

Aug. 17, 1937.

M. MORGAN

2,090,221

ROLLING MILL

Filed Sept. 25, 1935

3 Sheets-Sheet 1

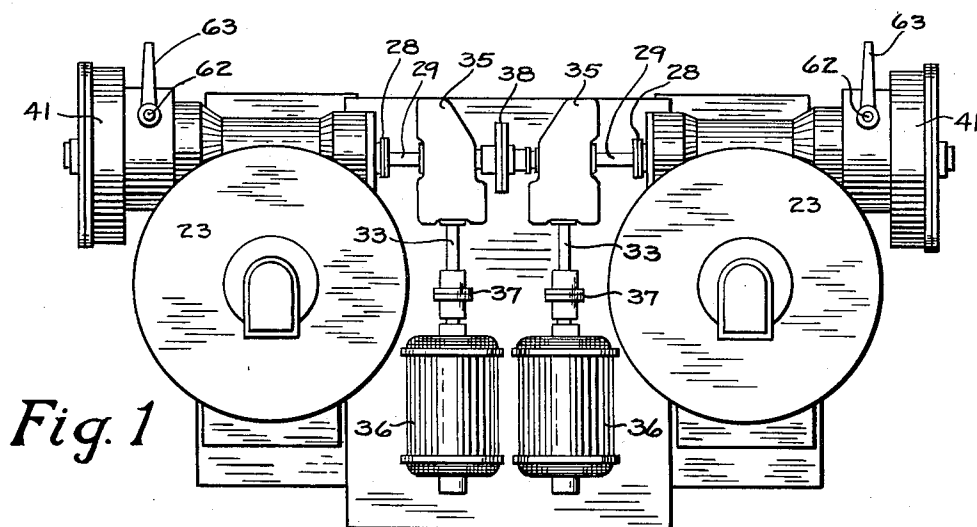


Fig. 1

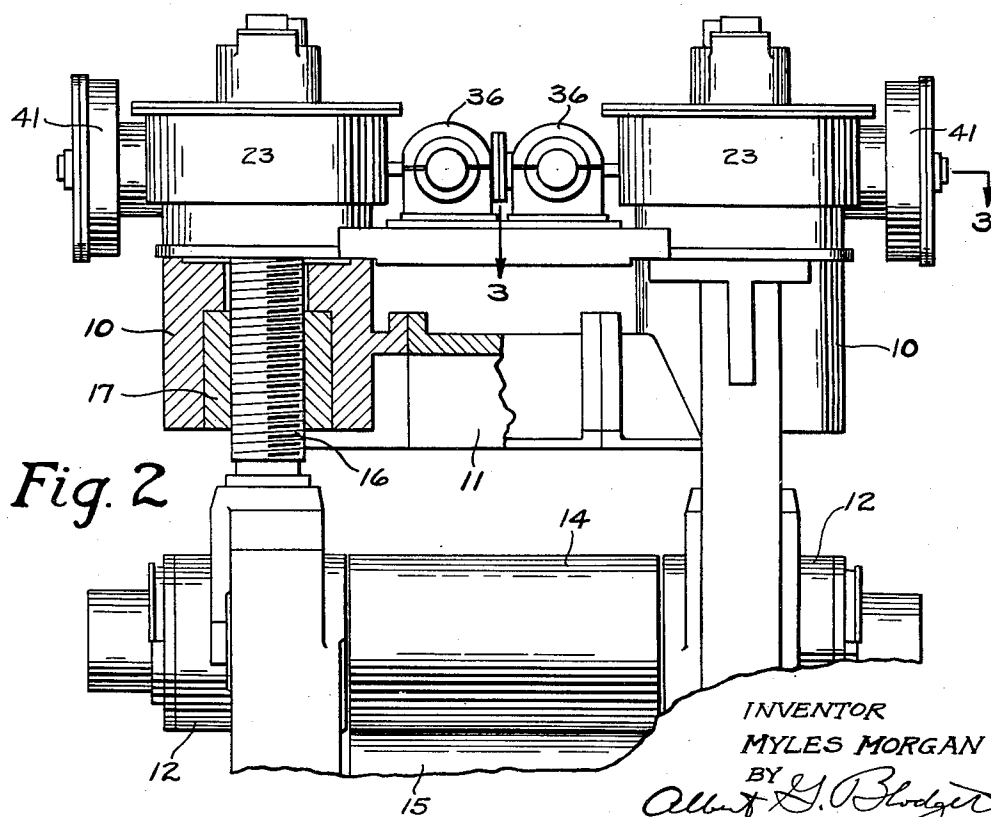


Fig. 2

INVENTOR
MYLES MORGAN
BY
Albert G. Budgett
ATTORNEY

Aug. 17, 1937.

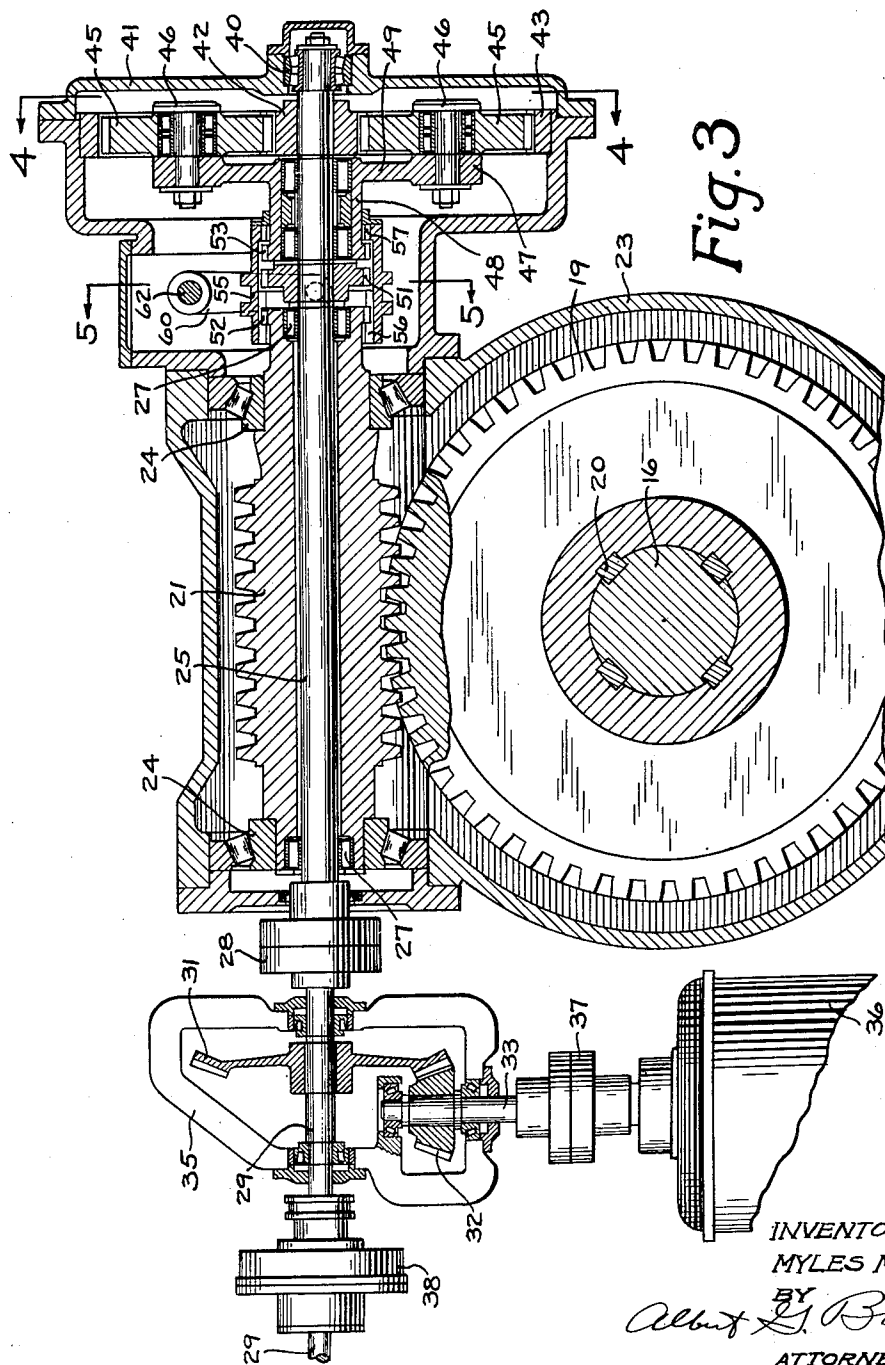
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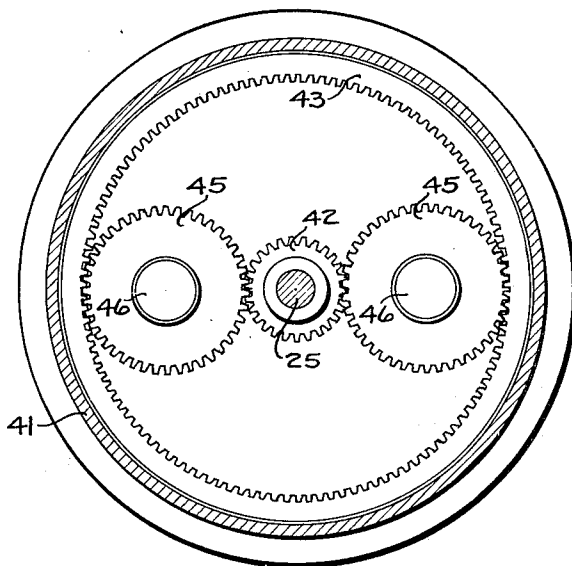


Fig. 4

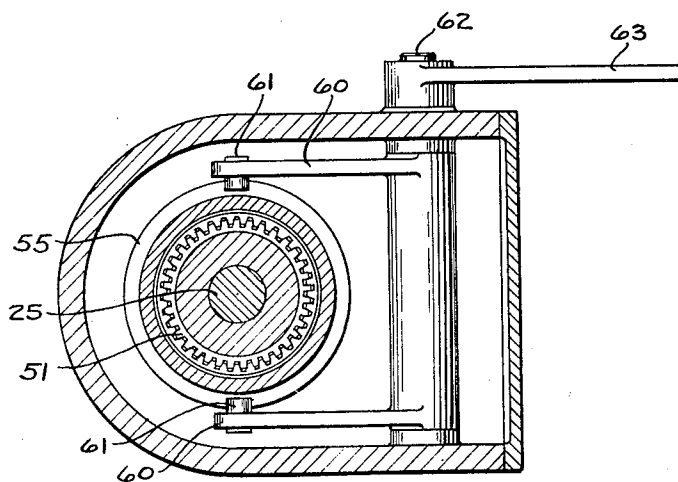


Fig. 5

INVENTOR
MYLES MORGAN

BY
Albert G. Blodgett
ATTORNEY

UNITED STATES PATENT OFFICE

2,090,221

ROLLING MILL

Myles Morgan, Worcester, Mass., assignor to
Morgan Construction Company, Worcester,
Mass., a corporation of Massachusetts

Application September 25, 1935, Serial No. 42,079

5 Claims. (Cl. 80—56)

This invention relates to rolling mills, and more particularly to mills of large size having power actuated means for adjusting the position of the rolls.

5 Ordinarily the rolls are subjected to tremendous pressures while the stock is passing through the mill, and these pressures make adjustment very difficult. It is customary to employ a suitable source of power, such as an electric motor, and
10 to connect this motor to the roll adjusting device, which is usually a rotatable screw. Because of the tremendous pressures involved and in order to avoid the necessity for a motor of extremely large size, it is the usual practice to provide a
15 high-ratio speed-reduction mechanism between the motor and the screw. This has the further advantage of permitting the use of a comparatively high speed and hence less expensive motor, while at the same time it makes possible a gradual and accurate adjustment of the rolls. The
20 prior construction, however, has a serious disadvantage in that considerable time is required to effect large adjustments of the rolls, and the entire mill is necessarily inoperative while such adjustments are being made. This effect is particularly noticeable when changing rolls in the
25 mill, for before the upper roll can be removed it is usually necessary to back off the adjusting screws for a considerable distance. Moreover, the prior mechanisms developed for this purpose
30 have been complicated and expensive to manufacture, inefficient in the transmission of power, and so bulky that it has been found difficult to accommodate them in the limited space available.

35 It is accordingly one object of the invention to provide a rolling mill having simple and compact power actuated means whereby the rolls can be adjusted with comparative rapidity while free
40 from load, and with great accuracy while under load.

It is a further object of the invention to provide a rolling mill having a comparatively high speed motor arranged to adjust the rolls slowly
45 and accurately, and particularly to provide a construction of this type which will utilize the power of the motor efficiently, and which can be accommodated in the limited space available.

50 With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

55 Referring to the drawings illustrating one em-

bodiment of the invention and in which like reference numerals indicate like parts,

Fig. 1 is a top plan view of a rolling mill;

Fig. 2 is a front elevation of the upper portion of the mill, certain parts being shown in section
5 for clearness of illustration;

Fig. 3 is an enlarged section taken substantially on the line 3—3 of Fig. 2;

Fig. 4 is a section on the line 4—4 of Fig. 3; and

Fig. 5 is an enlarged section on the line 5—5 of
10 Fig. 3.

The embodiment illustrated comprises a rolling mill having the usual spaced upright housings 10 connected at their upper portions by a distance
15 piece 11. The housings 10 support roll neck bearings 12 of suitable construction, in which is mounted the upper roll 14. The roll 14 cooperates with a lower roll 15 therebeneath, both rolls being rotated by a suitable source of power.

In order to adjust the position of the upper roll
20 14, and thus control the thickness of the stock as it leaves the rolls, there is provided a pair of vertical screws 16 which extend downwardly through threaded collars or nuts 17 mounted in the housings 10. The lower ends of the screws engage the
25 bearings 12, and their upper ends project above the housings.

Power actuated mechanism is provided to rotate the screws 16 and effect desired adjustments in the position of the upper roll. For this purpose a worm gear 19 is slidably secured to the
30 upper end of each screw, preferably by means of keys 20, and a hollow worm 21 is provided in mesh with each gear. The worms 21 are preferably arranged with their axes in alignment with
35 each other and parallel to the roll 14. Each worm and gear is enclosed by a casing 23, and each worm is supported at its ends in anti-friction bearings 24. A shaft 25 extends through each worm, being preferably supported therein by
40 means of anti-friction bearings 27.

The shafts 25 are driven by suitable means, and for this purpose I have shown the inner end of each shaft connected by couplings 28 to a shaft 29. Each shaft 29 carries a bevel gear 31
45 which is driven by a bevel pinion 32 mounted on a horizontal shaft 33 positioned at right angles to the shaft 29. Each bevel gear and its pinion are enclosed in a separate casing 35. The pinion shafts 33 are arranged to be driven by reversible
50 electric motors 36 directly connected to the shafts by means of couplings 37, the motors being located between the two worm gear casings 23 in a very compact arrangement. A suitable clutch
55 38, which is preferably of the magnetic type, is

mounted between the two shafts 29. It will be apparent that with this clutch engaged the shafts 29 and the shafts 25 may all be rotated as a unit.

Means is provided to transmit power from each shaft 25 to its corresponding worm 21, and since the same mechanism is used at each side of the mill, one mechanism only will be described. As illustrated particularly in Fig. 3, the outer end of the shaft 25 is supported in an anti-friction bearing 40 mounted in a casing 41 forming an extension of the worm gear casing 23. A sun gear 42 is mounted on the shaft 25 adjacent to the bearing 40, and an orbit gear 43 is mounted in the casing 41 in the same plane as the sun gear and surrounding the same concentrically. The gears 42 and 43 are connected by a pair of planet gears 45 rotatably supported on studs 46 carried by a rotatable member 47. This member 47 comprises a hollow cylindrical portion 48 and two radial arms 49 which project outwardly therefrom and support the studs 46. The cylindrical portion 48 is rotatably supported on the shaft 25 between the sun gear 42 and the worm 21.

Means is provided for connecting the worm 21 to the member 47 and the parts are preferably so arranged that if desired the worm may be connected to the shaft 25 instead. For this purpose I have shown a toothed member or collar 51 secured to the shaft 25 between the cylindrical portion 48 and the worm 21. Teeth 52 are provided on the outer end of the worm, and teeth 53 are provided on the inner end of the cylindrical portion 48. A cylindrical sleeve 55 surrounds the toothed member 51 and the teeth 52 and 53, this sleeve having inwardly projecting teeth 56 at its inner end and inwardly projecting teeth 57 at its outer end. The teeth 56 are elongated in the axial direction and in constant engagement with the teeth 52 on the worm, and the parts are so constructed that by shifting the sleeve 55 slightly to the left of the position shown in Fig. 3 the teeth 57 may be brought into engagement with the teeth 53, thus connecting the worm to the member 47 and causing the worm to be rotated at a comparatively low speed. If now the sleeve 55 is shifted slightly to the right of the position shown in Fig. 3 the teeth 56 will be brought into engagement with the toothed member 51, so that the worm will be connected to the shaft 25 and will be rotated at a comparatively high speed. With the parts positioned as shown in Fig. 3, no power will be transmitted to the worm.

The axial shifting of the sleeve 55 may be accomplished manually through any suitable mechanism. In the embodiment illustrated there is provided a yoke 60 having a pair of pins 61 which engage a circumferential groove in the outside of the sleeve 55. The yoke is secured to a vertical shaft 62 mounted in the casing 41 and provided with an operating handle 63 at its upper end.

The operation of the invention will now be apparent from the above disclosure. When it is desired to raise or lower the roll 14 evenly at both ends, the magnetic clutch 38 will be engaged and power will be supplied to both motors 36 to cause them to rotate in the proper direction. Each motor will transmit power through the corresponding bevel gears 32 and 31 to the corresponding shaft 29, and as a result the two shafts 29 and the two shafts 25 will rotate as a unit. When it is desired to raise or lower one end only of the roll 14, the clutch 38 will be disengaged, and power will be supplied to one of the motors only. If the roll is to be adjusted while under load, the handle 63 will be turned to shift the

sleeve 55 to the left of the position shown in Fig. 3, bringing the teeth 57 into engagement with the teeth 53 on the member 47. With the parts adjusted in this manner, the shaft 25 will rotate the member 47 at a comparatively low speed through the medium of the planetary gears 42, 45 and 43. The rotation of the member 47 will be transmitted by the sleeve 55 directly to the worm 21, and this in turn will rotate the worm gear 19 and the screw 16 at a very slow speed, thereby adjusting the roll position accurately and without overloading the motor. If now it is desired to make a considerable change in the roll position while no stock is being rolled, or if it becomes necessary to raise the screws 16 a substantial distance to permit changing of the rolls, the handle 63 will be turned to shift the sleeve 55 to the right of the position shown in Fig. 3, bringing the teeth 56 into engagement with the toothed member 51. This will connect the worm 21 directly to the shaft 25 for rotation therewith, and the screw 16 will be rotated at a comparatively high speed.

It will be noted that the invention provides a construction which is comparatively simple and inexpensive to manufacture. By locating the motor at one end of the worm and the planetary speed-reducing mechanism at the other end of the worm, and connecting them by a shaft which extends through the hollow worm, there is obtained a very compact construction. This feature of compactness is further aided by the location of the driving motors between the two worm gear casings 23. Since there is only a single worm gear reduction between each motor and its corresponding screw 16, the efficiency of the mechanism is relatively high, and yet a comparatively large reduction in speed is obtained.

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

1. A rolling mill comprising a housing, a horizontal roll having one end supported in the housing, an adjusting device for the roll located at the top of the housing and rotatable about a vertical axis, a worm gear secured to the device, a hollow rotatable worm in mesh with the worm gear and arranged with its axis parallel to the roll, a rotatable shaft extending through the worm, a motor connected to one end of the shaft, and a speed-reducing mechanism to transmit power from the other end of the shaft to the worm.

2. A rolling mill comprising a housing, a horizontal roll having one end supported in the housing, a vertical screw projecting upwardly from the housing to control the position of the roll, a worm gear secured to the screw, a hollow rotatable worm in mesh with the worm gear and arranged with its axis parallel to the roll, a rotatable shaft extending through the worm, a motor connected to the inner end of the shaft, and a speed-reducing mechanism to transmit power from the outer end of the shaft to the worm.

3. A rolling mill comprising a roll, a rotatable adjusting device for the roll, a worm gear secured to the device, a hollow rotatable worm in mesh with the worm gear, a rotatable shaft extending through the worm, a motor connected to one end of the shaft, a sun gear mounted on the other end of the shaft, planet gears surrounding the sun gear and in mesh therewith, a stationary orbit gear surrounding the planet gears and in mesh therewith, and means to connect the planet gears with the worm to drive the worm.

4. A rolling mill comprising a horizontal roll, an adjusting device for the roll rotatable about a vertical axis, a worm gear secured to the device, a hollow rotatable worm in mesh with the worm gear and arranged with its axis parallel to the roll, a rotatable shaft extending through the worm, a motor connected to one end of the shaft, a sun gear mounted on the other end of the shaft, planet gears surrounding the sun gear and in mesh therewith, a stationary orbit gear surrounding the planet gears and in mesh therewith, and means to connect the planet gears with the worm to drive the worm.

5. A rolling mill comprising a horizontal roll, an adjusting device for the roll rotatable about a vertical axis, a worm gear secured to the device, a hollow rotatable worm in mesh with the worm gear and arranged with its axis parallel to the roll, a rotatable shaft extending through the worm, a speed-reducing mechanism to transmit power from the outer end of the shaft to the worm, an electric motor mounted at the inner side of the worm gear and arranged with its axis horizontal and at right angles to the shaft, and gears connecting the motor to the shaft.

MYLES MORGAN.