April 14, 1942. A. SIMONS 2,279,350

METHOD AND APPARATUS FOR DRAWING METAL

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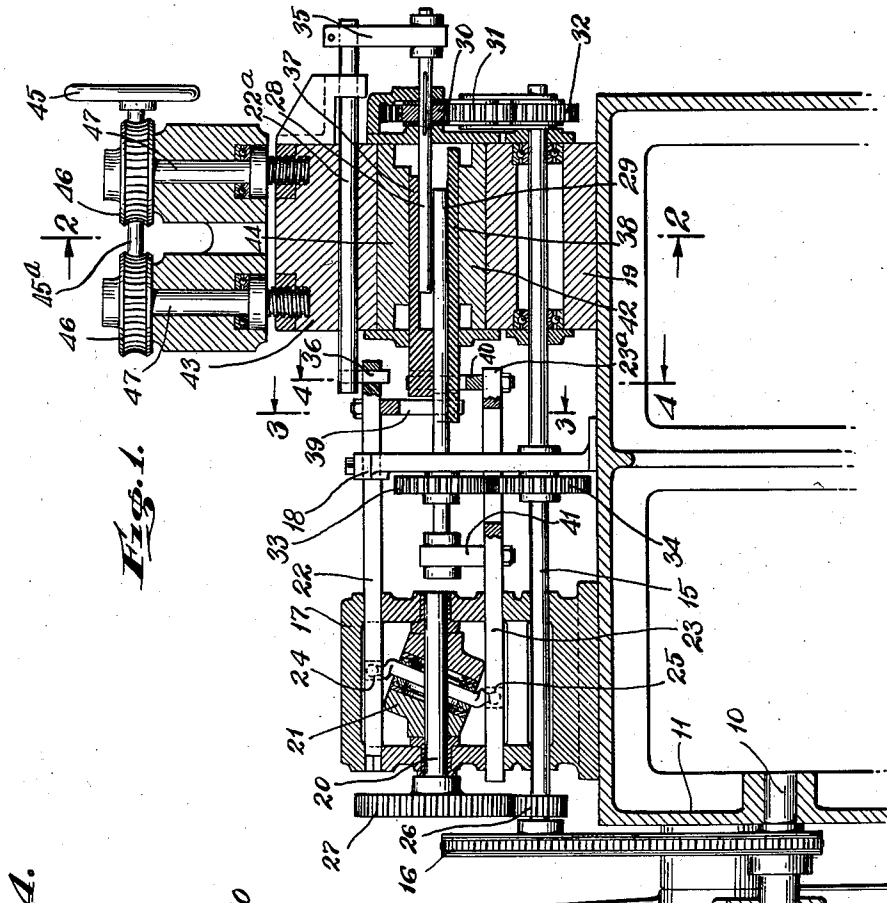


Fig. 1.

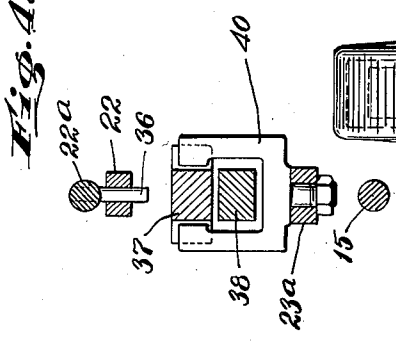


Fig. 4.

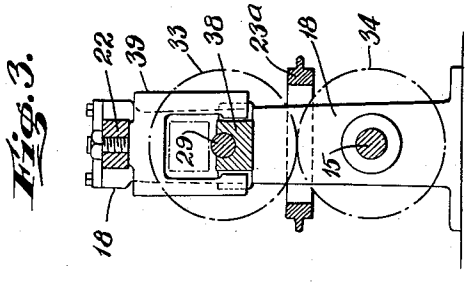


Fig. 3.

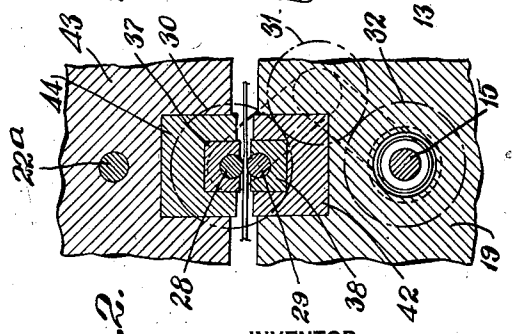


Fig. 2.

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METHOD AND APPARATUS FOR DRAWING METAL

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Application April 27, 1940, Serial No. 331,904

18 Claims. (Cl. 205—3)

This invention relates to machines for drawing metal strips, sheets and the like between rotatable die members or rolls of extremely small diameter adjustable toward and from each other to control the reduction in the workpiece drawn through the apparatus; and the object of the invention is to provide an apparatus of the character described wherein the die members or rolls are restrained against bending in any direction, and are reciprocated longitudinally of their axes in opposite directions while rotating on their axes, and wherein longitudinal friction bearings or backings are provided for the die members or rolls which bearings reciprocate longitudinally of the axes of the rolls and in directions opposite to the reciprocating movement imparted to their respective associated rolls, thereby controlling frictional relationship in an apparatus of the class described; a further object being to provide an apparatus of the character described wherein the combined reciprocatory movement of the die members or rolls and their respective bearings or backings maintain a constant support for the rolls throughout the working length of said rolls; and with these and other objects in view, the invention consists in the method of producing strips or sheets of the character defined and in the apparatus as more fully hereinafter described and claimed.

The invention is fully disclosed in the following specification, of which the accompanying drawing forms a part, in which the separate parts of my improvement are designated by suitable reference characters in each of the views, and in which:

Fig. 1 is a diagrammatic sectional view through a part of an apparatus or rolling mill made according to my invention.

Fig. 2 is a partial section on the line 2—2 of Fig. 1.

Fig. 3 is a partial section on the line 3—3 of Fig. 1; and

Fig. 4 is a partial section on the line 4—4 of Fig. 1.

The distinctive features of my novel method of drawing strip or sheet material and in the apparatus for performing this method, resides in the use of not only reciprocating and rotating die members or rolls, but also in utilizing longitudinal friction bearings or backings for the rolls which are also reciprocated in directions opposite to the reciprocating movement imparted to the associated rolls supported and backed thereby. In other words, the bearing or backing of one roll reciprocates simultaneously with the opposed roll. With this construction and method, it will appear that not only is the frictional surface resistance between the rolls and the workpiece material reduced, but the frictional surface resistance between the roll and its bearing or backing is also reduced, thereby facilitating the rotation of the rolls and the operation of drawing the workpiece between the die members or rolls. This method of procedure and mode of operating the several parts will also produce smoother or more perfectly finished drawn products. This operation will also further facilitate the greater reduction in thickness between the workpiece and the drawn product, thereby minimizing the number of passes required.

In order to simplify the illustration of the invention, I have diagrammatically illustrated in Fig. 1 of the drawing a sectional view through a part of a machine substantially of the type and kind illustrated in my prior application, Ser. No. 269,374, filed April 22, 1939, and have shown only such parts of the machine as are necessary to illustrate the operation of the new method and the structure employed for carrying out this method.

In the drawing, 10 represents a motor driven shaft supported in a suitable base or frame 11 of the machine, only part of which is illustrated. The shaft also passes through a housing 12 within which is arranged a small gear 13 on the shaft 10 for driving two large gears 14, only one of which is shown. The gears 14 are employed to drive drums in pulling a workpiece through the machine in two directions so as to provide a number of passes of the workpiece through the machine in a successive series or operations. Suitable means are provided to clutch the two gears 14 in driving position with respect to the drum shafts employed.

A shaft 15 is arranged longitudinally of the top of the frame 11 and is directly driven from the shaft 10 through a sprocket and chain drive as at 16, or in any other manner. The shaft 15 is supported in a housing 17 and also passes through a bearing plate 18 and through a die block 19.

Arranged within the housing 17 upon a shaft 20 is an oblique cylinder or other driving element 21 for imparting back and forth reciprocating movements to rods 22, 23 coupled with projecting terminals 24 and 25 on said cylinder. The gear 26 is arranged on the shaft 15 and cooperates with a gear 27 on the shaft 20 for driving the cylinder 21.

At 28 and 29 are disclosed two rotatable and reciprocating die members or rolls. Keyed to the

roll 28 is a gear 30 which meshes through an intermediate gear 31 to a gear 32 mounted on the shaft 15. The gear 31 is mounted upon pivotally coupled links, as indicated in Fig. 2, to compensate for the slight vertical adjustment of the roll 28 with respect to the roll 29 in gaging the spacing between the two rolls 28 and 29 in controlling the reduction in thickness of the workpiece to be drawn between said rolls.

Keyed to the roll 29 adjacent the bearing plate 18 is a gear 33 which meshes with a gear 34 on the shaft 15. Thus both rolls 28 and 29 are driven from the shaft 15, as will be apparent. The roll 28 has its outer end directly coupled with a supplemental rod 22a through a link 35. The rod 22a has a pin 36 operating freely in an aperture in the outer end of the rod 22 so as to directly couple the rod 22 with the roll 28 to impart reciprocating movement to said roll 28, while at the same time allowing vertical adjustment of the supplemental rod 22a with respect to the rod 22.

The rolls 28 and 29 are mounted in and reciprocate as well as rotate in longitudinal friction bearings or backings 37, 38. The backing 38 is directly coupled with the rod 22 through a link 39, the construction of which is shown in Fig. 3, whereas the backing 37 has a vertical sliding coupling with a forked pin 40 supported in the outer end 23a of the rod 23 as shown in Fig. 4. This end of the rod 23 is of O-frame construction so as to envelope and clear the bearing plate 18 as well as the gears 33 and 34 as shown in Fig. 3. The roll 29 is directly coupled with the rod 23 through a coupling link 41. It will thus be seen that in the back and forth reciprocating movement of the rods 22 and 23 in opposite directions to each other through the medium of the cylinder 21, the roll 28 together with the bearing or backing 38 of the roll 29, will reciprocate in the same direction and simultaneously with each other but in an opposite direction to the simultaneous movement of the roll 29 and the backing 37 of the roll 28. During this reciprocating movement of the rolls and backings the rolls are independently rotated as will be apparent. This construction will reduce by the maximum amount the frictional surface resistance between not only the die members or rolls and their respective bearings or backings, but also between the workpiece and the die members or rolls.

Arranged upon the block 19 is a stationary support or backing 42 which seats in the block 19 and forms a suitable guide and support for the reciprocating bearing 38. At 43 is shown a vertically adjustable block in connection with which is supported a corresponding support 44 for the reciprocating roll bearing 37. In all cases, the backings or bearings for the rolls will extend throughout the full working length of the reciprocating rolls.

The block 43 is adjusted vertically through the medium of a hand wheel 45 on a shaft 45a having worms or the like for rotating worm wheels 46 arranged upon vertical screw rods 47 which are coupled with the block 43, as in the prior application hereinbefore referred to. This adjustment of the block carries with it the roll 28 including the backing 37, and regulates the spacing between the rolls 28 and 29. While this adjustment is relatively small, it will, in different sized machines, care for workpieces of the different thicknesses handled.

As previously stated, the illustrations in the accompanying drawing are more or less diagrammatic simply to show the common means or drive for imparting the back and forth reciprocating motion to both the rolls and the backings for the rolls, while at the same time showing the means for rotating the rolls, all operated from a common drive which also drives the means for drawing the workpiece through or between the rolls. At this time, it will be understood, however, that independent sources of power may be utilized for actuating the drawing of the workpiece, and the other operative mechanisms of the machine, particularly in certain types and kinds of machines. One feature of a machine made according to my invention, and advantage of the novel method of drawing workpieces, resides in the fact that the movements imparted to the rolls and bearings or backings thereof produces finished surfaces on the drawn product which are smooth and unmarred because the working rolls are constantly maintained in motion.

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

1. In a rolling mill for reducing the thickness of an elongated workpiece, a pair of working rolls arranged in parallel relation, a pair of backings forming supports for said working rolls and extending substantially the full operative length of said rolls, means for reciprocating the rolls in opposite directions to each other while rotating said rolls, and means for reciprocating said backings in directions opposite to the rolls supported thereby.

2. In a rolling mill, a pair of working rolls, supporting bearings for said working rolls, and means for reciprocating said supporting bearings parallel to the axis of said rolls and for simultaneously reciprocating the rolls in said bearings in directions opposite thereto to reduce friction between said bearings and said rolls.

3. In a rolling mill, a pair of working rolls, supporting bearings for said working rolls, means for reciprocating said supporting bearings parallel to the axis of said rolls and for simultaneously reciprocating the rolls in said bearings in directions opposite thereto to reduce friction between said bearings and said rolls, and means for rotating said rolls while reciprocating the same.

4. In a rolling mill, a pair of working rolls, supporting bearings for said working rolls, means for reciprocating said supporting bearings parallel to the axis of said rolls and for simultaneously reciprocating the rolls in said bearings in directions opposite to the direction of movement of their respective bearings, means for rotating said rolls while reciprocating the same, and means for adjusting one of the working rolls toward and from the other to regulate spacing between said rolls.

5. An apparatus for drawing elongated workpieces to reduce the thickness thereof, comprising a pair of elongated die members, means for drawing the workpiece between said die members, a longitudinal friction bearing for each die member extending throughout the operative length thereof, means for reciprocating the die members in opposite directions to each other while reciprocating the bearing for each die member simultaneously in a direction opposite to the direction of movement of its die member and longitudinally of the axis of the die member.

6. An apparatus for drawing elongated workpieces to reduce the thickness thereof, comprising

a pair of elongated die members, means for drawing the workpiece between said die members, a longitudinal friction bearing for each die member extending throughout the operative length thereof, means for reciprocating the die members in opposite directions to each other while reciprocating the bearing for each die member simultaneously in a direction opposite to the direction of movement of its die member and longitudinally of the axis of the die member, and means for rotating said die members in their respective bearings.

7. An apparatus for drawing elongated workpieces to reduce the thickness thereof, comprising a pair of elongated die members, means for drawing the workpiece between said die members, a longitudinal friction bearing for each die member extending throughout the operative length thereof, means for reciprocating the die members in opposite directions to each other while reciprocating the bearing for each die member simultaneously in a direction opposite to the direction of movement of its die member and longitudinally of the axis of the die member, means for rotating said die members in their respective bearings, and means coupling the bearing of each die member with the opposed die member to provide synchronized reciprocating movement of said bearings and die members.

8. An apparatus for drawing elongated workpieces to reduce the thickness thereof, comprising a pair of elongated die members, means for drawing the workpiece between said die members, a longitudinal friction bearing for each die member extending throughout the operative length thereof, means for reciprocating the die members in opposite directions to each other while reciprocating the bearing for each die member simultaneously in a direction opposite to the direction of movement of its die member and longitudinally of the axis of the die member, means for rotating said die members in their respective bearings, and means adjusting the relative spacing of the die members one with respect to the other.

9. An apparatus for drawing elongated workpieces to reduce the thickness thereof, comprising a pair of elongated die members, means for drawing the workpiece between said die members, a longitudinal friction bearing for each die member extending throughout the operative length thereof, means for reciprocating the die members in opposite directions to each other while reciprocating the bearing for each die member simultaneously in a direction opposite to the direction of movement of its die member and longitudinally of the axis of the die member, means for rotating said die members in their respective bearings, means adjusting the relative spacing of the die members one with respect to the other, and stationary supports in which said reciprocating bearings are mounted.

10. The method of reducing the thickness of an elongated workpiece, which includes the steps of supporting each of a pair of dies throughout its operative length, moving the die supports parallel to the axis of the dies while moving said dies along the axes thereof in directions opposed to the movement of their respective supports, and simultaneously rotating the dies in the supports in controlling frictional relationship while pulling a workpiece through the dies.

11. The method of reducing the thickness of an elongated workpiece, which includes the steps of supporting each of a pair of dies throughout its operative length, moving the die supports parallel to the axis of the dies while moving said dies along the axes thereof in directions opposed to the movement of their respective supports, simultaneously rotating the dies in the supports in controlling frictional relationship while pulling a workpiece through the dies, and backing said supports throughout the operative length of said dies.

12. The method of reducing the thickness of an elongated workpiece, comprising mechanically drawing a workpiece between a pair of die members, supporting the die members throughout their operative length, rotating the die members in their supports, decreasing the frictional surface resistance between said die members and their respective supports by reciprocating the die members and their respective supports in opposite directions to each other longitudinally of the axes of the die members, while the die members are reciprocated in opposite directions to each other.

13. The method of controlling frictional relationship in a pull-mill, which includes the steps of supporting the working rolls throughout their operative length, moving the working roll supports parallel to the axis of the rolls, and moving the rolls along their axis so that each working roll moves in a direction opposed to the direction of movement of its support.

14. The method of operating a strip mill, which includes the steps of supporting the working rolls throughout their operative length, reciprocating the working roll supports parallel to the axis of said rolls, and reciprocating the rolls in directions opposite to the direction of reciprocation of their respective supports while pulling the strip through said working rolls.

15. The method of operating a strip mill, which includes the steps of supporting the working rolls throughout their operative length, reciprocating the working roll supports parallel to the axis of said rolls, reciprocating the rolls in directions opposite to the direction of reciprocation of their respective supports, and rotating said rolls while pulling the strip through said working rolls.

16. The method of reducing the thickness of an elongated workpiece, comprising mechanically drawing a workpiece between a pair of rotatable elements adjusted relatively to each other to control spacing between said elements, supporting said elements throughout their operative length, reciprocating the supports longitudinally of the axes of said elements while simultaneously reciprocating said elements in their supports in directions opposite to the direction of movement of their respective supports, thereby decreasing the frictional surface resistance between said supports and said elements.

17. The method of reducing the thickness of an elongated workpiece, comprising mechanically drawing a workpiece between a pair of rotatable elements adjusted relatively to each other to control spacing between said elements, supporting said elements throughout their operative length, reciprocating the supports longitudinally of the axes of said elements while simultaneously reciprocating said elements in their supports in directions opposite to the direction of movement of their respective supports, thereby decreasing the frictional surface resistance between said elements and the workpiece.

18. The method of reducing the thickness of an elongated workpiece, comprising mechanical-

ly drawing a workpiece between a pair of rotatable elements adjusted relatively to each other to control spacing between said elements, supporting said elements throughout their operative length, reciprocating the supports in bearings likewise extending throughout the operative length of said elements, said reciprocation being in a direction longitudinal of the axes of said elements, and simultaneously reciprocating said elements in their supports in directions opposite to the direction of movement of their respective supports, thereby decreasing the frictional surface resistance between said supports and said elements and between said elements and the workpiece.

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