(No Model.) 2 Sheets—Sheet 1.

J. ROBERTSON.

ROLLING MILL.

No. 403,290. Patented May 14, 1889.

FIG. 2.

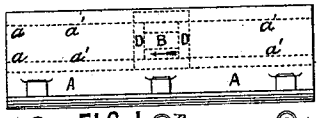


FIG. 3.

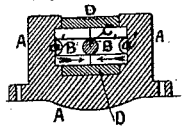


FIG. 11.

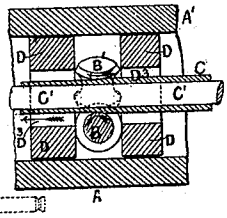


FIG. 1.

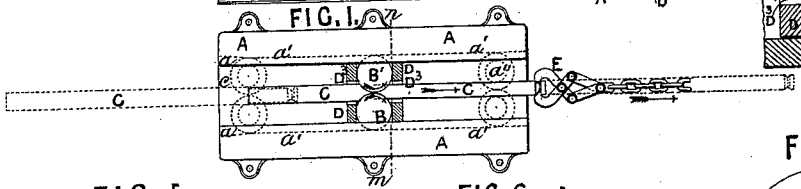


FIG. 12.

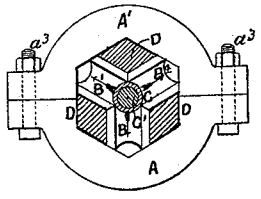


FIG. 5.

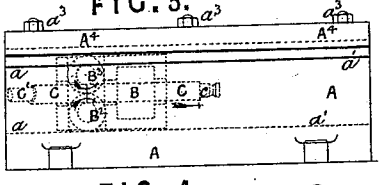


FIG. 6.

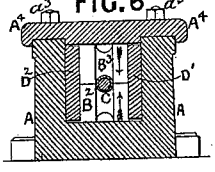


FIG. 4.

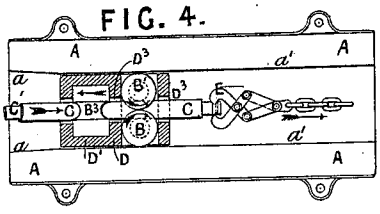


FIG. 7.

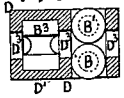


FIG. 8.

FIG. 13.

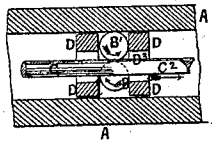


FIG. 14.

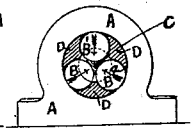


FIG. 9.

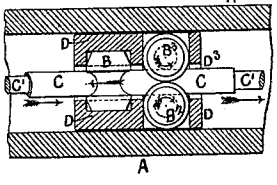
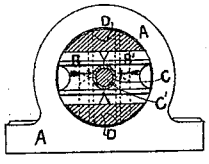


FIG. 10.



Witnesses:
John S. Parker
David S. Williams

Inventor
James Robertson
by his Attorneys Howson & Howson

(No Model.) 2 Sheets—Sheet 2.

J. ROBERTSON.

ROLLING MILL.

No. 403,290. Patented May 14, 1889.

Fig. 15.

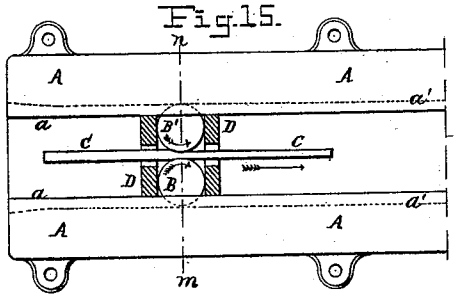


Fig. 16.

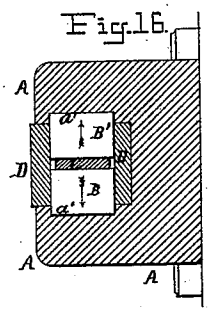


Fig. 17.

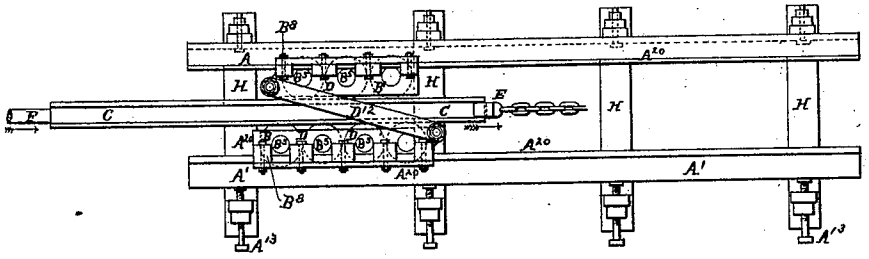


Fig. 18.

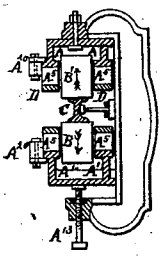


Fig. 19.

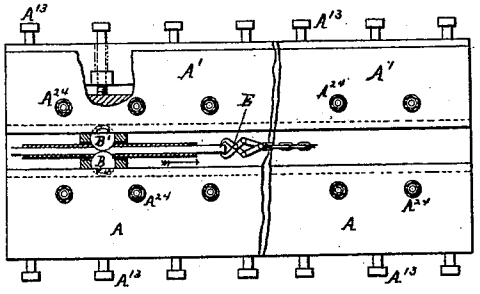
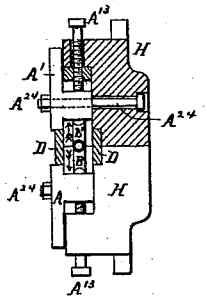


Fig. 20.



WITNESSES:

E. J. Griswold

George Baumann

INVENTOR

James Robertson

BY

Howson and Sons

his ATTORNEYS

UNITED STATES PATENT OFFICE.

JAMES ROBERTSON, OF BIRMINGHAM, COUNTY OF WARWICK, ENGLAND.

ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 403,290, dated May 14, 1889.

Application filed August 31, 1887. Serial No. 248,352. (No model.) Patented in England November 21, 1885, No. 14,290.

To all whom it may concern:

Be it known that I, JAMES ROBERTSON, a subject of the Queen of Great Britain and Ireland, and residing at 8 Newhall Street, Birmingham, in the county of Warwick, England, have invented certain Improved Constructions of Housings for Rolling, Drawing, and Pressing Mills and Machines, (for which English Patent No. 14,290, dated November 21, 1885, has been obtained,) of which the following is a specification.

My invention has reference to that class of mills and machines which are so far unique in their construction and action that they are composed of two or more strong rolls or rollers doing their work under great compression by rolling on the metal or other objective material passed between their circumferential surfaces for the various purposes of rolling, drawing, pressing, bending, and shaping the various metals into a great variety of shapes and forms, such as plate-bars, rods, wires, or tubes.

The object of my invention is to so construct such rolling appliances as to prevent or lessen the great loss of power usually experienced in such machines by the turning of the journals of the rolls in bush-bearings, and for this purpose I make use of a channel anti-frictional-roll housing in which the rolls traverse while the material is being forcibly pushed or pulled through between the rolls, as hereinafter described.

In the following description I will refer to the several figures in sequence without any preliminary geometrical description, in order as far as possible to avoid needless repetition in describing the various modifications shown.

Figure 1 is a plan, Fig. 2 a side elevation, and Fig. 3 an end sectional elevation, of a straight rectangular-channel anti-frictional-roll housing, A, and pair of rolls B and B′ without axes, and with a semicircular groove cut in each roll of my improved form, adapted for rolling and drawing out round metal rods and like articles. Each article is operated upon by drawing or pulling it through between the rolls B and B′ by a grasping-tongs, E, applied to its forward end, the tongs being attached to and actuated by the traversing chain of an ordinary draw-bench, as generally used for drawing tubes and rods. The rolls B and B′ are shown rolled on to mid-length through the channel-housing A, and the rod C half-length correspondingly pulled through the rolls, Fig. 3 showing the housing A in section through the line *m n* in Fig. 1 and giving a front view of the rolls B and B′, the roll-guide D being also shown in section in Fig. 3, and the object or rod C and grasping-tongs E being also shown in Fig. 1, thus showing the form of the rolls B and B′ and their guiding-piece D and rod C grasped between them. The front or roll-entering mouth end *a* of the channel-housing A is beveled out slightly wider than the joint diameters of the rolls B and B′ (shown by the dotted lines *a′ a′* of the channel in Fig. 1) to allow the rolls B and B′ to enter in freely into their containing-channel housing A and to allow the rod C or like article to be operated upon to be placed freely into the grooves in the rolls B and B′. From this beveled-out mouth *a*, which extends only inward about a distance equal to about one and a half times the diameter of the rolls B and B′, the channel-housing A, formed, by preference, of cast-iron or cast-steel, is planed out parallel throughout all the rest of its length, as shown by the sectional elevation of same in Fig. 3 and in plan, as indicated by the dotted lines *a′ a′*. On entering the rolls B and B′ with their guiding-piece D and rod C to be drawn, they are placed in the position in the housing A at its front entering end, *a*, in its beveled-out mouth, as indicated by the dotted lines *c*, (shown in Fig. 1.) When the rod C is drawn inward by the tongs E to a distance equal to about one-half the diameter of the rolls, the rolls B and B′ (rolling into the planed-out parallel channel *a′ a′*, which is planed out to the exact width of the joint diameters of the rolls) grasp with great force the billet C and roll it down by a semi-rolling-and-drawing action, the roll guide-piece D (shown also by dotted lines in elevation in Fig. 2) being shaped to slide freely in the channel of the housing to allow the rolls B and B′ to move round freely and retain the center of the rolls in direct cross-line to each other. When the rod C is half drawn through the rolls B and B′, as is shown in Fig. 1 and by dotted lines in Fig. 2, it is rolled into the center of the length of the housing, and when it is fully pulled through the rolls B and B′

the rolls and rod C assume the position at the exit end of the channel-housing A indicated by the dotted lines at a'', (shown in Fig. 1,) the motion and course of the rolls B and B′ and rod C being as indicated by the arrows, and the rod C, as shown by these dotted lines c, releases itself from the rolls B and B′, which thereafter, with their guiding-frame D, are again placed in the beveled-out entering-mouth a for a like fresh operation.

Fig. 4 is a plan, Fig. 5 a side external elevation, and Fig. 6 an end sectional elevation, of another and somewhat similar anti-frictional straight containing-roll housing, A, but adapted for two pairs of rolls, B and B′, to operate successively on the objective material, the object operated upon in this example being a tube, C, and shown drawn over a mandrel, C′, which is shown grasped by a pair of drawing-tongs, E. The channel roll-housing A has formed out at its entering end a tapering or inclined mouth on the bottom, and on its two sides, a, and is shown fitted with a strong cover, A^4, to the sides of the housing A, and secured to same by strong bolts a^3, this cover A^4 forming the abutting rolling-guide for the top roll of the after pair of rolls, B^2 and B^3. The channel-housing A in this modification is also planed out on its two sides in its entire length up to the taper entering beveled-out mouth a to the exact width of the two diameters of the front pair of rolls, B and B′, as described in connection with Figs. 1, 2, and 3. The bottom surface of the channel-housing A is also planed out, and the space left between the bottom of the channel-housing A and the internal planed surface of its cover, A^4, being equal to the exact joint diameters of the after pair of rolls, B^2 and B^3, and formed parallel throughout its length, thus forms a quadrilateral parallel containing-housing A for the two pairs of rolls B B′ B^2 B^3. To give room to the guide-frame D for holding each pair of rolls in center line to each other, both in the line of their axes and in their transverse or cross line, as also in the relative positions of the two pairs of rolls to each other, the rolls are formed somewhat shorter than their joint diameters to leave space for the containing sides D′ D^2 of the roll-guide piece D, which is planed on its four sides to slide freely and form an easy-working fit in the housing-channel A. This guide-piece D is cast or formed with two transverse recesses in it for each to contain a pair of rolls with their axes at right angles to each other, forming an easy-working fit. Fig. 7 is a sectional plan, and Fig. 8 a corresponding end section, of this roll-guide piece or frame D, the sectional plan, Fig. 7, showing the relative positions of each pair of rolls B B′ B^2 B^3, and the end elevation, Fig. 8, showing the positions of the forward pair of rolls, B and B′, and after pair of rolls, B^2 and B^3, by dotted lines to each other in the guide-piece D, and showing the hole D^3 in the frame for the passage of the tube C, and the mandrel C′ being operated upon, the motions on it and on the rolls being as indicated by the arrows placed on the same. The two pairs of rolls B B′ B^2 B^3, besides having a double rolling and drawing effect on the article being operated upon, by being placed with their axes at right angles have a correcting effect on each other in rolling such articles as rods or tubes to a round or other form, there being no lubrication necessarily required in drawing such articles as metal rods and tubes by these new and improved rolls and apparatus. Such articles as rods and tubes may be drawn in a hot as well as a cold state, and tubes may also be welded while being drawn. The motion on rolls B, B′, B^2, and B^3, the tube C, mandrel C′, and grasping-tongs E are all as indicated by the arrows, and the same letters of reference and numerals referring to like parts, as in Figs. 1, 2, and 3, need not be further described.

Instead of a rectangular straight containing-housing for the rolls and their guide, a round housing of a tubular form may be used, which is more easily constructed for such objective articles as metal rods and tubes, and is more easily constructed than the rectangular form of containing anti-frictional straight roll-housing last described.

Fig. 9 is a side sectional elevation shown broken off at both ends, and Fig. 10 is an end sectional elevation of a cylindrical tubular anti-frictional straight-channel housing A, shown with two pairs of rolls, B B′ and B^2 B^3, operating on a tube, C, with a mandrel, C′, inside the tube C. The two pairs of rolls B and B′ and B^2 B^3 are shown in their guide-piece D. The same letters of reference refer to like parts, and the motions are as indicated by the arrows.

Instead of two rolls acting together on objective material in a pair, as described in connection with Figs. 1 to 10, three or more rolls may be placed to roll on the objective material opposite each other, and this would be the most advantageous form of housing to use for such objective articles as metal rods, it being of a hexagonal form and with three rolls only acting together with grooves in their peripheries for grasping and rolling such articles as rods and tubes.

Fig. 11 is a side sectional elevation of a straight anti-friction-roll housing of a transverse hexagonal form and bolted together in two parts, A A′, by the bolts a^3, and Fig. 12 an end elevation of the same adapted for three rolls, B, B′, and B^4, acting together over a metal tube, C, and mandrel C′, the rolls being shown in suitable recesses for them opposite each other to form an easy-working fit in their guide-piece D. (Shown clearly in Fig. 12.) The same letters and numerals refer to like parts, and the motions are as indicated by the arrows. In this, as in mostly all other modifications of these housings and rolls, two or more sets of rolls can be used to operate on the objective material successively at the

same instant and be placed in succession in one guide, as described in connection with Figs. 5 to 10. The rolls used may be of almost any form or configuration, as the purpose they are to be used for may require, whether for operating on the objective material between the rolls or between the rolls and the containing-housing or an actuating-bar placed between the rolls. Spherical rolls contained and operated in a plain cylindrical or grooved cylindrical housing are very suitable for shaping or fluting metal rods and metal wire for nail-rod and similar purposes.

Fig. 13 is a side sectional elevation with both ends broken off, and Fig. 14 an end external elevation, of a straight cylindrical housing, A, bored out internally smooth and parallel, and three spherical rolls, B, B′, and B^4, are placed in a guide, D, opposite each other in a similar way to that described, with a piece of round wire, C, shown passed through between the rolls, the wire receiving from the surfaces of the rolls the triangular fluted shape shown in its rolled end C^2. The arrows indicate the direction of the motions of the rolls B, B′, and B^4, guide-piece D, and the wire C being operated upon. Two or more rolls can be used of this shape in the housing, and when used on metal rods produce readily rounded-out flutes corresponding to the number of rolls used opposite each other, and which may be increased in number by a successive set or sets placed in one guide-piece, as described in connection with Figs. 9 and 10. Rolls placed in these improved anti-frictional housings can be actuated by pulling through the object being operated upon between them, as described, or by pushing it through between them when it is of a sufficiently stiff and strong nature to withstand sufficient force to be exerted on it in this way.

Fig. 15 is a plan, and Fig. 16 a transverse section, on the line *m n* of same, of a housing, A, and rolls B B′, the housing A also of the same general form as described in connection with Figs. 1, 2, and 3; but in this example the rolls have plane surfaces for rolling a plane-surface bar, C. The internal guiding and containing surface of the roll-housing is planed out, tapering lengthwise, thereby causing the rolls to close (or it may open out) on the bar as it is drawn through and roll a taper bar, C, as shown. Besides plane taper bars being easily producible in this way, the rolls B B′ may have their surfaces shaped at their rolling peripheries to any irregular form to produce a corresponding shape of taper bar, as in sword-blades, bayonets, and the like, and the rolls may also have devices engraved on their surfaces, so as to produce corresponding devices on the articles formed.

Fig. 17 is a plan, and Fig. 18 a transverse section, of an arrangement of rolling-machine adapted for shaping and straightening double T-bars C. The housings A A′ and rolls B B′ roll on the necks B^5 of the rolls and give thereby a greater degree of traverse to the bar C operated upon than the length of their housing A A′. The housings A A′ in this example are also shown placed in four strong base-plate girders, H, one half, A, being shown secured to the four base-plate cross-girders H by bolts, and the other half of the housing, A′, made adjustable by the strong set-screws A^{13} for adjusting the housing to the width of the bar C to be operated upon. The bar C in this example is drawn through between the rolls by pulling-gear E or pushed by the ram F. The guides D are shown in separate halves sliding on guides A^{20}, planed on the housing A A′ and connected to each other by the angular bar D^{12} by pivot-bolts, so as to allow the halves D to move outward or inward toward each other and keep them in their proper relative positions to each other lengthwise. This form of housing and means of adjustment on the rolls is intended to be used generally for most of the purposes to which these housings and rolls are applicable. As heretofore described, the rolls can be shaped or configurated on their surfaces to suit the rolling of almost any kind or form of objective material, with ready means of adjustment and inexpensive construction combined, with great strength. The rolls also can be set opposite each other in housings of this kind for any kind of drawing and rolling purposes.

Fig. 19 is a plan, and Fig. 20 a transverse section, of another housing, A A′, in halves and adjustable to any required width within all ordinary requirements, somewhat differently arranged from that just described in connection with Figs. 17 and 18, and advantageously suitable for the straight forms of these improved anti-frictional-roll housings generally. The housing A A′ is shown placed in a strong containing base-plate, H, the full length of the housing shown with its contained housings in Fig. 19 broken off short. The housings A A′ are also planed on their under sides, and are bolted hard down to the bottom planed-out surface of their containing sole-plate H, one half of the housing A′ and base-plate H being shown in end section in Fig. 20, showing the positions of the fixing-down bolts A^{24} of the housings and the adjusting-screws and their nuts A^{13} placed in the sole-plate H.

It will be readily seen that any width of channel for the rolls within the limits of the adjusting-screws can be readily obtained as well as any degree of taper for rolling tapered or other forms of articles when required by this arrangement of housing, as described in connection with Figs. 15 and 16. Instead of having two adjustable housing-pieces, A A′, as shown, within the sole-plate H, the internal channel-surface of the sole-plate H can, with advantage for some purposes, be made to serve as the side of the housing A′, and instead of the adjusting-screws A^{13} the movable and adjustable part of the housing can be adjusted by wedge-pieces or radial

bars like those of a parallel-ruler, eccentrics, and like means. The arrangement and form of rolls, as well as the mode of operation and of being actuated, are the same as described in connection with Figs. 1, 2, and 3, this example, too, being shown adapted for rolling round rods and tubes, and need not be further described.

Curvilinear anti-frictional-roll housings of the same general forms as these straight ones described may be formed and used for like purposes; but they possess no advantage over the straight housings shown, and would be much more difficult to construct properly.

I claim as my invention—

1. The combination of an elongated channel-housing with rolls traversing said housing, a guide for the rolls, and means for forcibly passing the material through between the rolls and thereby traversing the latter in the housing.

2. The combination of an elongated channel-housing with a pair of rolls traversing said housing, a guide for the two rolls, and means for applying power to the material to forcibly pass it through between the rolls and thereby traverse the latter in the housing.

3. The herein-described machine for rolling metal and other objects, said machine comprising a pair of rolls between which the material is operated on and a guide for the rolls, in combination with elongated channel-housings in which bearing-surfaces of the rolls traverse and are revolved by frictional contact.

4. The combination of an elongated channel-housing with grooved rolls traversing said housing, a guide for the rolls, and means for applying power to the material to pass it through between the rolls and thereby traverse the latter in the housing.

5. The combination of an elongated channel-housing with grooved rolls traversing the housing, a guide for the rolls, and a mandrel to be passed with the metal through between the rolls, substantially as described.

6. The combination of an elongated channel-housing with two pairs of grooved rolls at right angles to each other and traversing said housing, a guide for the rolls, and means for applying power to the material to pass it through between the rolls and thereby traverse the latter in the housing.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES ROBERTSON.

Witnesses:

W. R. M. THOMSON,

JOHN SIME,

Both of 96 *Buchanan Street, Glasgow, Scotland.*