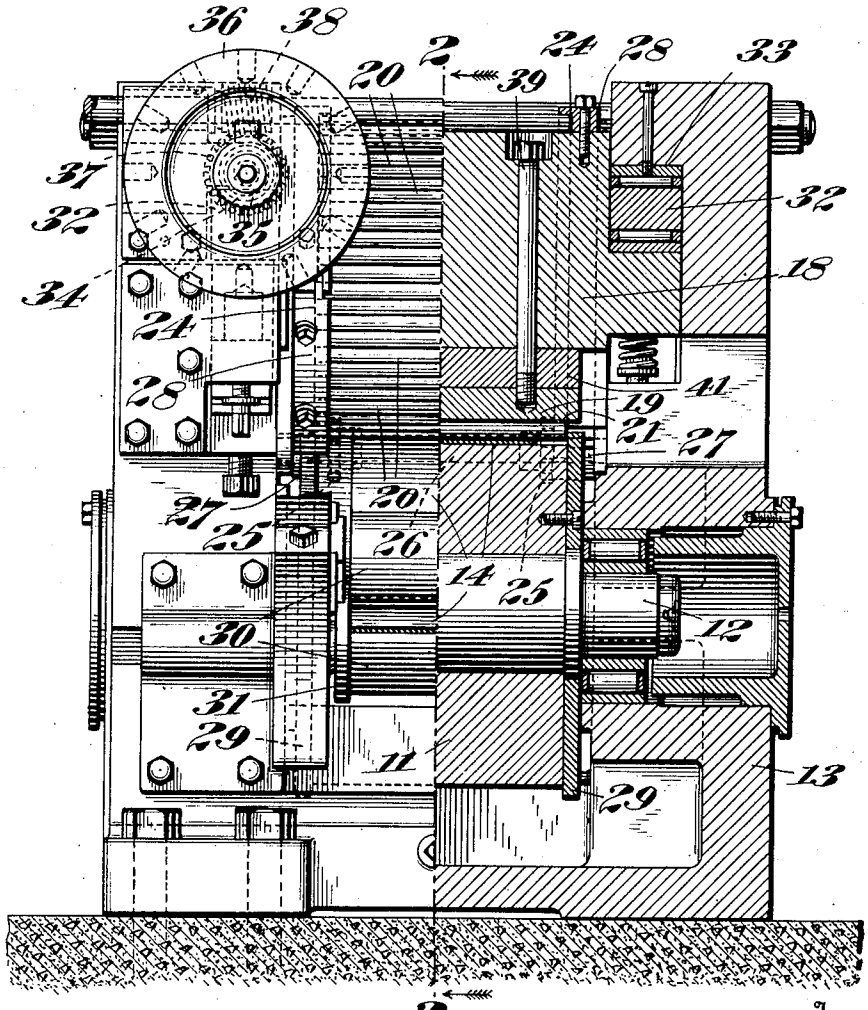
Feb. 2, 1937. H. A. KESSLER 2,069,496

ROLLING MILL

Filed April 15, 1933 4 Sheets-Sheet 1

Fig. 1.



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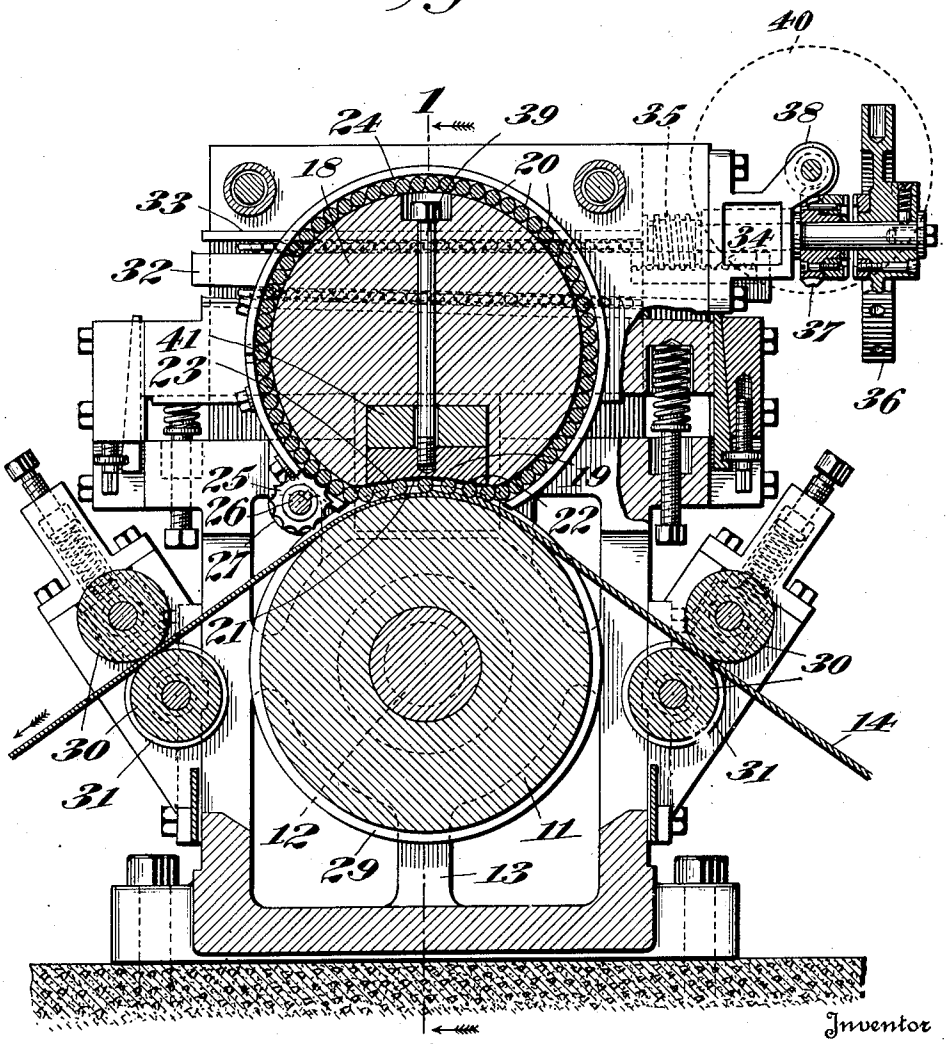
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ROLLING MILL

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Fig. 2.



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Fig. 3.

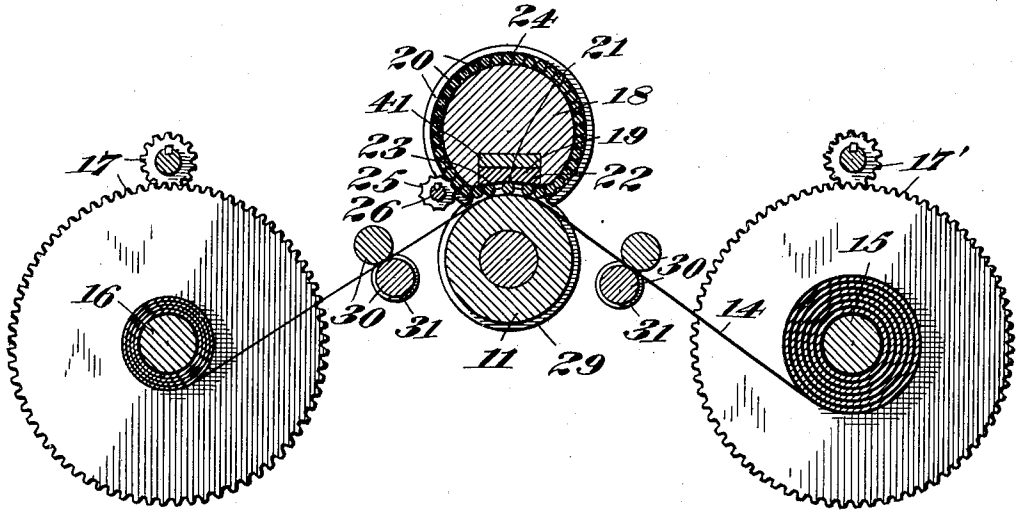
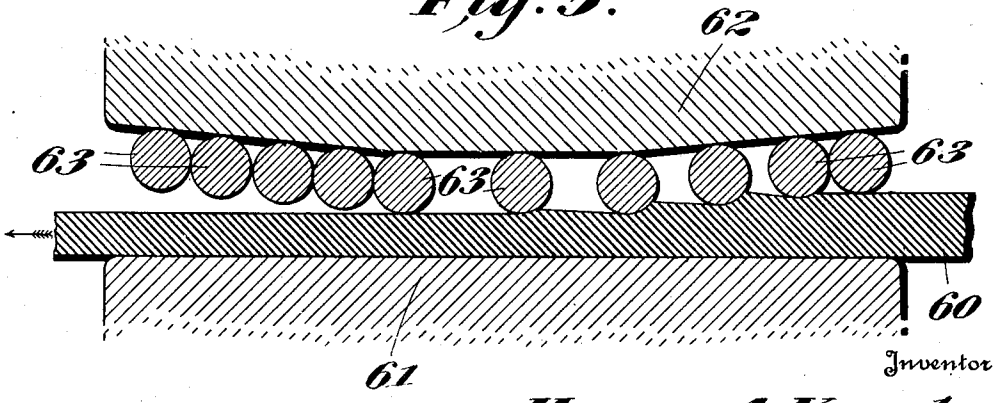


Fig. 5.



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ROLLING MILL

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Fig. 4.

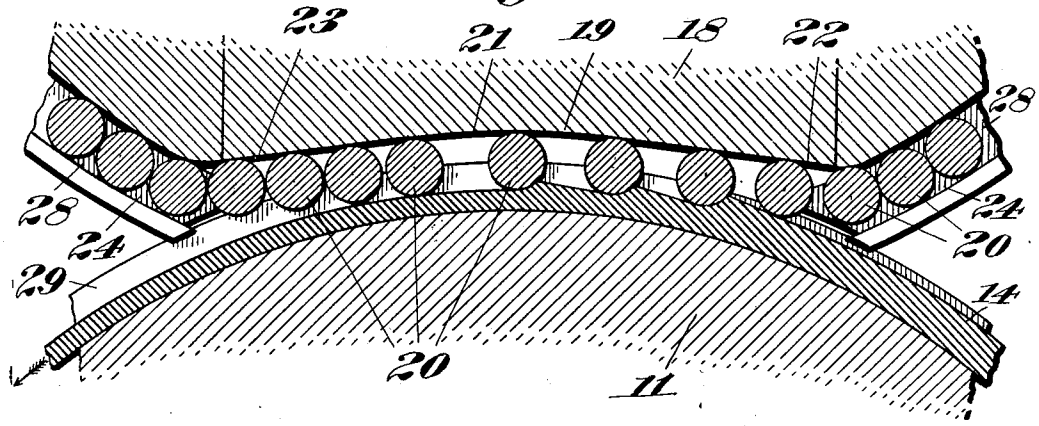
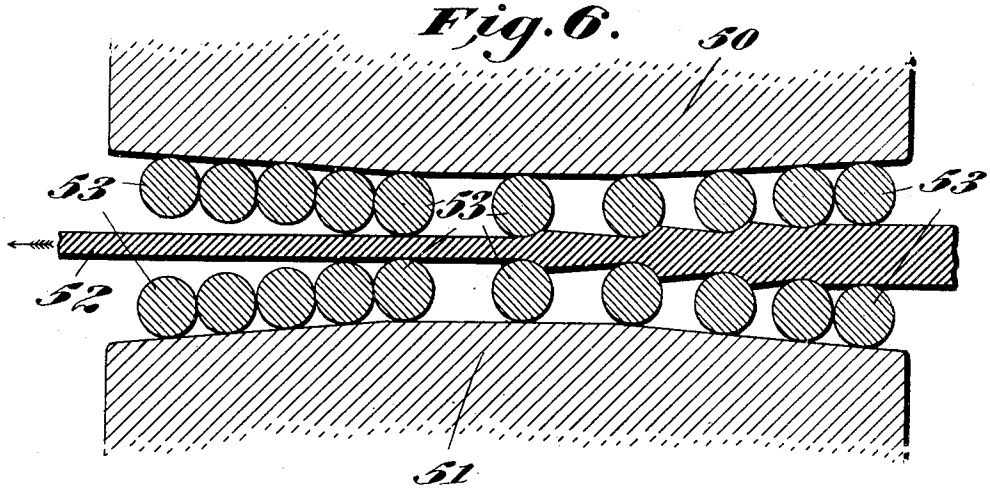


Fig. 6.



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UNITED STATES PATENT OFFICE

2,069,496

ROLLING MILL

Harry A. Kessler, Buffalo, N. Y., assignor to Kalman Steel Corporation, a corporation of Delaware

Application April 15, 1933, Serial No. 666,253

9 Claims. (Cl. 80—40)

This invention relates to a machine for the rolling of metal or similar materials employing as a reducing agency a series of rollers acting in succession on successive portions of the material. It is preferably used for cold rolling strip metal where rolling pressures are heavy and accuracy of gauge must be accurately maintained. The principles and method of operation of the invention will be best understood from the following description and drawings of which

Fig. 1 is a front elevation of a mill built according to the principles of this invention, partly sectionalized along the line 1—1 of Fig. 2;

Fig. 2 is a section along the line 2—2 of Fig. 1;

Fig. 3 is an end elevation in diagrammatic form of the mill and accessory apparatus;

Fig. 4 is a diagram illustrating certain principles of operation of the device;

Fig. 5 is a diagram illustrating certain principles of operation of an alternative form of the device;

Fig. 6 is a diagram illustrating certain principles of operation of a second alternative form of the device;

Figs. 1—4 show a specific embodiment of the invention. Here 11 is a roll with neck 12 mounted in fixed bearings in housing 13. Strip 14 which is being reduced passes over this roll unwinding from reel 15 and winding on reel 16, the latter driven by a motor or other suitable source of power through gearing 17. Mounted above roll 11 is the rigidly supported platen 18 which has a hardened concave portion 19 facing roll 11. Small rollers 20 are allowed to feed between the platen and the strip which is in contact with the roll, and these rollers drawn through the throat so formed by the movement of the strip exert a rolling action which causes a reduction of the gauge of the strip. Figure 4 shows the operation in exaggerated scale. It will be seen that the concave portion of the platen consists of three zones; a middle one 21 practically concentric with roll 11; a tapering entrance zone 22; and a tapering discharge zone 23. The small rollers are fed in closely spaced relationship, each as it reaches the entrance zone is drawn in to cause it to bite into the strip and to roll the portion of the strip below it into a tapering step, and then as it is drawn further through the concentric portion, these steps are completely smoothed out to cause a uniformly reduced thickness of metal. The discharge zone serves to relieve the pressure on each roller gradually, and thus avoid any tendency to leave marks across the strip which would result if the pressure were abruptly terminated at a given point of its travel. After any given roller has come in contact with the strip and the platen its further movement is caused entirely by the movement of the strip, no attempt being made to control it externally. Since it is in rolling contact both above or below, its rate of travel will be half that of the strip and since the strip is being elongated and travels at a greater speed at the exit end, the rollers are accelerated and therefore increase their spacing as they travel through the throat. After a roller has travelled a short distance along the discharge zone, the pressure will be entirely relieved and it will tend to remain at this point of the throat until it is pushed along and replaced by the immediately succeeding roller.

Curved trackway 24 surrounding platen 18 serves as a guide to cause the ejected rollers to travel over the top of the platen and to return to the entrance end. For the purpose of bringing the rollers into parallelism with the platen, aligning mechanism 25 may be employed, comprising two toothed wheels keyed to a common shaft 26 revolving freely in bearings 27. The teeth of the wheels pass between the rollers near their ends and adjust any slight lack of parallelism that may exist. Such an arrangement may be placed anywhere along the circuit of roller travel or two or more of them may be installed. The rollers are made with a slight end clearance between flanges 28 on the platen so that they travel freely but are kept in the proper endwise position. In addition roll 11 is provided with flange pieces 29, fastened to the roll as shown for the purpose of further guiding the rollers. The strip in general is somewhat narrower than the length of the rollers and is guided sideways by suitable guides. These may take the form of pinch rollers as shown at 30, provided with properly spaced flanges 31, which not only guide the strip sideways and vertically but may be used to apply a back tension.

Platen 18 can be adjusted vertically in relation to roll 11 by means of wedges 32 which act between the ends of the platen and the mill housing 33. These wedges are shown as provided with rollers for reducing friction so that the adjustments can be made easily either manually or by means of a small motor or motors. Each wedge is provided with an end portion 34 cut to mesh with and to be traversed by rotation of worm wheel 35, such rotation being caused by handwheel 36 or by worm wheel 37, worm 38 and other suitable mechanical elements to connect the latter to a source of power such as motor 40. Through suitable interlocks and control mecha-

nism such as is ordinarily employed for mill screw downs it is arranged that either end of the platen may be adjusted independently or both simultaneously.

The working portion 19 of the platen is preferably made separable from the main body, and is attached thereto by suitable means as illustrated by bolts 39. A filler 41 may conveniently be employed for initially adjusting this section to the platen and to compensate for changes due to wear or regrinding of the working surface. It further furnishes a convenient means of shaping the contour of the active pass, since this filler can be crowned or concaved to suit conditions and the working member 19 will flexibly accommodate itself to the slight curvature required.

If a number of successive passes are to be given to a strip in this mill it will be best to make the mill reversible. This will necessitate a power connection, as shown at 17'; to drive reel 15. The two reels will then act alternately, one pulling the strip through in one direction and the other pulling it back. An unrolled portion will be left on each end of the finished coil which will be cut off and removed.

One of the principal advantages of this type of mill is the possibility of using rollers of a much smaller size than can be employed in the ordinary mill, where there is difficulty in keeping small rolls from lateral flexure. It has been found practicable to roll strip with rollers as small as 3/8" in diameter reducing it as much as 0.018" at a single pass. In the same mill with 3/4" rollers 0.025" reduction can be obtained. If too heavy a draught is attempted for a given size of roller it is obvious the roller will tend to slip on the platen, imbedding itself in the strip rather than rolling it. The advantage in using as small a roller as possible is obvious. Small rollers bite into the work and are able to roll harder material than large ones; the total rolling pressure is less and the spring of the mill is therefore decreased or a lighter mill can be employed with the same amount of spring; the small rollers are cheaper, can be obtained of a more homogeneous structure and can be accurately and cheaply ground.

As the material elongates during the pass a certain amount of slippage must occur between the strip and the lower roll. This can be eliminated by providing small rollers both above and below the strip as shown in Figure 6. Here 50 and 51 are platens held rigidly in a spaced relationship. Strip 52 is pulled in the direction of the arrow between the throat so provided by any suitable pulling means. Small rollers 53 are employed as rolling means between the strip and the platens, the rollers acting in pairs, the members of each pair being in vertical alignment. The throat between the platens comprises a parallel zone and entrance and exit zones, the manner of operation, which is essentially the same as in the previous case being shown in the figure. With this scheme reduction occurs on both sides of the strip and the action is almost devoid of friction.

In certain cases where friction is a minor consideration the modification shown in Fig. 5 may be desirable. Here strip 60 is pulled across the face of fixed plate 61, platen 62 and rollers 63 acting as in the previously discussed constructions.

A mill of the type disclosed in this invention can be used for either hot or cold rolling of any metal or other material, but its principal application is in the cold rolling of steel and other resistant metals. When so used it results in a saving of power, a cheaper and lighter mill and an ability to reduce the gauge a given amount with less abusive action on the structure of the metal.

It will be understood that the specific details of the apparatus are described for illustrative purposes only.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a machine for reducing the thickness of strip material, the combination of a plurality of bearing members, a roll rotatably supported between said bearing members, the cylindrical surface of said roll contacting with a surface of said material, a plurality of rollers acting on another surface of said material, a platen constituting an abutment for said rollers, and means for fixing said platen in relation to said bearings.

2. In a machine for reducing the thickness of strip material, the combination of a roll, the cylindrical surface of which contacting with one surface of said material, a plurality of cylindrical rollers in series formation contacting with another surface of said material and a platen constituting an abutment for said rollers having a portion of its surface of cylindrical shape and substantially concentric with the cylindrical surface of said roll.

3. In a machine for reducing the thickness of strip material, a large roll the periphery of which serving as abutment means for a first surface of said material, a platen member having a face including an entrance zone and a discharge zone, a plurality of disconnected rollers, means to cause each of said rollers to move across a face of said platen from said entrance zone to said discharge zone in rolling contact with said face and with a second surface of said material, means for returning each of said rollers in succession from said discharge zone to said entrance zone, means for holding said platen member in a predetermined position, and means to bring the axis of each roller into predetermined alignment during its passage from said discharge zone to said entrance zone.

4. In a machine for reducing the thickness of material, a roll contacting with a first surface of said material, a housing, bearings for supporting said roll, a platen member having an entrance zone forming a converging angle with the surface of said roll, a middle zone having a cylindrical surface substantially concentric with said roll surface and a discharge zone, means associated with said housing for supporting said platen and said bearings, a plurality of rollers in rolling contact with said platen and with a second surface of said sheet, means for traversing said rollers across a face of said platen from said entrance zone to said discharge zone, means for returning each of said rollers in succession from said discharge zone to said entrance zone, and means for applying forces to said material to urge it to pass between said roll and said rollers.

5. In a machine for reducing the thickness of material, a roll contacting with a first surface of said material, a housing, bearings for supporting said roll, a platen member having an entrance zone forming a converging angle with the surface of said roll, a middle zone having a cylindrical surface substantially concentric with said roll surface and a discharge zone forming a diverging angle with said roll surface, means associated with said housing for rigidly supporting and for adjusting the spatial relationship between said platen and said bearings, a plurality of rollers in rolling contact with said platen and with a

second surface of said sheet, means for traversing said rollers across a face of said platen from said entrance zone to said discharge zone, means for returning each of said rollers in succession from said discharge zone to said entrance zone, means for bringing the axis of each of said rollers into parallelism with the axis of said roll during such return, means for limiting the axial movement of said rollers and means for applying forces to said material to urge it to pass between said roll and said rollers.

6. In a machine for reducing the thickness of strip material, a fixed platen carrying an endless series of axially spaced, disconnected rollers in rolling contact with a face portion of said platen and with a surface of said material, a plurality of bearing members, a large roll rotatably supported between said members, the cylindrical surface of said roll contacting with the other surface of said material, and means for causing each of said rollers to pass over said material and said large roll and to act in succession on successive portions of said strip.

7. In a machine for reducing the thickness of strip material, a fixed platen carrying an endless series of axially spaced, disconnected rollers in rolling contact with a limited face portion of said platen and with a surface of said material, a plurality of bearing members, a large roll rotatably supported between said members, a portion of the cylindrical surface of said roll contacting with the other surface of said material, and means for pulling said material through the active pass formed by said rollers and said roll in a continuous manner for causing each of said rollers to pass over said material and to act in succession on successive flat portions of the material.

8. In a machine for reducing the thickness of strip material, a platen having a concaved portion, a roll rotatably mounted in concentric spaced relation to the concaved portion of said platen, an endless series of axially spaced, disconnected rollers surrounding said platen, means for guiding said rollers into the space formed by the concaved portion of said platen and said roll to form a pass, means for adjusting said platen relative to the axis of said roll, means for guiding strip material into said pass, and means for continuously drawing said material through said pass, whereby to cause a plurality of said rollers to act simultaneously on successive portions of the material in unequally spaced relation.

9. In a machine for reducing the thickness of strip material, a non-rotatable platen having convexed and concaved portions, an idler roll rotatably mounted in concentric spaced relation to the concaved portion of said platen, an endless series of disconnected rollers mounted in peripheral contact with said platen, means for guiding said rollers into the space formed by the concaved portion of said platen and said roll to form a working pass, means for adjusting said platen relative to the axis of said roll in vertical and horizontal planes, means for feeding strip material into said pass, and means for continuously drawing said material through the pass.

HARRY A. KESSLER.