J. R. GEORGE.

ROLLING MILL.

APPLICATION FILED JUNE 8, 1903.

966,089. **Patented Aug. 2, 1910.**

3 SHEETS—SHEET 1.

Fig. 1.

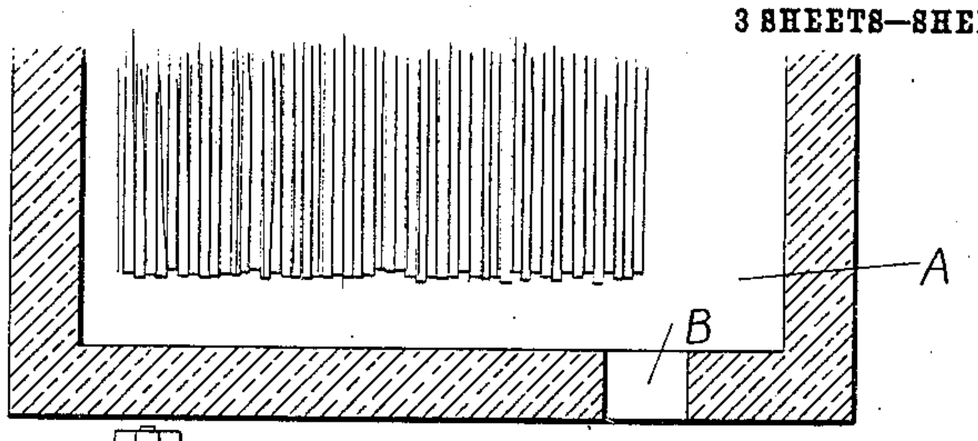


Fig. 7.

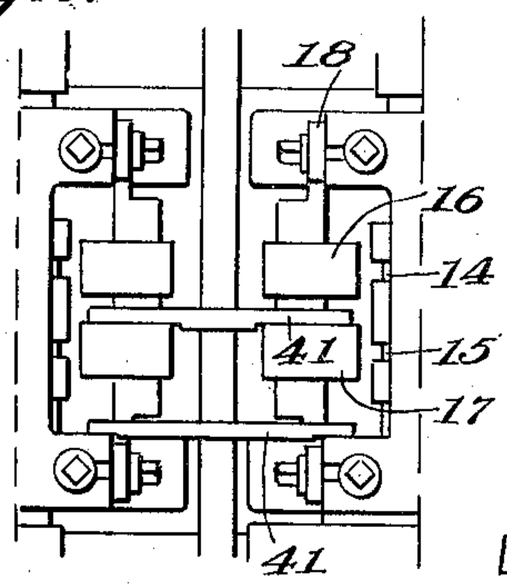
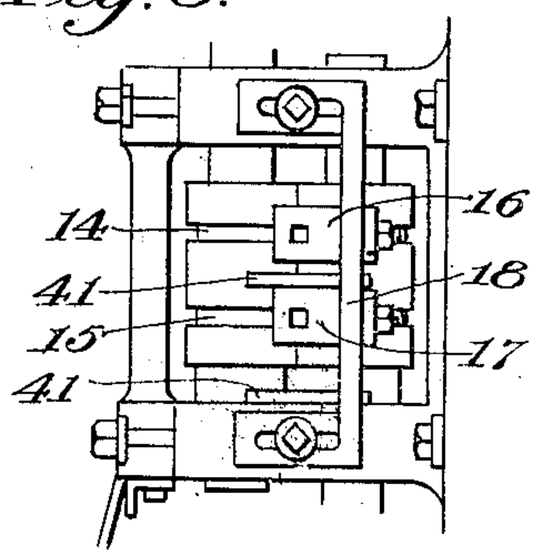
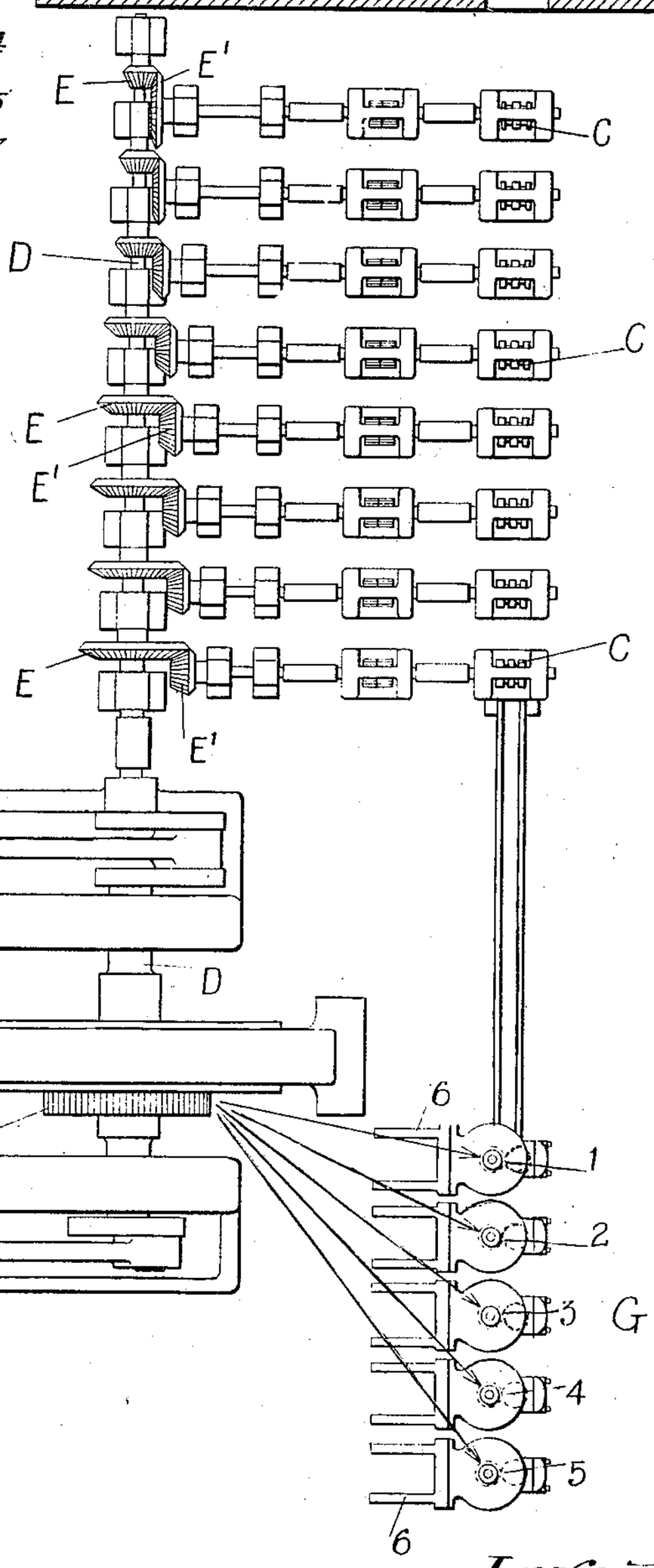


Fig. 8.





Witnesses

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3 SHEETS—SHEET 2.

Fig. 2

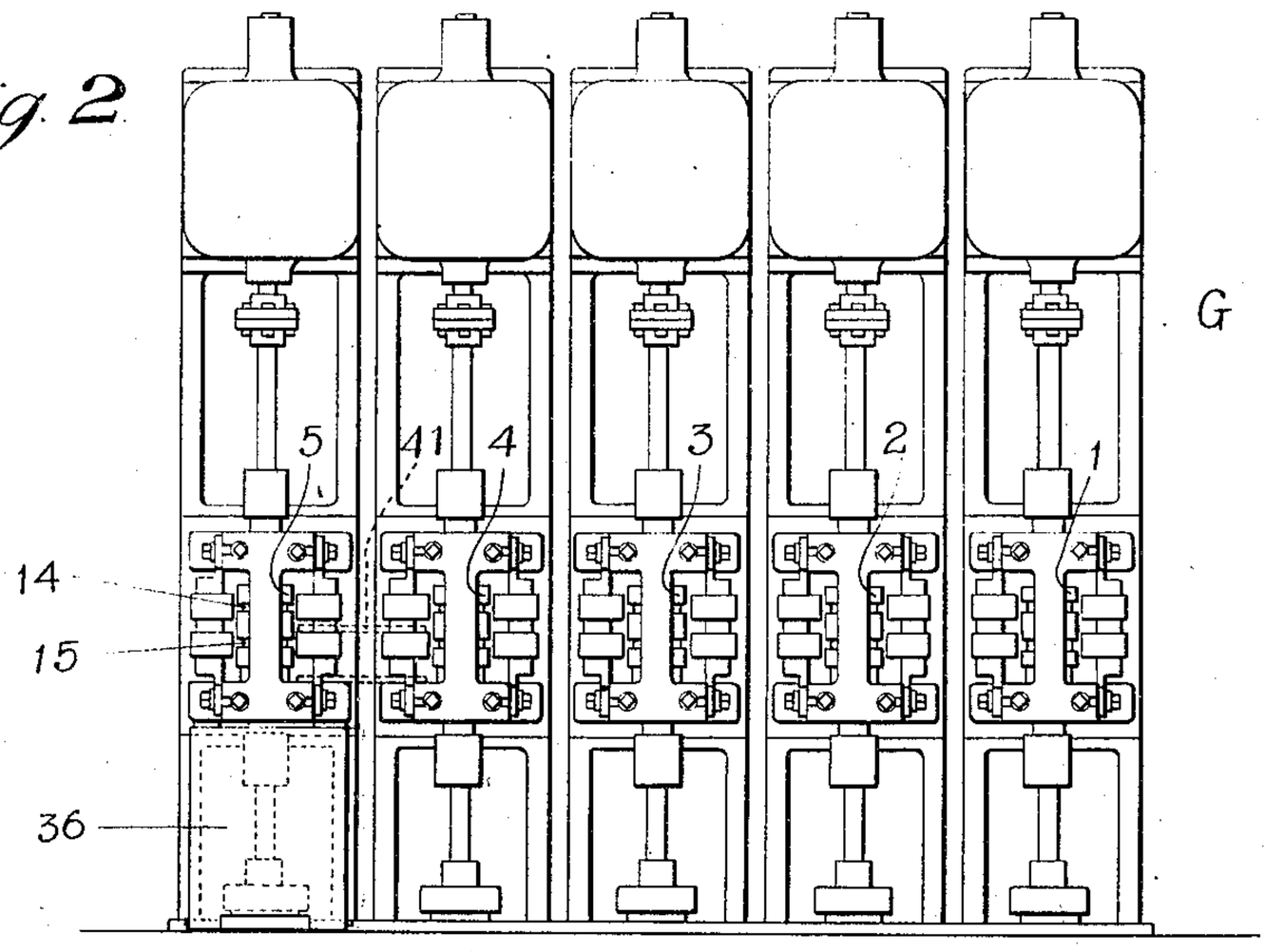


Fig. 3

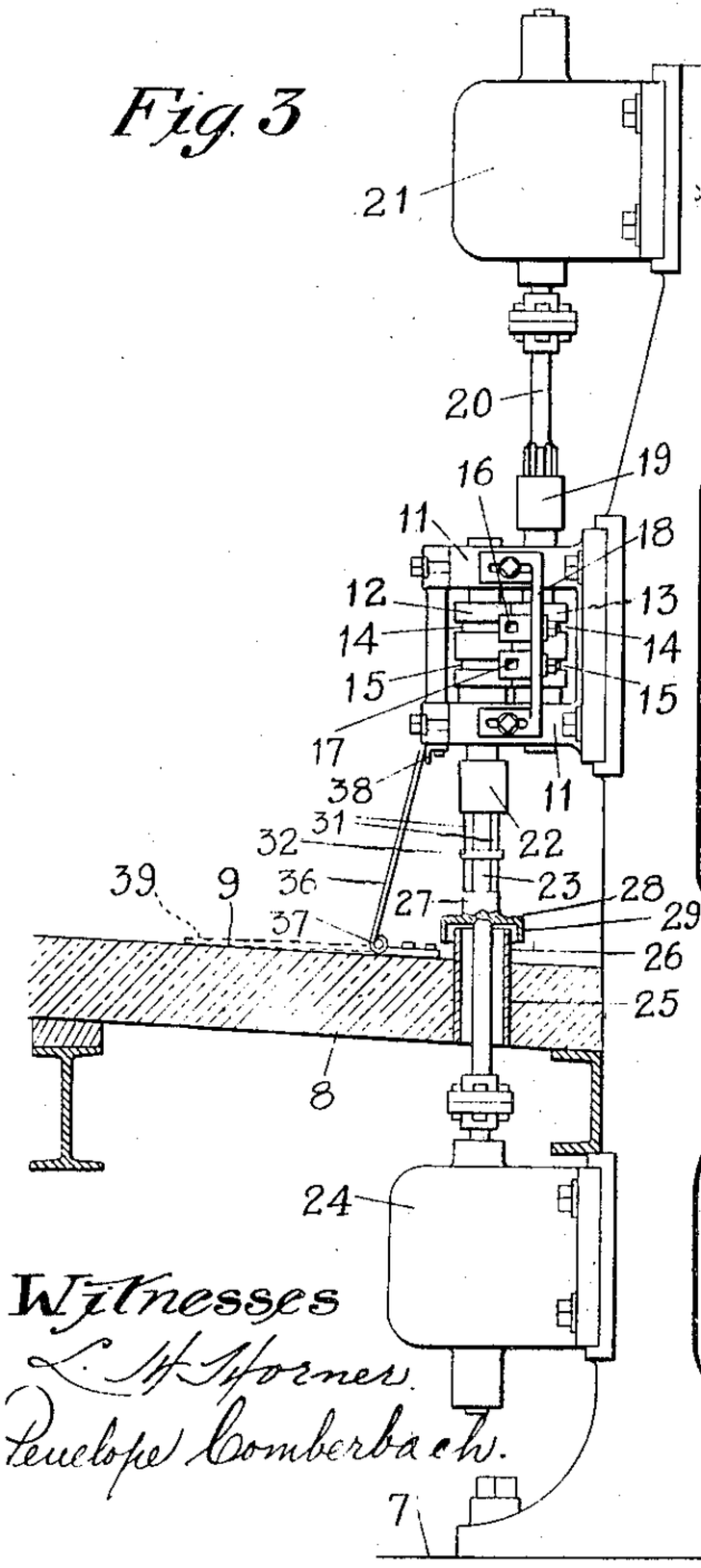
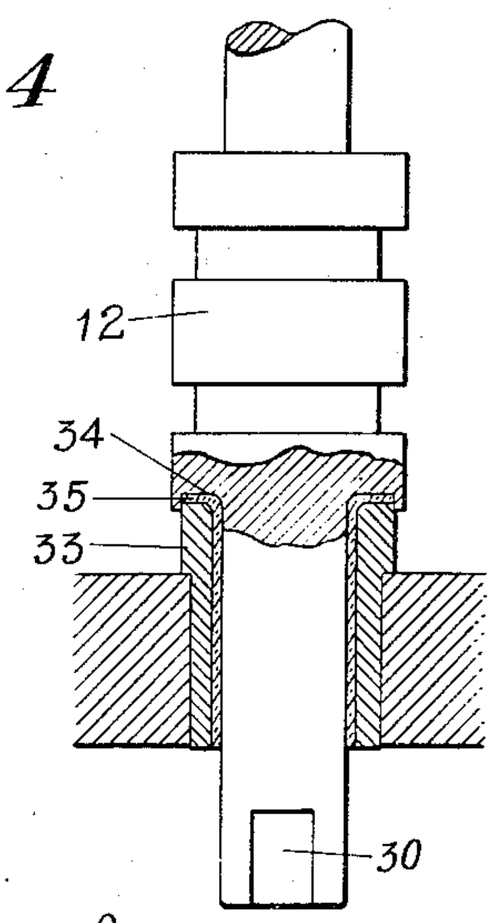
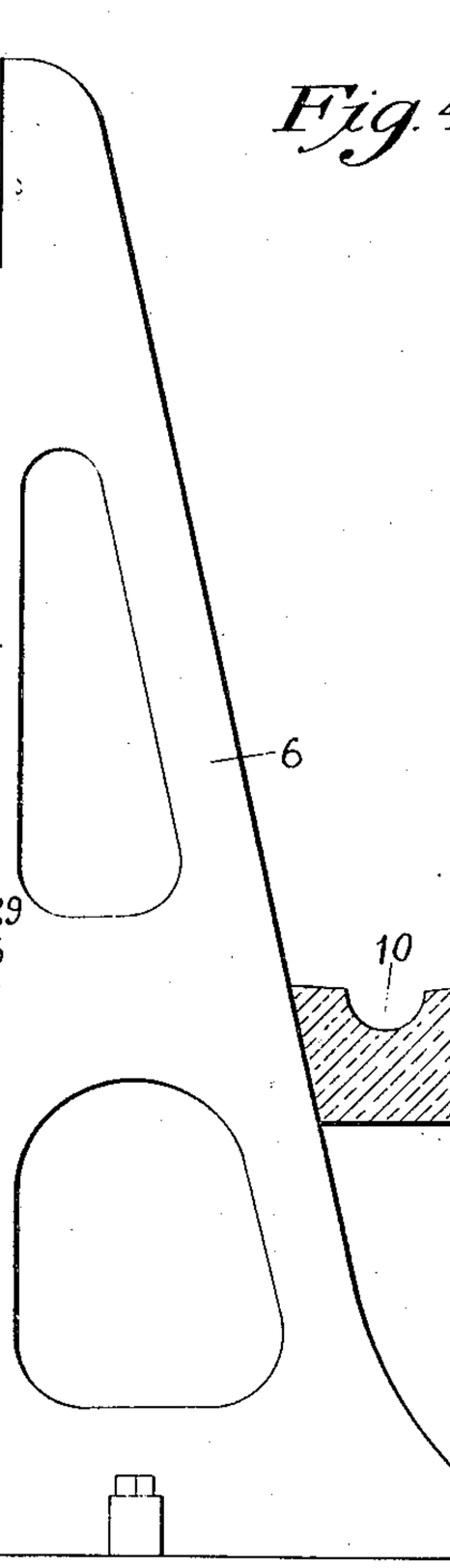


Fig. 4





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966,089.

Patented Aug. 2, 1910.

3 SHEETS—SHEET 3.

Fig 5

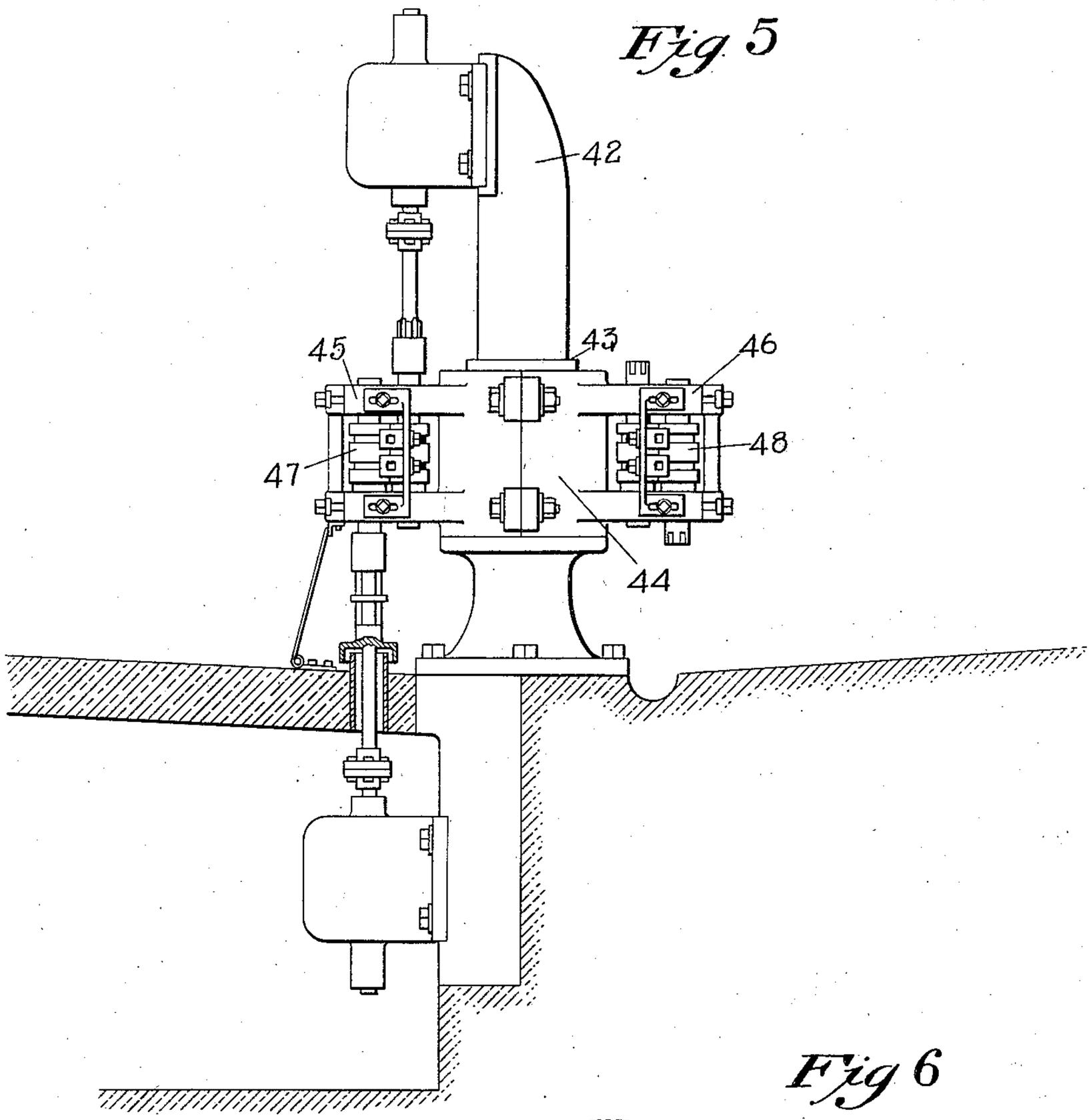
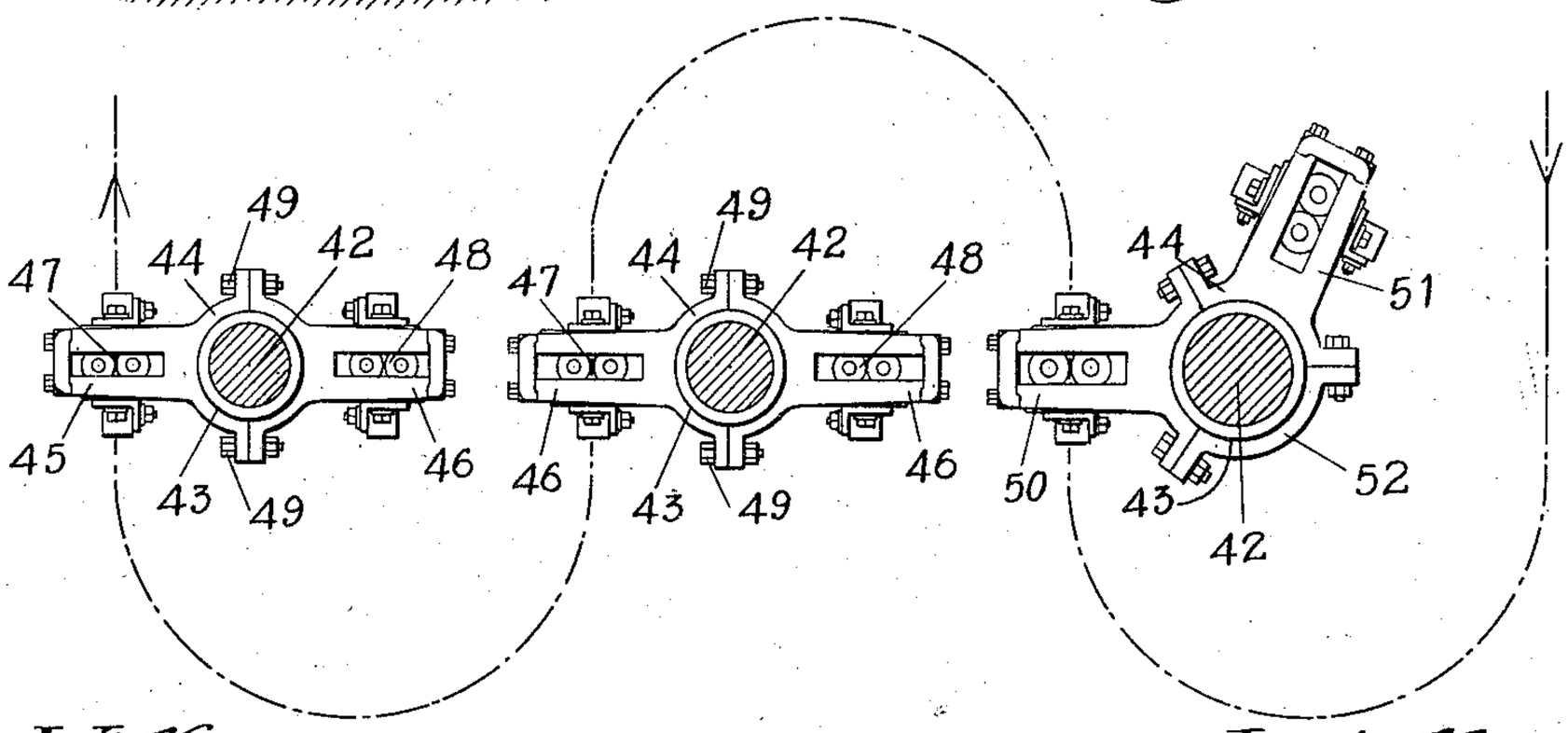


Fig 6



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UNITED STATES PATENT OFFICE.

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ROLLING-MILL.

966,089. Specification of Letters Patent. Patented Aug. 2, 1910.

Application filed June 3, 1903. Serial No. 159,904.

To all whom it may concern:

Be it known that I, JEROME R. GEORGE, a citizen of the United States, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Improvement in Rolling-Mills, of which the following is a specification, accompanied by drawings forming a part of the same, in which—

Figure 1 is a plan view of a rolling mill showing the rolls of a roughing mill through which an ingot is first passed when taken from the furnace, and also a finishing mill, embodying my invention. Fig. 2 is a front view of the rolls of the finishing mill. Fig. 3 is a side view of one of the pairs of rolls of the finishing mill with its supporting housing. Fig. 4 is a detail in sectional view of one of the rolls of the finishing mill with its lower journal bearing. Fig. 5 represents a modified construction whereby different pairs of rolls are interchangeable, and Fig. 6 is a plan view of several pairs of interchangeable rolls arranged for the successive reduction of a rod. Figs. 7 and 8 are front and side views respectively on an enlarged scale, showing the guides for the rod between adjacent pairs of rolls and the removable supporting plates 41 between the guides.

Similar letters and figures of reference refer to similar parts in the different views.

My present invention relates to certain improvements in rolling mills, and particularly to that class of rolling mills known as finishing mills, in which the final reduction of a rod or bar is accomplished, and it has for its objects to increase the efficiency and convenience of this class of mills, and it consists in the construction and arrangement of parts as hereinafter described and pointed out in the annexed claims.

Referring to the accompanying drawings, A denotes a portion of a heating furnace, having a delivery opening B in position to deliver a heated ingot to the series of rolls C, C, forming what is known as a roughing mill, adapted to the initial reduction of an ingot to a rod or bar, suitable to be delivered to the rolls of a finishing mill for its final reduction to a desired size in cross section. The successive pairs of rolls C, C, are rotated at varying speeds by means of their connection with a common driving shaft D, through a series of bevel gears E, E^1. As a rod is delivered from the last pair of rolls in the roughing mill, it is directed by a guide F to the rolls of a finishing mill G, embodying my invention, and comprising in the present instance five pairs of rolls, 1, 2, 3, 4 and 5, adapted to the continuous reduction of a rod, by a series of consecutive grooves or passes. Each of the rolls of the finishing mill like the rolls C of the roughing mill, are provided with two grooves or passes for the simultaneous reduction of two rods or bars, but the number of passes can be varied as desired. Each pair of rolls in the finishing mill is journaled in housings and supported by an upright post or framework which are the duplicates of each other, so that a description of one will serve as a description for all.

Referring to Fig. 3, 6 denotes an upright framework, supported upon a suitable base 7, in a pit or other substructure beneath a floor 8, having its upper surface 9 slightly inclined to form a water shed leading to a sunken trough or conduit 10.

Secured to the frame 6, and at a suitable distance above the floor 8 for the convenience of the operator standing thereon, is a roll housing 11, provided with bearings for a pair of rolls 12 and 13, having vertical axes and circumferential grooves or passes, 14 and 15, one above the other, into which the rod is conducted by guides 16 and 17, which are supported on a plate 18, attached to the housing 11. The upper gudgeon of the roll 13, extends above the housing and is connected by a coupling sleeve 19, such as is usually employed in rolling mills, to a vertical shaft 20, to which rotary motion is imparted by an electric motor 21, which is supported upon the upright frame 6. The lower gudgeon of the roll 12 extends below the housing and is similarly connected by a coupling sleeve 22, to a vertical shaft 23, rotated by an electric motor 24, which is supported by the upright frame 6, below the floor 8. The shaft 23, where it passes through the floor 8, is inclosed by a tube 25, which projects above the floor and forms a dam 26, to prevent water from flowing from the floor around the shaft 23, and the opening through the tube 25 is closed at its

upper end by a collar 27, provided with a flange 28, having a downwardly turned edge 29, overlapping the upper end of the tube 25.

The coupling sleeves 19 and 22, are of the usual construction, and are capable of vertically sliding on the shafts 20 and 23, with which they have the usual toothed or splined connection with a similar connection with the gudgeons of the rolls, the ends of which are provided with recesses as shown at 30, Fig. 4, to receive corresponding interior projections in the sleeves. The sleeve 19 is normally held in engagement with the gudgeon of roll 13 by gravity, allowing the roll to be disconnected at will by simply raising the sleeve 19 on the shaft 20. The sleeve 22 is held in its operative position by interposing a couple of wooden bars 31, 31, between the sleeve 22 and the collar 27, said bars being held in place by a strap 32. The lower journal bearings of each of the rolls 12 and 13 are protected from water by extending the bushing 33 above the housing 11, and entering the upper end of the bushing in a recess 34, in the lower end of the roll, said recess forming an annular lip 35 which overlaps the bushing 33. The shaft and coupling connections of the rolls between the housing 11 and the floor 8, are protected by guard plates 36, only one being shown in Fig. 2. The guard plates are hinged at 37 near the floor 8, and with their upper edges resting against a bracket 38, attached to the housing 11, and when access is desired to the lower coupling, the guard plates are lowered upon the floor, as shown by the broken line 39.

Each of the electric motors in the mill are electrically connected in the usual manner with a dynamo 40, on the main driving shaft D, with the speed of the individual motors regulated to impart the proper speed to the rolls to suit the reduction of the rod, with the speed of the dynamo constant and corresponding with that of the main shaft D, from which the rolls C, C, of the roughing mill, are driven. Any variation, therefore, in the speed of the main shaft D, will not affect the relative speed of the rolls in the roughing mill, with the rolls of the finishing mill. The lower guides 17 and the lower roll housings serve as shelves for the support of removable plates 41, two of which are shown by broken lines in Fig. 2, in connection with the pair of rolls 5. The plates 41 are placed in the position shown in Fig. 2, whenever any interruption occurs in the passage of a rod through the rolls, forming what is known as a "cobble", thereby enabling such a rod to be manipulated by the operator, while supported on a plate 41, and the rod in the upper grooves 14 is prevented from falling into contact with the rod below, in the grooves 15, and each of the rods may be thus supported whenever necessary for the adjustment of guides or for other purposes, and when not needed the plates 41 may be readily removed.

It is customary in rolling mills to prevent the overheating of the rolls by their contact with the heated metal by a current of water directed against the rolls, which washes away much of the scale liberated from the heated metal. By the employment of vertical rolls their upper journals are above and therefore entirely free from contact with the unclean water, and the lower journals are effectually closed to the admission of water by the overlapping lip 35, and the lower motor 24, is likewise protected by the flanged collar 27 and tubular dam 26, causing the entire flow of water over the rolls to be received upon the inclined surface 9 of the floor, and conducted away by the conduit 10.

In my improved rolling mill, the operator, from his position in front of the vertical supporting frames 6, has free and equal access to each pair of rolls, passing from one pair to another, for the proper manipulation of the rod; the adjustment of the guides; the inspection and adjustment of the several journal bearings; the connection or disconnection of the rolls with their respective vertical shafts by means of the sliding loosely fitting sleeve couplings, or for the inspection of the operation of each pair of rolls. The control of each rod in its passage through the rolls is permitted by the supporting plates 41, which are easily inserted, as described, whenever the exigencies of the work requires, and their use does not conceal the passing rods or the operative parts of the mill. As each roll in a pair is individually rotated at its proper speed by its direct connection with the driving power, the use of pinions for connecting the rolls in each pair is unnecessary, thereby avoiding the friction, noise and excessive wear incident to the transmission of power by gearing. Additional advantages are also obtained, due to the increase in the speed of the rolls beyond the speed limit, possible when pinions are used, thereby enabling smaller rolls to be used, without reducing the product of the mill, and with the outlay of less power, and the use of smaller rolls is desirable especially in finishing mills, for the further reason that greater accuracy of dimension in cross section is thereby obtainable in the finished product. An independent adjustment of the rolls in each pair is rendered possible, and also a much greater range of adjustment relatively to the connection with the motor, for the reason that longer intermediate shafts can be employed, by the use of vertical instead of horizontal shafts, thereby reducing the angularity of the intermediate shaft for a given range of adjustment of the roll from its alinement with its motor.

In my improved mill a change can be made in the connections between any pair of rolls and their motors without stopping the remaining rolls in the mill. When the rolls in each pair are driven independently by means of bevel gears, as shown in the case of a roughing mill in Fig. 1, the work of each pair of rolls is divided between two pairs of gears instead of one, as when the rolls are connected by pinions.

In Figs. 5 and 6, I have shown a modification in which the upright framework 6, as shown in Figs. 1, 2 and 3 is replaced by an upright post 42, provided with a circular bearing 43, to receive a revolving turret 44, upon which is supported housings 45 and 46 for two pairs of rolls 47 and 48. The turrets are made in parts clamped on the posts by the clamping bolts 49. By a one half revolution of the turrets on the posts, one pair of rolls can be thrown out of action and the other pair brought into action. If greater space is desired between the posts, or for any reason it is not desirable to have the pairs of rolls on diametrically opposite sides of the post, the roll housings can be arranged as shown at 50 and 51, Fig. 6, or 120° apart instead of 180°, with the turret divided into three parts with an interchangeable piece 52, thereby allowing the housings 50 and 51 to change places.

While the construction shown in Figs. 1, 2 and 3 possesses many advantages, especially in a finishing mill employed in the production of what is known as "merchant" iron and steel, by its increased facilities for changing the pairs of rolls for different sizes of finished product, the construction shown in Figs. 5 and 6, I consider desirable for the reason that frequent changes in the products in mills of this class are necessary, and can be accomplished by the simple swinging of a turret on its supporting post.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a rolling mill, the combination with a series of pairs of vertical rolls for the continuous reduction of a rod, of a supporting framework and horizontal shelf like housings for each pair of rolls, with one roll of each pair arranged nearer to said framework than the other roll.

2. In a rolling mill, the combination with a series of pairs of vertical rolls for the continuous reduction of a rod, of a supporting framework and horizontal shelf like housings for each pair of rolls, with the housings for all the pairs of rolls arranged upon the same side of the successive supporting frameworks.

3. In a rolling mill, the combination with a series of pairs of vertical rolls for the continuous reduction of a rod, of a supporting framework and horizontal shelf like housings for each pair of rolls, with the housings for all the pairs of rolls arranged upon the same side of the successive supporting frameworks, and with one roll of each pair nearer to said framework than the other roll.

4. In a rolling mill, the combination with a series of pairs of vertical rolls having parallel axes for the continuous reduction of a rod, of a supporting framework and horizontal shelf like housings for each pair of rolls, with a roll of each pair arranged nearer to said framework than the other roll, means supported by said framework above said housings for driving said nearer roll, and means below said housings for driving said outer roll.

5. In a rolling mill, the combination of a series of vertical frameworks, roll housings supported by and extending laterally from said frameworks, a series of pairs of rolls journaled in said housings and having their axes in a vertical plane, means for rotating said rolls, plates supported by said housings and rod guides supported by said plates and extending laterally therefrom, and forming shelves for rod supporting plates.

6. In a rolling mill, the combination with a series of pairs of vertical rolls having parallel axes for the continuous reduction of a rod, of a supporting framework and horizontal shelf like housings for each pair of rolls, with one roll in each pair arranged nearer to said framework than the other roll, means for driving said nearer roll from above said housings, and means for driving said outer roll from below said housings

7. In a rolling mill, the combination with roll housings and a pair of rolls journaled in said housings, of driving means below said housings, a cover below said housings for said driving means having an opening, a shaft arranged to connect one of said rolls and said driving means passing through said opening, a cylindrical member in said opening inclosing said shaft and projecting above said cover, and a collar surrounding said shaft and overlapping the upper end of said cylindrical member.

8. In a rolling mill, the combination with roll housings and a pair of rolls journaled in said housings, of driving means below said housings, a floor between said driving means and said housings having an opening, a shaft connecting one of said rolls and said driving means passing through said opening, a hollow member held in said opening surrounding said shaft and projecting above said floor, and a cover for the upper projecting end of said member around said shaft.

9. In a rolling mill, the combination with roll housings and a pair of rolls journaled in said housings, of driving means below said housings, a cover between said driving means and said housings having an opening,

a shaft connecting one of said rolls and said driving means passing through said opening, a dam in contact with said cover surrounding said opening, and means surrounding said shaft for closing the upper end of said dam.

10. In a rolling mill, the combination with a supporting framework, of a roll housing attached to said framework and projecting laterally therefrom, a pair of rolls journaled in said housing, with their axes in a vertical plane, a floor beneath said housing, a driving shaft passing through said floor and operatively connected with one of said rolls, and a hinged guard plate supported by said floor in front of said driving shaft.

11. In a rolling mill, the combination with a series of vertical posts, horizontal roll housings supported on each post, a pair of rolls supported by said roll housings on each post, guides supported by each post for each pass in said rolls, and removable plates below and between the guides on adjacent posts supported by said guides and by said roll housings.

12. In a rolling mill, the combination with a series of vertical posts, a pair of vertical rolls supported on each post, with the passes of all the pairs of rolls in alinement, guides supported on each post for each pass in said rolls, and removable rod supporting plates below and between said guides and supported by them, thereby preventing contact of the rods in the various guides.

13. In a rolling mill, the combination with a vertical supporting framework, of roll housings for two independent pairs of rolls, said housings being connected and capable of being rotated around their supporting frame, whereby either of said pairs of rolls can be brought into operative position at will, substantially as described.

14. In a rolling mill, the combination of a vertical post having a bearing for a rotating turret, a rotating turret, and roll housings carried by said turret and extending laterally therefrom, whereby either of said housings can be brought into operative position, substantially as described.

15. The combination with a vertical post having a bearing for a rotating turret, of a turret made in parts, clamping bolts by which said parts can be clamped on said post, roll housings carried by said turret and extending laterally therefrom, substantially as described.

16. In a rolling mill, the combination with a series of pairs of vertical rolls for the reduction of metal rods, each pair of rolls provided with a plurality of passes in alinement throughout the series to receive said rods, removable means between said pairs of rolls for supporting the rod in each pass, whereby possibility of the interference of different rods is obviated.

17. In a rolling mill, the combination with a series of pairs of vertical rolls for the reduction of metal rods, each pair of rolls provided with a plurality of passes in alinement throughout the series to receive said rods, of guides for each pass in each pair of rolls, and removable means for supporting said rods between the several guides, thereby preventing their interference.

Dated this 29th day of May, 1903.

JEROME R. GEORGE.

Witnesses:

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