearings

in the table-frame parallel to the axis of the die-rolls, in such manner as that their grooves will be exactly in a line, both horizontally and vertically, with the cavities of said die-rolls, as represented in Figs. 2, 3, and 4. One set of these grooved feeding-rolls *m* is arranged adjacent to the die-rolls I, while between them and the other set is arranged a set of grooved supporting-rolls, *k*, and another grooved supporting-roll is arranged on the front side of the outer set of feeding-rolls, *m*.

The supporting-rolls, having no motion except that imparted to them by the bar which is being operated on, aid in preventing said bar from being fed forward by the said feed-rolls with force enough to lift the stop-rolls before the proper time. The grooves of these supporting-rolls *k* are arranged in the same vertical line with the grooves of the feeding-rolls *m*, with their upper sides in the same horizontal plane as the grooves of said feeding-rolls, and they form intermediate supports to the bar while being carried forward by the feeding-rolls *m*. The feeding-rolls rotate continuously, and tend continuously to carry the blank forward to the die-rolls, irrespective of any particular point at which it should be received by the dies. To counteract this, and to permit the bar to be projected between the rolls at the proper time only, I arrange, in connection with the inner series of the feed-rolls *m*, grooved stop-wheels *n*, mounted upon the inner ends of hinged arms N, so that there will be one stop-wheel to each inner feed-roll resting upon the upper periphery of the said inner feed roll, which arrests the forward movement of the blank upon the feed-table. These arms N are hinged at their outer ends to a common axis, *r*, secured in studs *p* upon the outer cross-bar of the feeding-table F, while their inner ends are inclined downward from the axis *q* of the stop-wheels *n*, and the two outer arms embrace the sides of one of the intermediate die-rolls, as shown in Fig. 2, and the inclined end N′ of the intermediate arm extends to the periphery of said die-roll, as shown in Fig. 4. These arms N, with their stop-rolls, may be made to act from beneath the feed-table F by an upright coming up between the first feed and supporting roll from the rotary die, whereby the feed-table will be less encumbered, enabling the attendants to work with more freedom; but, in the present instance, they receive the action of lifting-plates *y*, Figs. 2, 3, and 4, made adjustable upon the die-rolls I with reference to the cavities therein, causing the ends of the said arms to lift at the proper moment, and allowing the blank to pass under the stop-wheels *n* and be received into the cavities *v* of the rotary compress forming-dies. These lifting-arms and stop-wheels thus constitute a series of automatic adjuncts to feed-rolls, operated by the die-rolls, and are applicable to die-rolls for rolling almost any standard article in general use, such as wagon and railway axles, harrow-teeth, horseshoes, hexagon-headed bolts, &c.

The rotation of the feed-rolls is, as has already been said, constant; but, after carrying the bar forward until the end of it strikes against the stop-wheel, they are powerless to carry it farther until the stop-wheel shall have been removed from its path; and their velocity is much greater than that of the die-rolls, in order that they may, the moment the stop-wheel is removed, suddenly and rapidly thrust the bar forward and cause it to overtake and abut against a stop, *x*, located within the cavities *v* of one of the die-rolls of each pair, which stop is made adjustable by means of a slot and set-screw, for the purpose of setting it in proper relation to the lifting-plates *y*, or equivalent devices, and, consequently, to the time of the forward thrust imparted to the bar by the feed-rolls on the removal of the stop-wheel.

The lifting-plates *y* are also made adjustable, and for the same purpose. Thus in a twofold manner I am enabled to regulate the several movements described, and to insure the deposition of the bar in the place designed for it in the die-groove with absolute certainty.

The axis of each feeding-roll *m* of the feeding-table is provided with a toothed wheel, *o*, of the exact diameter of the feeding-rolls, and they are connected together by means of a chain, M, Figs. 1 and 2, (or miter gearing may be substituted for the chain, if desirable,) so that their motion is uniform, and that of the feed-wheels rendered positive at the same speed. These feeding-rolls receive their motion from the driving-gear wheel of the intermediate rotary dies I by means of a pinion, L, on the projecting end of the shaft *i* of the inner series of feed-rolls, *m*, which matches with a pinion, L′, of equal diameter, which in turn matches with the driving-gear wheel of the said intermediate rotary die.

The feeding-rolls *m* of the lower feeding-table, F, receive their motion from the gear-wheel J of the lower die-roll by means of pinions similar to those just described; and, as the central gear-wheel is the driver, it is obvious that the several rotary dies receive motion from said driver in a fixed relationship as to speed with the feed-rolls.

In order that any irregularity in the working of the toothed cog or gear wheels J of the mill may with still greater certainty be prevented, as well as all backlash in their motion avoided, so that the dies I may revolve with a steady and exact motion to bring the several parts of their forming-cavities *v* in opposition to one another with an absolute degree of exactness, I prefer to employ gear-wheels of peculiar construction, having their hubs and arms fixed permanently to the shafts H of the rotary dies I, while their toothed rims are made adjustable thereon by means of adjusting-screws, for the purpose of compensating for the wear of the teeth by adjusting the rims of each wheel, so as to take up any wear or looseness between their teeth, and effectually prevent any lost motion or backlash; and, as these adjustable wheels J are placed upon the

opposite ends of the rotary die-shafts H, it is obvious that this adjustment can be accomplished so as to maintain a constant, steady, and regular motion of the dies I, that when the motor is started all the gear-wheels respond to it in perfect unison; but as this invention is the subject of a separate application for a patent, a further description of it here is deemed unnecessary.

The delivering-table G consists of a series of rolls, *l*, arranged parallel with the axes of the rotary dies upon which the blank is received after its passage through the dies in a position above the feeding-table of the lower pair of dies, so that the blank can be conveniently taken from the delivering-table and placed again upon the feeding-table below it.

The feeding-table F of the lower pair or rotary dies is of the same construction and arrangement of feed-rolls, supporting-rolls, stop-wheels, and hinged arms as that of the feeding-table first described, and is likewise provided on the opposite side of the die-rolls with a series of delivering-rolls, *l*, from which the article being formed is conveniently taken and placed again upon the first feed-table, to be passed through the die-rolls a second time, thereby constituting a double machine, with only two pairs of rolls, through one pair of which the article being formed passes to attendant No. 2, who causes it to pass back, through the lower pair of dies in another and still smaller cavity, to attendant No. 1, so as to give it another pressure, and remove any fin or joint imperfections, who then passes it back, through another and still smaller cavity, to attendant No. 2, and so on until the article is completed in the most perfect manner possible.

The die-cavities *v* are provided with cutters *z*, so as to cut off the surplus length of the article being formed as each decreasing cavity shall elongate it.

Instead of the adjustable stop *x* of the die-cavities, one of the walls thereof may constitute the stop, if desired.

Having described my invention, I claim—

1. The method herein described of insuring the deposition of the bar or blank in its proper place in the die-groove—that is to say, carrying the blank forward on feed-rolls continuously revolving at a speed greater than that of the die-rolls, temporarily arresting the forward movement of said blank by a stop interposed in its path, and securing the second forward movement of the blank up to and against a stop in the die-groove by the feed-rolls, in virtue of their superior velocity, and by adjustments of the mechanism so as to regulate and co-ordinate the times of arrest and of movements, all substantially as described.

2. The combination of the automatic stop-wheels *n* with the feeding-rolls *m* and die-rolls, substantially as before described.

3. The combination of the hinged arm N, and the automatic stop-wheels *n*, connected thereto, with the feeding-rolls *m* and adjustable lifting-plates *y*, arranged directly upon the die-rolls, substantially as before described.

4. A feeding-table composed of grooved rolls arranged parallel to the axis of the die-rolls, in combination with said die-rolls and with the automatic stop-wheels *n* and feeding-rolls *m*, substantially as before described.

5. The arrangement of the die-rolls I in sections, by placing two upon a central shaft and one upon the opposite ends of an upper and a lower shaft, and each receiving a positive motion from its gear-wheel, so as to match in pairs, as hereinbefore described.

W. H. WARD.

Witnesses:
J. N. STARIN,
THOS. TOWNE.