(No Model.) 4 Sheets—Sheet 1.

A. L. HAMMARBERG & A. BERGLÖF.

MACHINE FOR ROLLING ANGLE BARS.

No. 519,452. Patented May 8, 1894.

Fig. 1.

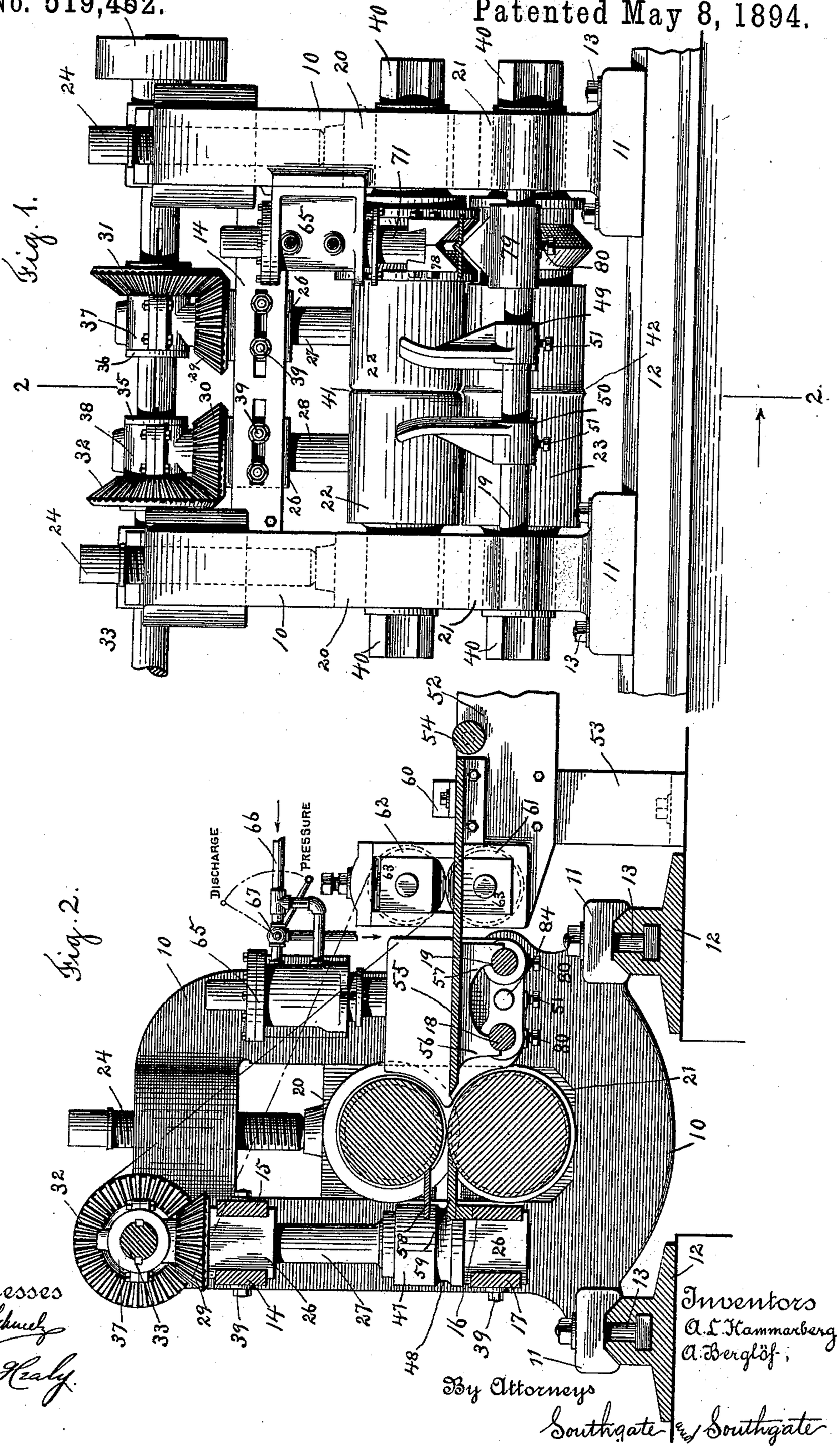

Fig. 2.

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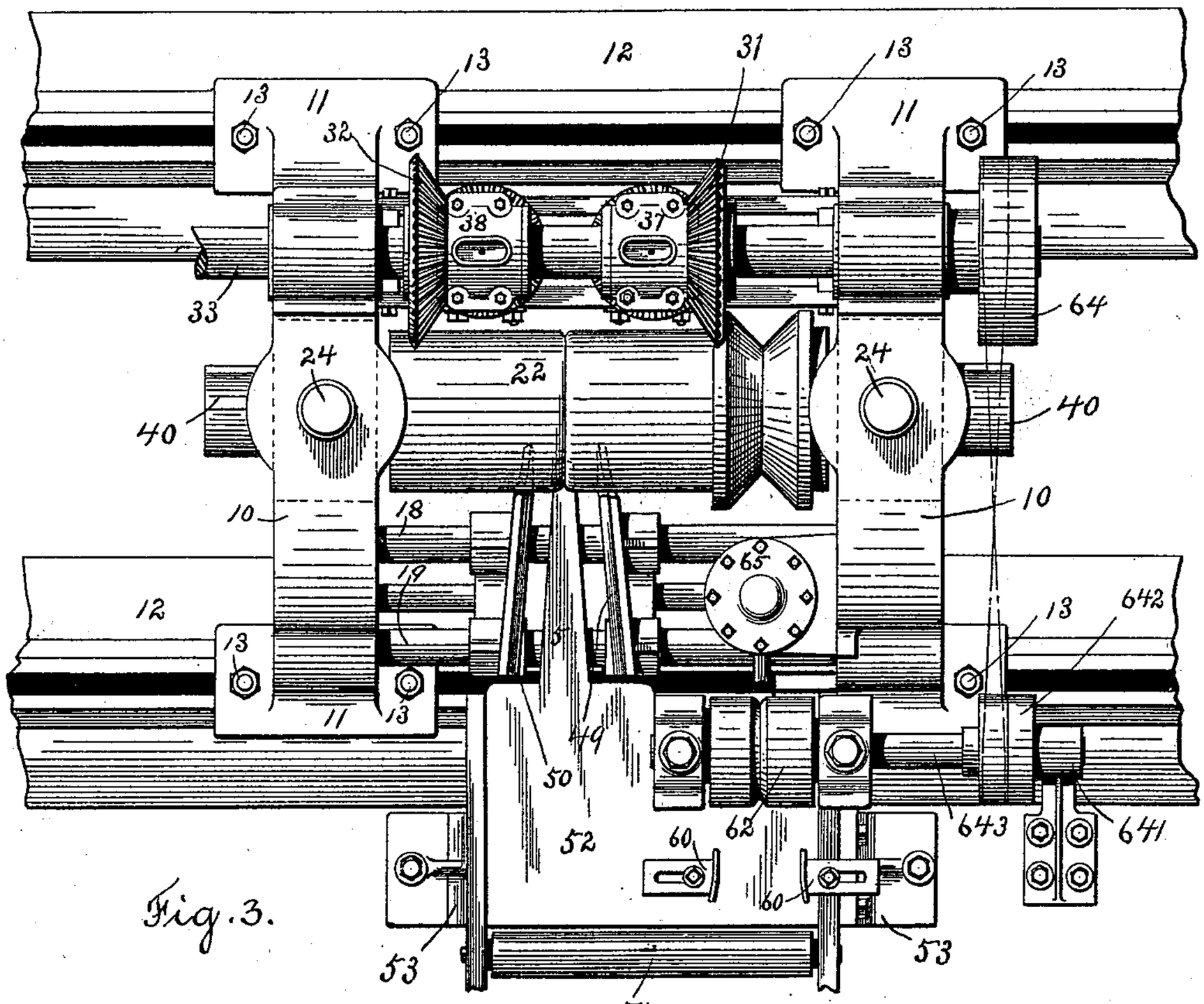

Fig. 3.

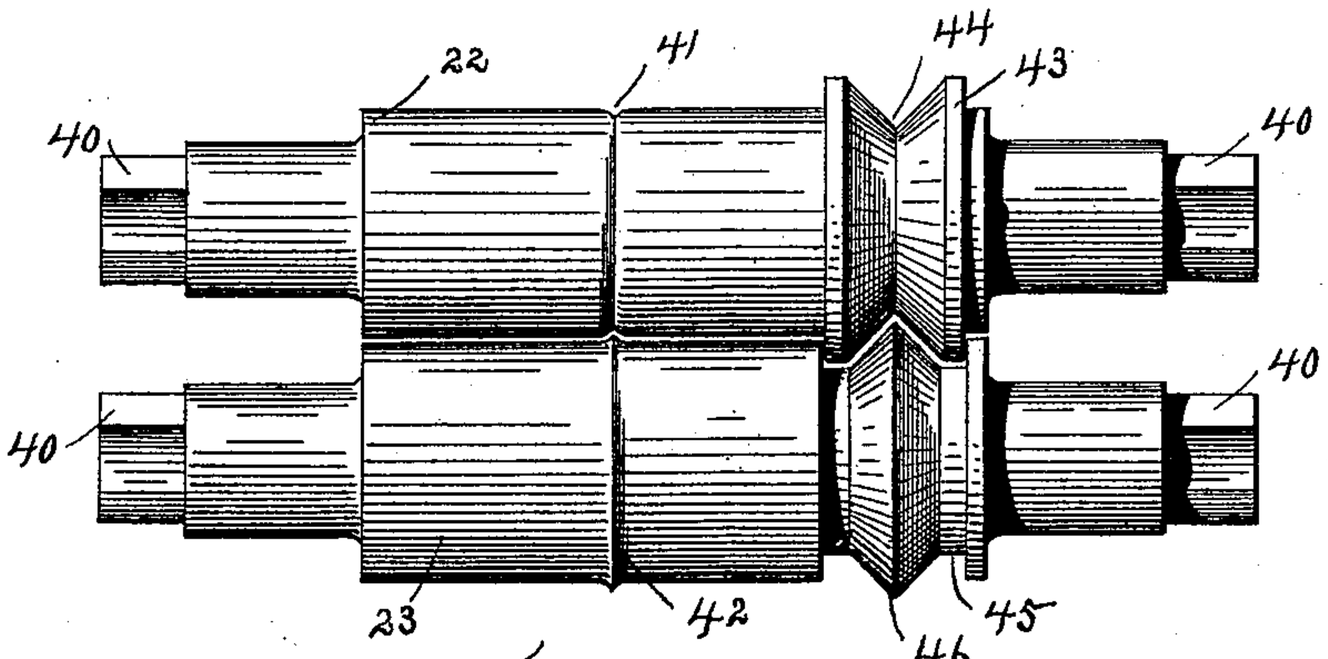

Fig. 4.

Witnesses
Chas. F. Schmelz
E. M. Healy.

Inventors
A. L. Hammarberg,
Algot Berglöf.
By Attorneys
Southgate & Southgate

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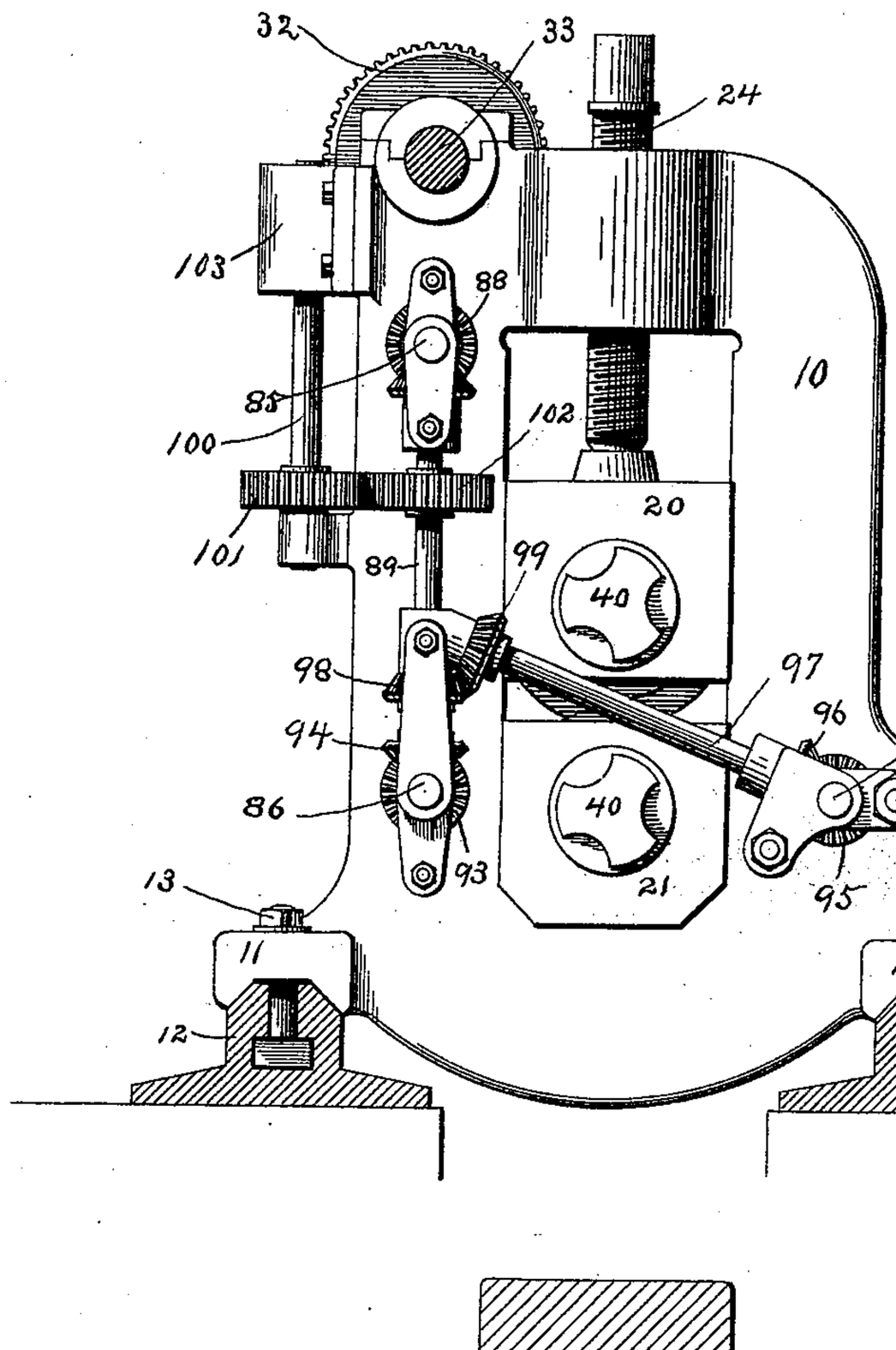
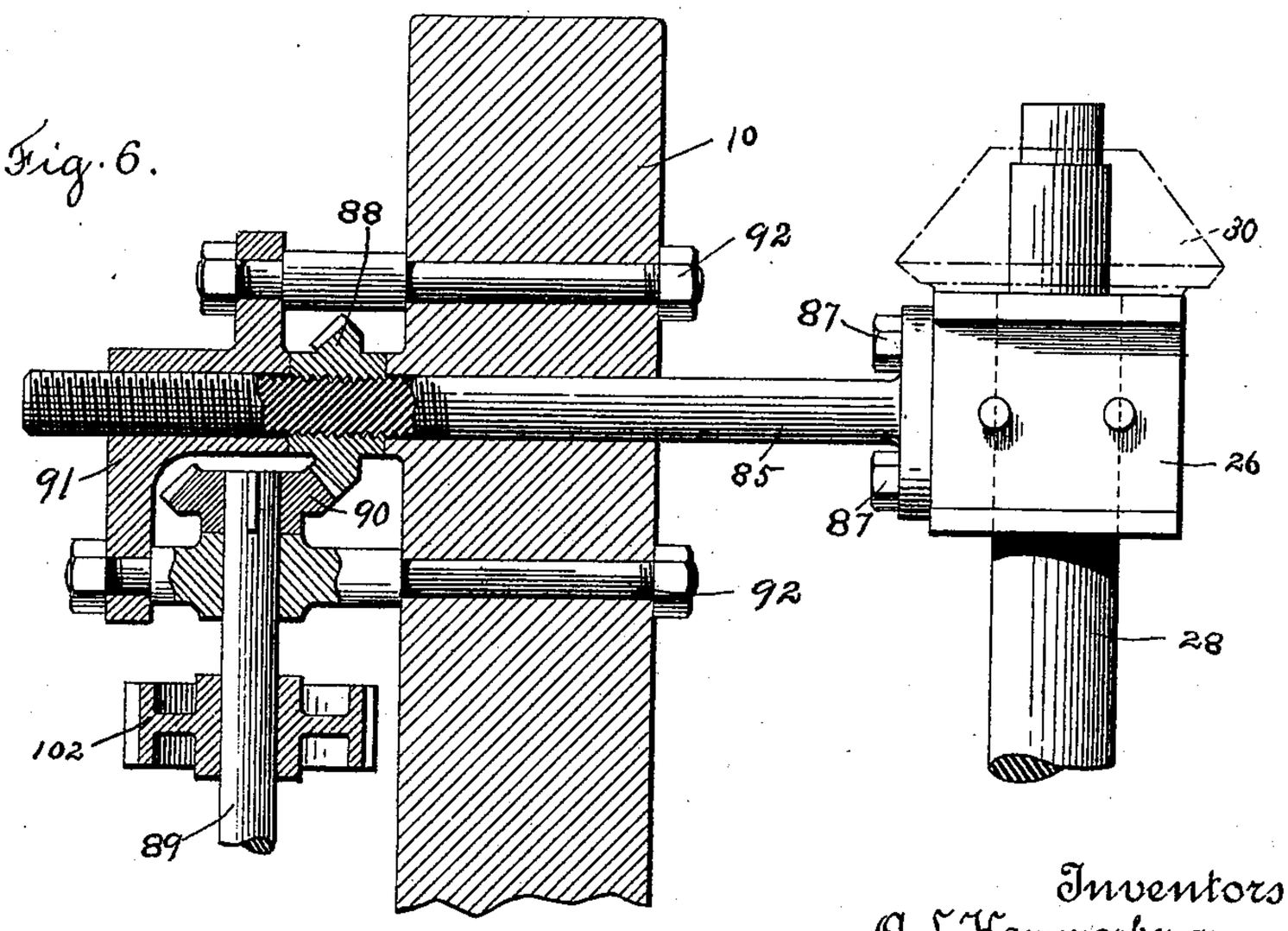


Fig. 5.

Fig. 6.



Witnesses
Chas. F. Schmelz
E. M. Healy.

Inventors
A. L. Hammarberg
Algot. Berglöf.

By Attorneys
Southgate & Southgate

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

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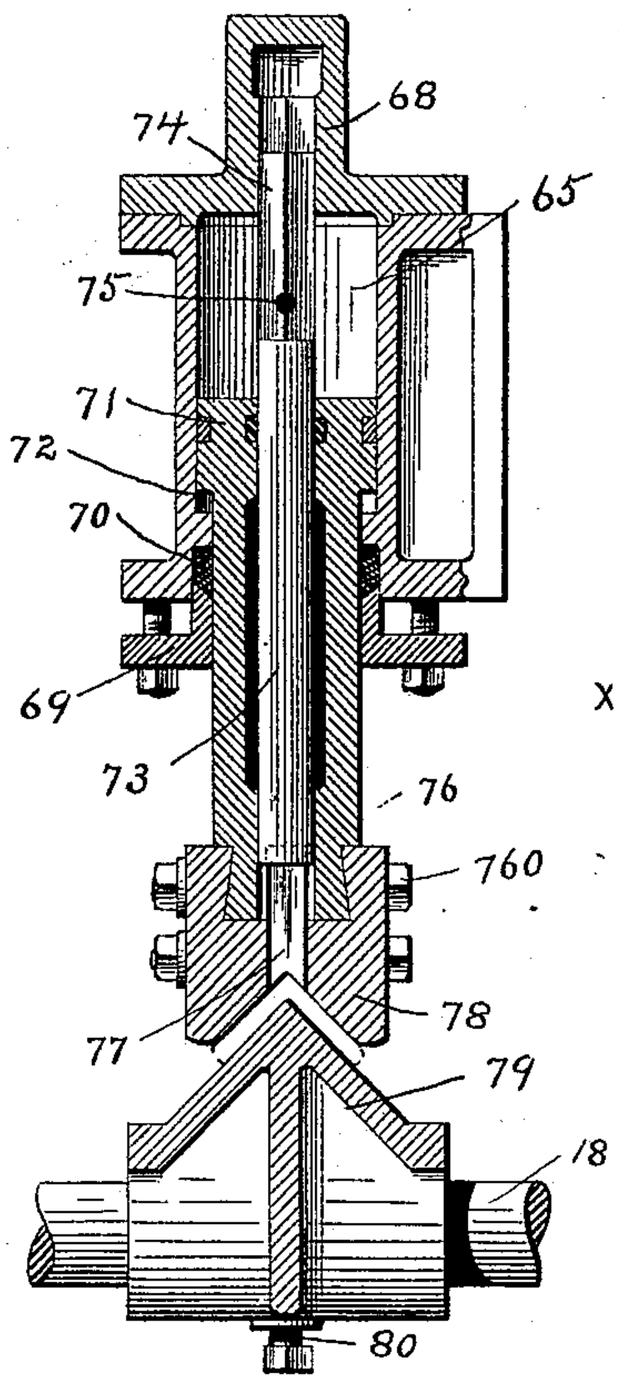


Fig. 10.

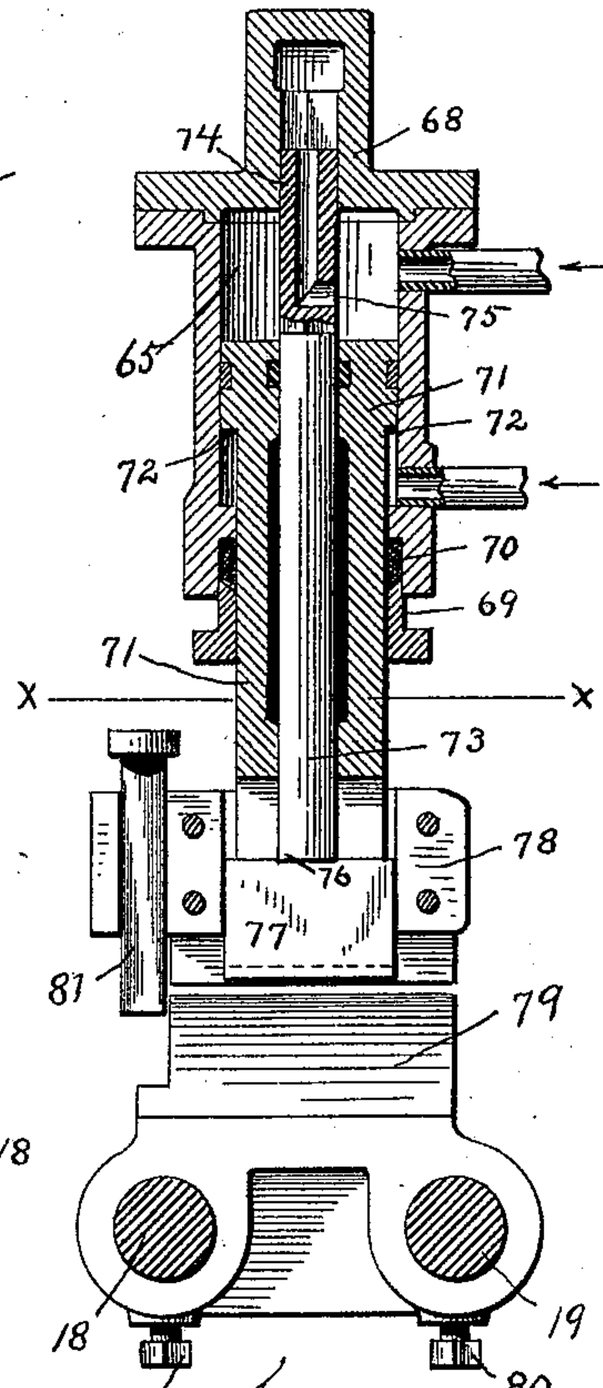


Fig. 7.

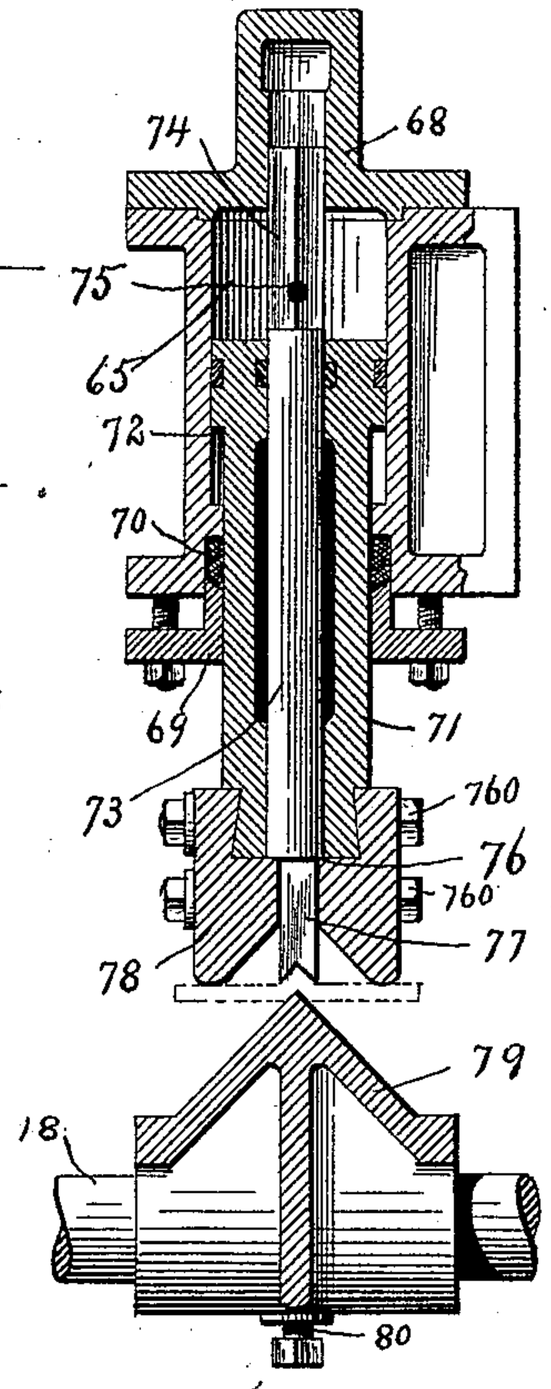


Fig. 9.

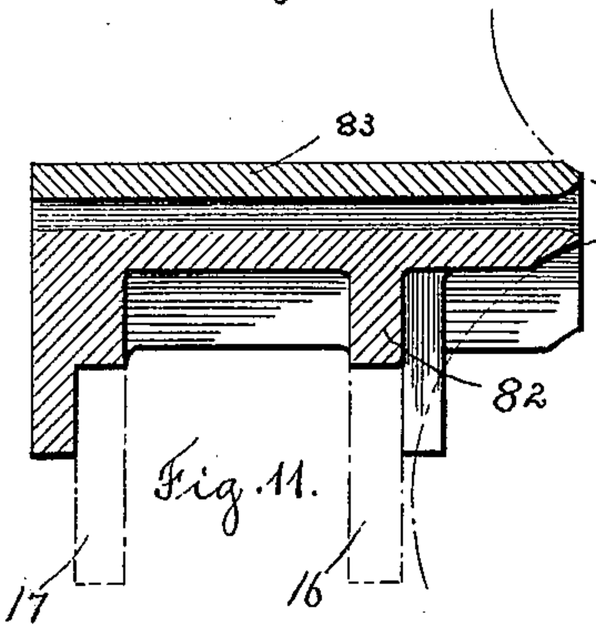


Fig. 11.

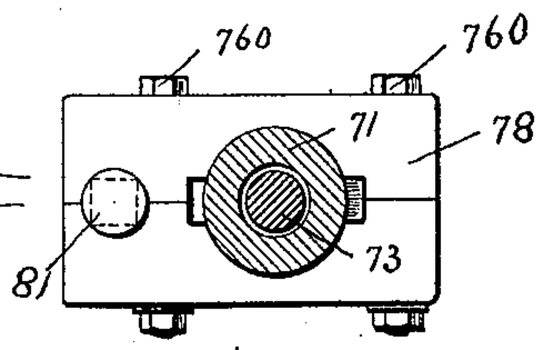


Fig. 8.

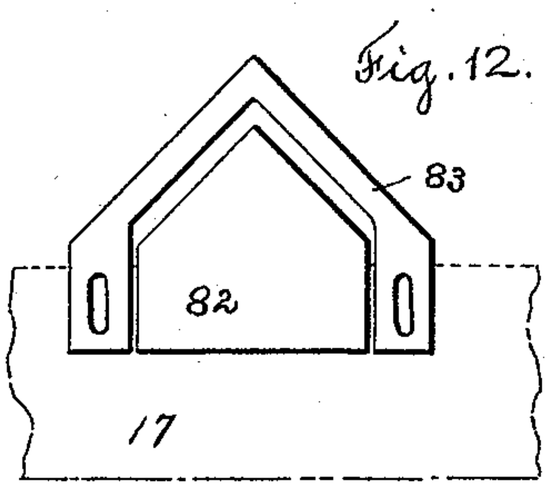


Fig. 12.

Fig. 13.

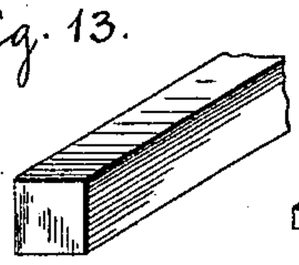


Fig. 14.

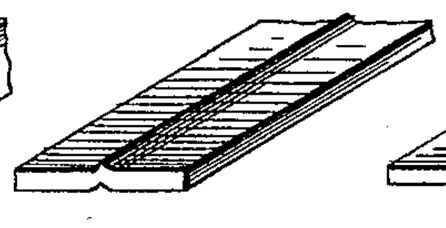
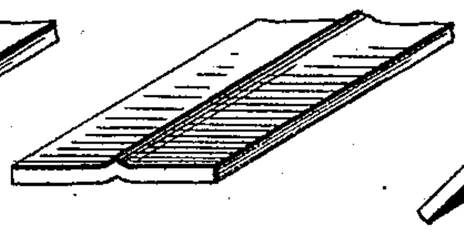


Fig. 15.



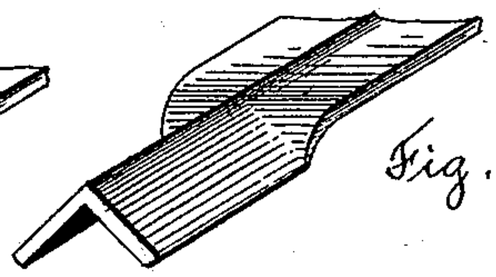
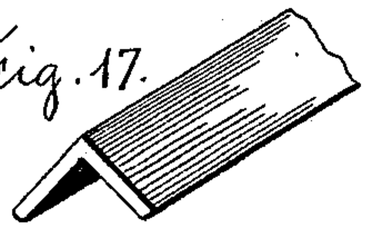


Fig. 16.

Fig. 17.



Witnesses
Chas. F. Schmelz
E. M. Healy.

Inventors
A. L. Hammarberg,
Algot Berglöf.
By Attorneys
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THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ARNOLD L. HAMMARBERG AND ALGOT BERGLÖF, OF WORCESTER, MASSACHUSETTS.

MACHINE FOR ROLLING ANGLE-BARS.

SPECIFICATION forming part of Letters Patent No. 519,452, dated May 8, 1894.

Application filed December 7, 1893. Serial No. 492,976. (No model.)

To all whom it may concern:

Be it known that we, ARNOLD L. HAMMARBERG and ALGOT BERGLÖF, subjects of the King of Sweden and Norway, residing at Worcester, in the county of Worcester and State of Massachusetts have invented a new and useful Improvement in Rolling-Mills, of which the following is a specification.

The object of our invention is to provide a strong, simple and durable rolling mill, which may be readily adjusted to produce different sizes and shapes of bars, and to these ends, our invention consists of the parts and combinations of parts as hereinafter described, and more particularly pointed out in the claims at the end of this specification.

In the accompanying four sheets of drawings, Figure 1 is a front elevation of a rolling-mill constructed according to our invention, the rest or table, which is usually located at the front of the mill, being removed. Fig. 2 is a transverse section on the line 2—2 of Fig. 1. Fig. 3 is a plan view of the mill. Fig. 4 is a detail view showing the form of the horizontal rollers, which we preferably employ. Fig. 5 is an end elevation, and shows one system of gearing for adjusting the vertical rolls and vertical guides. Fig. 6 is a detail view of the same. Figs. 7 to 12 inclusive are detail views to be hereinafter referred to, and Figs. 13 to 17 inclusive are views showing the blank or billet in its different forms or stages when treated according to our method.

Referring to the drawings and in detail, 10—10 designate side or end frames, which are provided with the foundation feet 11, the foundation feet being clamped in place, and secured to the foundation plates 12 by means of the bolts 13. The end frames 10 are connected by the beams or girders 14 and 15, the girders 16 and 17, and the tie-rods 18 and 19. Near their center, the side-frames 10 are provided with ways, in which are mounted the adjustable boxes 20 and 21. Mounted in the boxes 21 is the lower horizontal roll 23, and carried in the boxes 20 is the upper horizontal roll 22. The rolls 22 and 23 can be adjusted with respect to each other by means of the adjusting screws 24, and the rolls 22 and 23 are of a peculiar shape, as will be hereinafter described. At the rear of the structure, the beams or girders 14 and 15 and 16 and 17 form ways, in which are mounted the adjustable boxes 26 for the vertical rolls 27 and 28. The vertical roll 27 above its box 26 is provided with a beveled pinion 29, the vertical roll 28 being provided with a similar beveled pinion 30. The beveled pinions 29 and 30 mesh with and engage the beveled gears 31 and 32, which are adjustably splined on a horizontal shaft 33 carried by boxes on the side frames 10, and which may be driven from any desired source of power. In order that the beveled gears 30 and 32 may be maintained in working engagement, the hub of the gear 32 is extended as at 35, and carried in a groove in the hub 35 is a split collar 38, which has a bearing or socket to receive the end of the shaft of the vertical roll 28. In a similar manner the beveled gears 29 and 31 are tied together by the split collar 37, which is mounted in a groove in the hub 36 of the gear 31. By reference to Fig. 3, it will be seen that these split collars, which are fastened together by suitable bolts, are provided with a suitable oil-duct, by which they may be kept well lubricated. In order to adjust the vertical rolls 27 or 28, it is merely necessary to loosen the clamping nuts 39, set the rolls in the desired position, and secure them by again tightening the clamping bolt 39. The horizontal rolls 22 and 23 are extended beyond the side-frames 10 in both directions, and their hubs are shaped as shown, so that they may receive couplings to connect them with any desired source of power.

The construction thus far described resembles the ordinary universal rolling mill, but the construction of rolls that we employ is peculiar. By reference to Fig. 4, it will be seen that the horizontal roll 22 is provided with a peripheral groove or depression 41, and that the lower horizontal roll 23 is provided with a peripheral ridge or projection 42, which fits into the groove 41. Near its end, the roll 22 is provided with an enlarged portion 43, which has a peripheral groove 44 formed in the same. The roll 23 has a reduced portion 45, and a peripheral rib or projection 46 which fits into and engages the groove 44. The groove 41 and the projection

42 form a pass, by means of which the billet or blank is reduced to approximately the desired thickness, and the groove 44 and projection 46 form a bending section or pass, which gives the angle bar the desired bend or angle. The vertical rolls 27 and 28 are not intended to exert any great pressure upon the blank or billet, but are rather for the purpose of truing up and slightly rounding over the edges of the angle bar, as it has been found in practice that the billets or blanks are liable to chip or break off at their corners or edges. These vertical rollers are, therefore, arranged so that they will round off the edges of the billet or blank upon a slight curve or arc, and as these vertical rollers are intended to bear upon the billet or blank only during the first reduction or rolling, and are then arranged apart so as not to touch the billet or blank, it has been found that the subsequent reductions restore or form an even edge or corner for the completed article.

By reference to Fig. 2, it will be seen that the vertical roll 27 is provided with an enlarged portion 47, which has a peripheral groove 48 formed therein. The vertical roll 28 may be of similar construction.

In order to accurately center the billet or blank, and direct it to the proper position between the horizontal rolls, we preferably provide the adjustable guides 49 and 50, which are carried by the tie-rods 18 and 19, and can be clamped in position by means of the screws 51.

To properly guide the blank or billet from the horizontal rolls to the proper position between the vertical rolls we provide guide plates 58 and 59, as shown in Fig. 2, and which can be made of any desired construction, and are preferably made adjustable.

In front of the rolling mill is located a table 52, which is carried by legs 53, and which is provided with idle-rolls 54, the table 52 preferably being long enough to provide for easily handling angle bars or billets of considerable length. At its front end, the table 52 is provided with a projecting nose or plate 55 extending between the vertical guides 48 and 49, and is provided with lugs 56 and 57, which rest upon the tie-rods 18 and 19, and support the projecting nose.

At the front of the table 52, opposite the bending or finishing pass, are provided the adjustable guides 60, and mounted in suitable frames carried by the table 52 are the feed rollers 61 and 62 carried by adjustable boxes 63, the upper boxes being adjusted by screws, as shown. The shaft 643 of the upper feed roll 62 is preferably extended beyond the frame, is supported by a bearing 641, and provided with a pulley 642. The shaft 643 may be driven by a belt from a pulley 64 carried on the horizontal shaft 33, as most clearly shown in Fig. 3.

Bolted to the side frame 10 in front of the finishing or bending pass, we provide a hydraulic cylinder 65, of peculiar construction. The hydraulic cylinder 65 is connected by a pipe 66 with any suitable source of fluid pressure. The pipe 66 is provided with two branches, one being connected to the lower part of the cylinder 65, and the other to the upper part of the cylinder 65. In the upper branch is located a three-way valve 67, which controls the action of the piston.

The detailed construction of the hydraulic cylinder 65 is most clearly shown in Figs. 7 to 10 inclusive. In these views, Fig. 7 is a central longitudinal section of the cylinder 65. Fig. 8 is a transverse section taken on the line x—x of Fig. 7. Fig. 9 is a central vertical section taken at right angles to Fig. 7, and Fig. 10 is a similar view showing the piston in its lowest position. The cylinder 65 is provided with a cover 68, and bolted to its lower end, is a stuffing box 69, which holds in place the ordinary packing ring 70. Mounted in the cylinder 65 is a differential piston 71 which is turned down, and provided with a shoulder 72, against which the fluid pressure from the lower branch of the pipe 66 is allowed to act, thus having a constant tendency to raise the piston. The piston 71 is bored out longitudinally, and is provided with an inner or secondary piston 73. The upper end of the secondary piston 73 is square in cross section, and fits into a guide formed in the cylinder cover 68. A pressure-duct 75 is bored in the piston 73, and allows the fluid pressure to act on the upper end of said piston. At its lower end, the piston 73 is provided with a shoulder 76, and below the shoulder 76 is secured a plate 77. A die or former 78 made in two parts is bolted by means of the bolts 760 to the lower end of the piston 71, and carries a stop or abutment 81. A suitable anvil 79 is fastened to the tie-rods 18 and 19 by means of the screws 80, and co-operates with the pistons. It will thus be seen that when the pressure is turned on to the upper end of the cylinder the inner piston will be lowered until the plate 77 comes in contact with the end of the billet or blank, and will thus maintain it in proper position until the end of the billet or blank is completely bent or formed to the desired shape by means of the die or former 78. When the pressure is disconnected from the upper end of the cylinder, the pressure acting against the shoulder 72 of the piston, will raise the piston, which will in turn raise the inner piston out of the way by means of the shoulder 76; the stop 81 also being carried up by the die or former.

In Figs. 11 and 12, we have shown a form of guide, which we preferably employ, to receive the complete product or angle-bar. This guide is formed of a casting 82, which may be adjustably secured to the beams or girders 16 and 17, and of a casting 83, which fits over the casting 82, and may also be adjustably secured to the beams 16 and 17. The guide which is thus formed, is located at the rear of the bending or finishing pass in

the rollers, and prevents the angle bar from clogging or interfering as it leaves the mill.

In some cases it is desirable to provide means for synchronously adjusting the vertical rolls and the guides 49 and 50. In Figs. 5 and 6, we have illustrated one form of gearing for accomplishing this purpose. Referring to these figures, 85 designates a rod or lead-screw, which is bolted to the adjustable box 26 of the roll 28 by means of the bolts 87. 86 designates a similar rod, which is fastened to the lower adjustable box, and 84 designates a third rod or lead-screw, which is connected to the guide 50. The lead-screw 85 extends through the side frame 10, and is engaged by a nut 88 which is made in the form of a beveled pinion, and meshes with and engages a beveled gear 90, which is secured to the vertical shaft 89. The beveled gears 88 and 90 are held in working engagement by means of the bolts 92. The lead-screw 86 is of a similar construction save that it has a left-hand screw thread, which engages a nut 93 made in the form of a beveled pinion, which engages the beveled gear 94 secured to the shaft 89. The lead-screw 84 which is secured to the guide 49 is of a similar construction to the lead-screw 85, and engages the nut 95 which is made in the form of a beveled pinion, which meshes with the beveled gear 96 carried by the shaft 97. The shaft 97 and the vertical shaft 89 are geared together by means of the beveled gears 98 and 99. It will thus be seen that as the vertical shaft 89 is rotated, the boxes 26 of the vertical roll 28 and the front guide 50 will be moved synchronously. When the vertical roll and the guide have been adjusted to the desired position, they may be secured in place by the clamping screws, as shown.

Any desired means for rotating the shaft 89 may be adopted, as desired, and as shown in Fig. 5, the shaft 89 is geared to a vertical shaft 100 by means of the gears 101 and 102, the shaft 100 being connected to an electric motor 103, which is bolted on to the end of the side frame 10. Of course the adjusting gearing before described is duplicated at the other end of the machine, for adjusting the other vertical roll, and its corresponding front guide. In some cases it may be desirable to have both vertical rolls move in unison, and if such be the case, the electric motors 103 at each side of the machine may be geared together by any suitable form of friction clutch or other connection.

The operation of producing an angle bar by our improved apparatus may be briefly described as follows:—A heated billet or blank of substantially the shape shown in Fig. 13 is placed upon the table 52, passed between the guides 49 and 50 and through the reducing pass formed by the rolls 22 and 23. The peripheral speed of the vertical rolls is preferably slightly greater than that of the horizontal rolls, so as to "coax" the billet through the mill. When the billet has been passed through the first pass, it has substantially the form shown in Fig. 14. The vertical rolls are then set slightly apart so as to no longer come in contact with the billet or blank, and the horizontal rolls are set slightly closer together. The mill is then reversed, and the billet or blank passes back again through the reducing pass, and assumes substantially the form shown in Fig. 15. The billet is then moved on the table 52 opposite the bending pass formed by the rolls 22 and 23, and the end of the billet is brought over the anvil 79. The pressure is then turned on so as to force down the piston, and the end of the billet or blank is compressed substantially as shown in Fig. 16, so that it will fit nicely into the bending pass. The angle bar is then completed by being fed through the bending pass, and assumes substantially the form shown in Fig. 17.

With the above described apparatus an improved quality of angle-bar can be easily and cheaply produced.

Compressing or shaping the end of the billet or blank to conform to the bending pass, we consider a feature of especial importance, as it entirely overcomes the difficulty in introducing the billet between the rolls.

We have shown in the drawings a reciprocating compressing device, which is intermittent in its action, and which is actuated by hydraulic pressure for performing this function, but it is evident that other means may be substituted for producing the same result. Of course bars and girders of different shape from that shown in the drawings may be produced by our rolling mill, if desired and we are aware that many changes may be made in the construction and operation of the device without departing from the scope of our invention, as expressed in the claims.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a rolling mill, the combination of shaping or bending rolls, and a reciprocating compressing device for shaping the end of the billet or blank to conform to the rolls, substantially as described.

2. In a rolling mill, the combination of bending or shaping rolls, a shaping device, and means for intermittently actuating said shaping device, whereby the end of the billet or blank is shaped to conform to the rolls, substantially as described.

3. In a rolling mill, the combination of rolls having corresponding configurations which form a reducing pass and a bending pass, with means for shaping the end of the billet or blank to conform to the bending pass, substantially as described.

4. In a rolling mill, the combination of rolls having a corresponding peripheral groove and projection, which form part of a reducing pass, and also having a corresponding groove and projection, which form a bending pass,

with means for shaping the end of the billet or blank to conform to the bending pass, substantially as described.

5. In a universal rolling mill, the combination of rolls having a corresponding peripheral groove and projection forming a reducing pass which is adapted to receive billets or blanks of different sizes, and having a corresponding peripheral groove and projection, which form a bending pass, with adjustable means for truing up the ends of the billet or blank, substantially as described.

6. In a rolling mill, the combination of bending rolls for bending the billet or blank to the desired form, and a hydraulic cylinder and piston for compressing the end of the billet or blank to conform to the pass between the bending rolls, substantially as described.

7. In a rolling mill, the combination of bending rolls, a suitable anvil and a hydraulic cylinder and piston carrying a die or former to shape the end of the billet or blank so that it may be readily introduced between the bending rolls, substantially as described.

8. In a rolling mill, the combination of suitable bending rolls, and a differential hydraulic piston for shaping the end of the billet or blank to conform to the bending rolls, the hydraulic piston having a small area under constant pressure tending to raise the piston, substantially as described.

9. In a rolling mill, the combination of bending rolls, a hydraulic cylinder and piston carrying a former which co-operates with a suitable anvil, and a secondary piston for holding the end of the billet or blank in position while it is being acted upon by the former, substantially as described.

10. In a rolling mill, the combination of bending rolls, a hydraulic cylinder having a differential piston mounted therein, which carries a die or former, said die or former co-operating with an anvil to compress the end of the billet or blank, to conform to the bending rolls, substantially as described.

11. In a rolling mill, the combination of bending rolls, and a hydraulic cylinder and piston carrying a die or former, the former being provided with a stop or gage, substantially as described.

12. In a rolling mill, means for shaping the end of the billet or blank, consisting in the combination of a cylinder, a differential piston, an inner piston for holding the billet or blank while acted upon by a former carried by the piston, the inner piston having a square portion fitting into a guide formed in the cover of the cylinder, and a suitable anvil co-operating with the former, substantially as described.

13. In a rolling mill, the combination of a cylinder, a differential piston mounted therein, an inner piston which prevents the main piston from turning by means of a blade at its lower end, and a square portion at its upper end, substantially as described.

14. In a rolling mill, the combination of a hydraulic cylinder, a differential piston mounted therein, and an inner piston, the inner piston being raised with the differential piston by means of a shoulder, substantially as described.

15. In a rolling mill, the combination with the horizontal rolls, the adjustable vertical rolls, the adjustable front guide 60, the feed rolls, a hydraulic piston for shaping the end of the billet, and suitable guides for receiving the completed bar, substantially as described.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

ARNOLD L. HAMMARBERG.
ALGOT BERGLÖF.

Witnesses:
LOUIS W. SOUTHGATE,
PHIL W. SOUTHGATE.